

# C/K TRUCK

1 9 9 4

Driveability, Emissions,  
and  
Electrical Diagnosis  
Manual



## **CAUTION**

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed:

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure, or tool that is not recommended by the vehicle manufacturer must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool selected.

It is important to note that this manual contains various 'Cautions' and 'Notices' that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these 'Cautions' and 'Notices' are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.



# FOREWORD

This Driveability and Emissions Section of this manual replaces SECTION 6C and SECTION 6E of the C/K Service Manual for gasoline engines with throttle body fuel systems and diesel engines with electronically controlled fuel injection pumps.

The Electrical Diagnosis section of this manual contains wiring diagrams and electrical diagnosis for C/K models.

Procedures involving disassembly and assembly of major components for these vehicles are published in the Light Duty Truck Unit Repair Manual (NATP-9437). Diagnosis, on-vehicle maintenance, and light repair procedures are published in the C/K service manual (NATP-9431).

**CAUTION: General Motors service manuals are intended for use by professional, qualified technicians. Attempting repairs or service without the appropriate training, tools, and equipment could cause injury to you or others and damage to your vehicle that may cause it not to operate properly.**

# 1994

## **C/K TRUCK DRIVEABILITY, EMISSIONS, AND ELECTRICAL DIAGNOSIS MANUAL**

The Table of Contents on the following page indicates the sections covered in this manual. At the beginning of each individual section is a Table of Contents which gives the page number on which each major subject begins.

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

**General Motors Corporation  
Detroit, Michigan**

NATP-9442

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# TABLE OF CONTENTS

The table of contents on this page indicates the sections covered in this manual. At the beginning of each individual section is a table of contents which gives the page number on which each major subject begins.

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| 3       | ELECTRICAL DIAGNOSIS                          |

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- Section and page number(s)
- Description of problem

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# DRIVEABILITY AND EMISSIONS (GASOLINE)

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# SECTION 1

## GENERAL INFORMATION

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ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

## GENERAL DESCRIPTION

## DRIVEABILITY AND EMISSION CONTROLS

A control module is designed to maintain exhaust emissions levels at Federal or California emissions standards while providing good driveability and fuel efficiency. The functions of the system are based on data gathered by sensors and switches located throughout the vehicle. The control module maintains control over fuel delivery, ignition, idle air flow, the fuel pump and other system components, while monitoring the system for faulty operation with its diagnostic capabilities. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The control module language for communicating the source of the malfunction is a system of diagnostic trouble codes. When it finds a problem, it lights a Malfunction Indicator Lamp (MIL) "Service Engine Soon" on the instrument panel and a Diagnostic Trouble Code (DTC) will be stored in the control module memory. This does not mean that the engine should be stopped right away, but that the cause of the light coming "ON" should be checked as soon as reasonably possible.

It is important to review the system sections and control module wiring diagrams for a specific engine to determine what is controlled by the control module and what systems are non-control module controlled. Abbreviations which are used in driveability and emissions are listed in "Abbreviations," SECTION 14.

## VEHICLE EMISSIONS CONTROL INFORMATION LABEL

The Vehicle Emissions Control Information label contains important emission specifications and procedures. On the upper left corner is exhaust emission information. Refer to Figure 1-1 for further break out clarification. Also, there is an illustrated emission components and a vacuum hose schematic. This label is located in the engine compartment of every vehicle. If the label has been removed, a replacement label can be ordered from General Motors Service Parts Operation (GMSPO). Refer to the standard Parts Catalog.

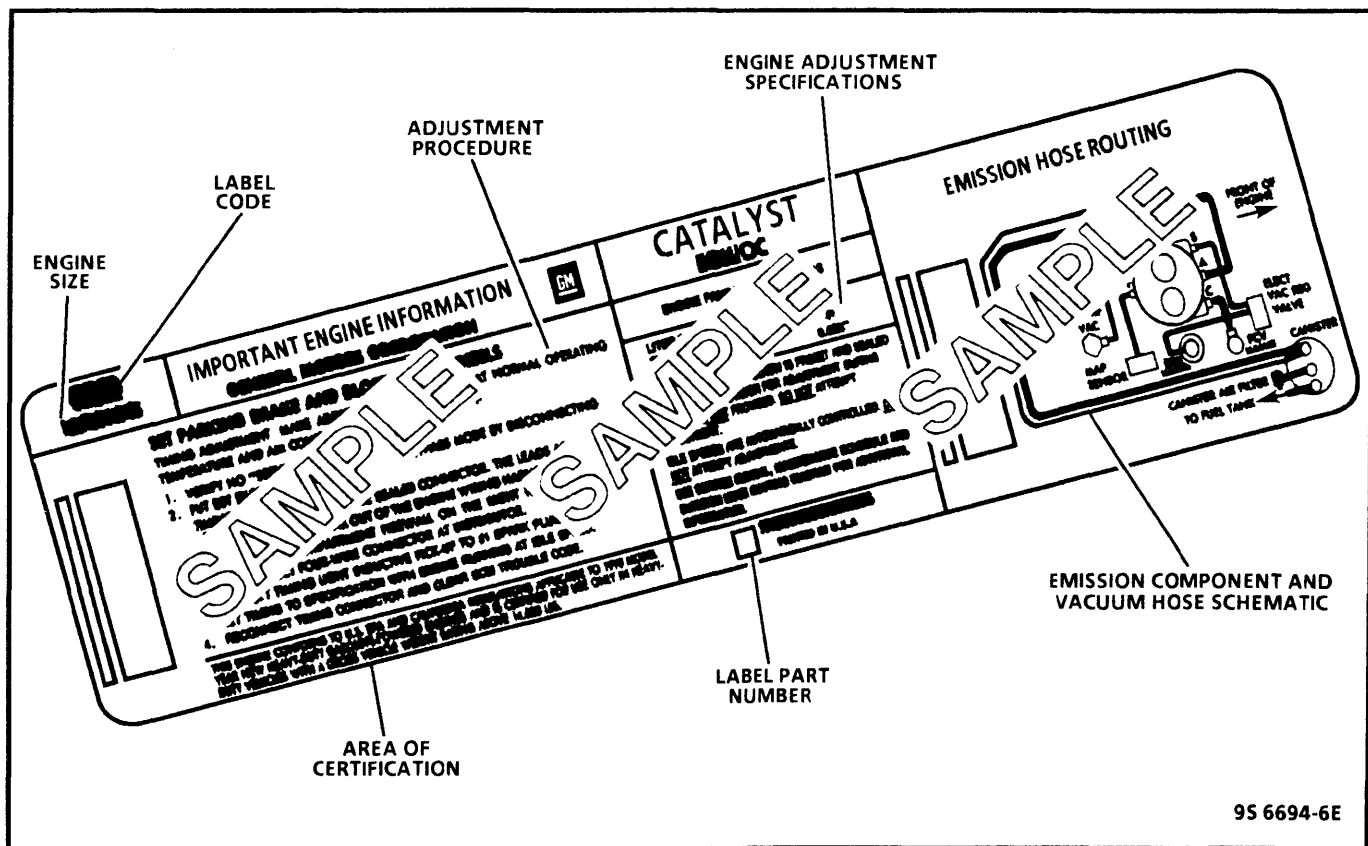


Figure 1-1 - Vehicle Emission Control Information Label

## MAINTENANCE SCHEDULE

Refer to "Maintenance and Lubrication," SECTION 0B of the proper Light Duty Truck Service Manual or in the vehicle glove box for the maintenance service. Proper schedule maintenance should be performed to retain emission control performance.

## BLOCKING DRIVE WHEELS

The vehicle drive wheels should always be blocked with parking brake firmly set while checking system.

## VISUAL/PHYSICAL UNDERHOOD INSPECTION

One of the most important checks that must be done as part of any diagnostic procedure is a careful visual/physical underhood inspection. This can often lead to fixing a problem without further steps. Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects. Be sure to inspect hoses that are difficult to see beneath the air cleaner, compressor, generator, etc. Inspect all the wires in the engine compartment for correct and good connections, burned or chafed spots, pinched wires, or contact with sharp edges or hot exhaust manifolds. This visual/physical inspection is very important. It must be done carefully and thoroughly. Refer to component locations at end of this section.

## BASIC KNOWLEDGE AND TOOLS REQUIRED

To use this manual most effectively, a general understanding of basic electrical circuits and circuit testing tools is required. You must be familiar with wiring diagrams, the meaning of voltage, ohms, amps, the basic theories of electricity, and understand what happens in an open or shorted wire.

To perform system diagnosis, the use of the Tech 1 diagnostic computer or equivalent scan tool is required. A test light, digital multimeter with 10 megohms impedance, J 39200 or equivalent vacuum gauge, and jumper wires are also required. You must become acquainted with the tools and their use before attempting to diagnose a vehicle. Special tools which are required for system service and the ones described above are illustrated in "Special Tools," SECTION 13.

## WHAT THIS MANUAL CONTAINS

The Driveability and Emissions has been developed to describe the function and operation of the control module control system that controls the driveability and emissions of the vehicle. Emphasis is placed on the diagnosis and repair of problems related to the system.

The diagnostic charts and functional checks for each system are found in "Diagnosis" of each section.

The "Driveability and Emissions" service manual is divided into 11 sections each dealing with diagnosis and repair. These sections can be summarized as follows.

### SECTION 2: DRIVEABILITY SYMPTOMS

This section assists in the diagnosis of intermittent problems or problems which don't result in the storing of Diagnostic Trouble Codes (DTCs). It is arranged by symptoms of poor driveability and emissions and lists probable causes of the problems.

### SECTION 3: CONTROL MODULE SYSTEMS

This is an electronically controlled exhaust emission system that uses a control module to control fuel delivery, ignition timing, air management and exhaust recirculation.

This section deals with the diagnosis and repair of each control module system with the use of a Tech 1 scan tool.

This section contains:

- Description and details of basic operation.
- On-Board Diagnostic (OBD) system check. This must be the first step of any diagnostic procedure.
- Functional Checks/Diagnostic charts.
- Diagnostic Trouble Code (DTC) tree charts with facing pages containing circuit diagrams, circuit operation information, and helpful diagnostic aids.
- Wiring diagrams.
- Control Module Connector Terminal End View and Terminal Definitions.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 4: FUEL SYSTEMS

The control module controls the air/fuel delivery to the combustion chamber by controlling the fuel flow through the injectors. The control module also controls idle speed, in-tank fuel pump, and A/C compressor clutch on some models.

This section describes in detail the fuel system.

This section contains:

- Description and details of operation.
- Diagnosis and repair of the fuel system.
- Idle Air Control (IAC) system check.
- Fuel pressure test procedure.
- On-Vehicle Service.
- Part Names and Group Numbers.

## 1-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

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### SECTION 5: EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

This system limits fuel vapors from escaping into the atmosphere by storing the fuel vapors in a vapor canister. When the engine is able to use the extra fuel vapor, the fuel vapor is then purged from the carbon element by intake air flow and returned to the intake manifold for combustion during engine operation.

This section contains:

- Description and details of operation.
- Diagnosis.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 6: DISTRIBUTOR IGNITION (DI) SYSTEM

This system is controlled by the control module and controls ignition timing used on all engines.

This section deals with controlled ignition timing only. Additional information on the ignition system is found in SECTION 6 of the Light Duty Truck Service Manual.

This section contains:

- Details of basic operation.
- Diagnosis including system check chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 7: KNOCK SENSOR (KS) SYSTEM

This system uses a knock sensor in conjunction with the control module to control spark timing to allow the engine to have maximum spark advance without spark knock. This improves driveability and fuel economy and is used on all engines.

This section contains:

- Description and details of operation.
- Diagnosis including system check chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 8: SECONDARY AIR INJECTION SYSTEM (AIR)

This system provides additional oxygen to the exhaust gases to continue the combustion process. Air management is used only on engine/transmission combinations that require the system to meet emission standards.

This section contains:

- Description and details of operation.
- Diagnosis including system check chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 9: EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The EGR system uses a valve to feed a small amount of exhaust gas back into the intake manifold to control formation of NOx. This system is used on all engines and is controlled by the control module.

This section contains:

- Description and details of operation.
- Diagnosis including system check chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 10: TRANSMISSION CONTROLS

The electronic 4L60E/4L80E transmission is controlled by a Powertrain Control Module (PCM), which controls all transmission and torque converter operations.

On manual transmission applications, the control module operates the shift lamp to indicate the best shift point for maximum fuel economy.

This section contains:

- Description and details of operation.
- Diagnosis including functional check.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 11: CRANKCASE VENTILATION SYSTEM

The crankcase ventilation system passes crankcase vapors into the intake manifold. This system is not controlled by the control module and is used on all engines.

This section contains:

- Description and details of operation.
- Diagnosis including functional check.
- On-Vehicle Service.
- Part Names and Group Numbers.

### SECTION 12: AIR INTAKE SYSTEM

The air intake system supplies cool filtered air to the engine from outside the engine compartment. On most applications the air intake system regulates heated air through the air cleaner to provide uniform inlet air temperature which provides good driveability under various climatic conditions. This system is not controlled by the control module.

This section contains:

- Description and details of operation including the Air Cleaner (ACL).
- Diagnosis including functional check.
- On-Vehicle Service.
- Part Names and Group Numbers.

**SECTION 13: SPECIAL TOOLS**

This section lists and briefly describes the use of the special tools required for diagnosis and repair of the fuel and emission systems.

**SECTION 14: ABBREVIATIONS AND GLOSSARY OF TERMS**

This section list the abbreviations and acronyms used in this manual along with an explanation of each.

**COMPONENT LOCATIONS**

There are many components used to control fuel and emissions. Each system is described in a section which includes general description of the system, diagnosis and on-vehicle service. Component locations for all series vehicles and all engines are illustrated in Figures 1-2 through 1-38. The "Component Location" views show all emission systems that may be used for the particular vehicle/engine combination. Not every vehicle requires all the systems or components shown, but only the ones needed to meet emission standards for the area of certification.

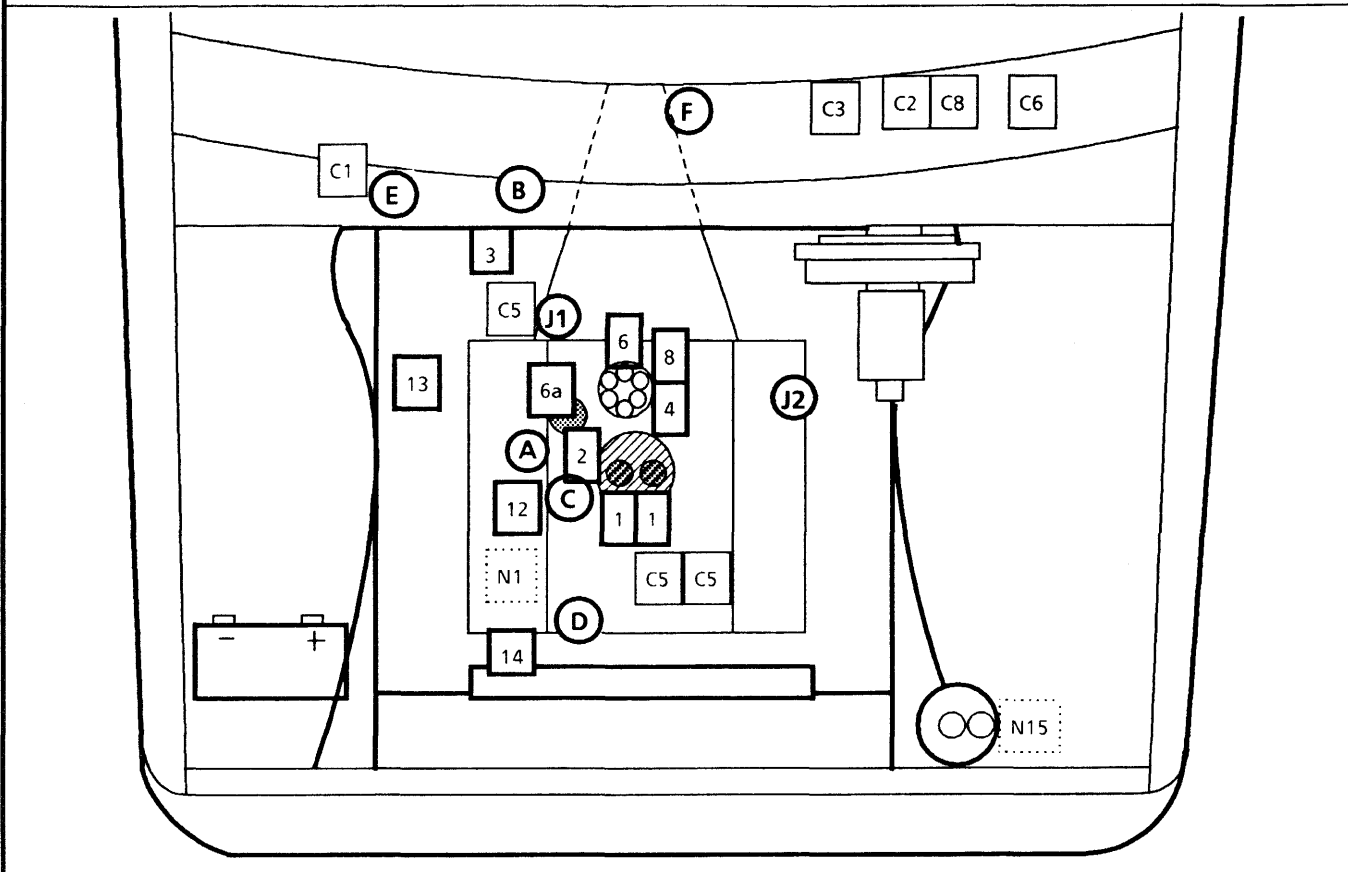


'C/K' SERIES

RPO:LB4

ENGINE CODE:Z

4.3L V6



### CONTROL MODULE SYSTEM

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuse pump prime terminal "G" of DLC

### PCM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 13 A/C Low Pressure Switch (pressure cycling)
- 14 A/C High Pressure cut-out switch

### ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP) sensor
- B Heated Oxygen Sensor (HO2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS)
- J1 Knock Sensor (KS) 1 of 2
- J2 Knock Sensor (KS) 2 of 2

### EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase vent valve
- N15 Fuel vapor canister

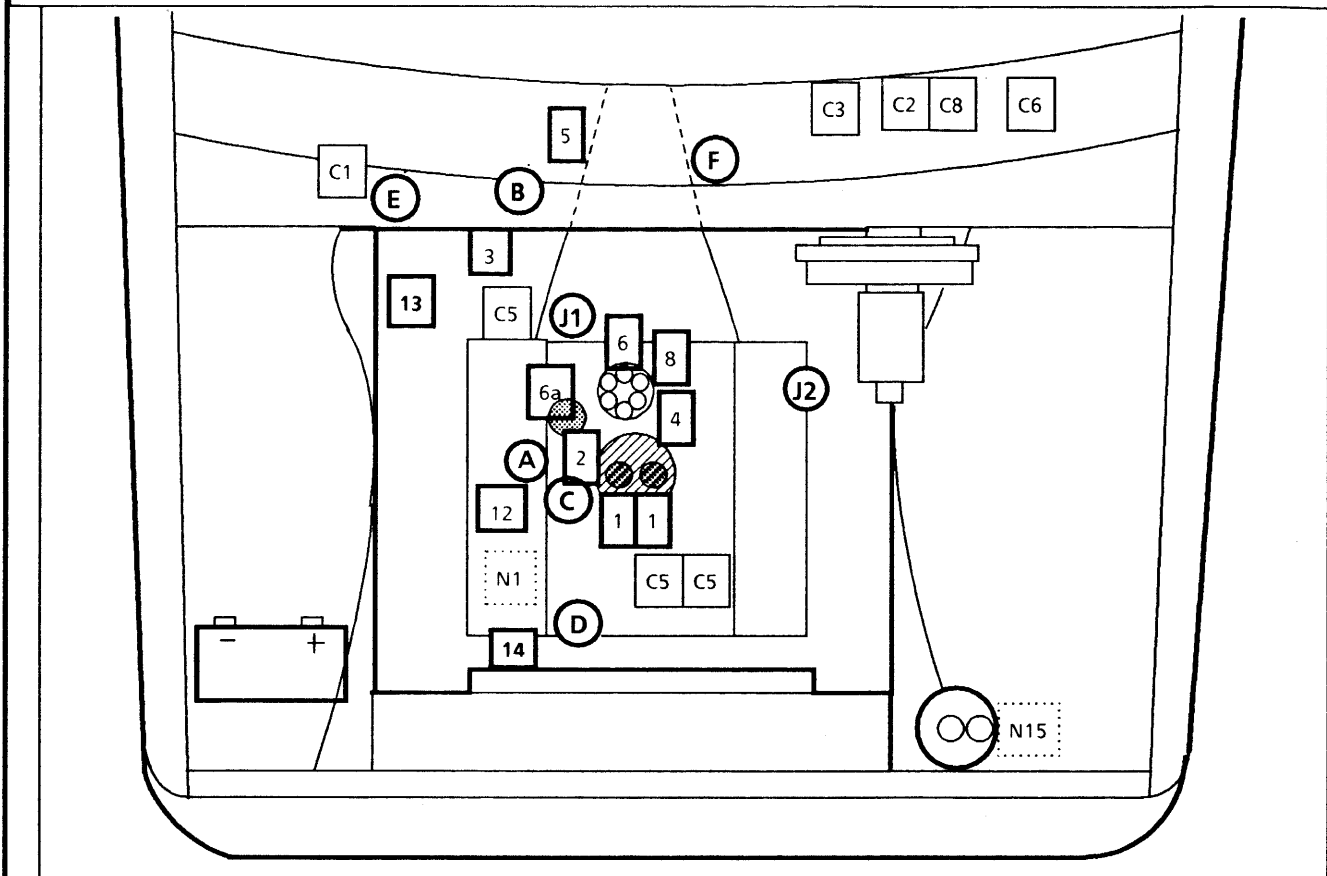
Figure 1-2 - Component Locations - 4.3L "C/K" with Manual Transmission

'C/K' SERIES

RPO:LB4

ENGINE CODE:Z

4.3L V6



**CONTROL MODULE SYSTEM**

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

**PCM CONTROLLED COMPONENTS**

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 5 Transmission connector
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 13 A/C Low Pressure Switch (Pressure Cycling)
- 14 A/C High Pressure Cut-Out Switch

**PCM INFORMATION SENSORS**

- A Manifold Absolute Pressure (MAP) sensor
- B Heated Oxygen Sensor (HO2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS)
- J1 Knock Sensor (KS) 1 of 2
- J2 Knock Sensor (KS) 2 of 2

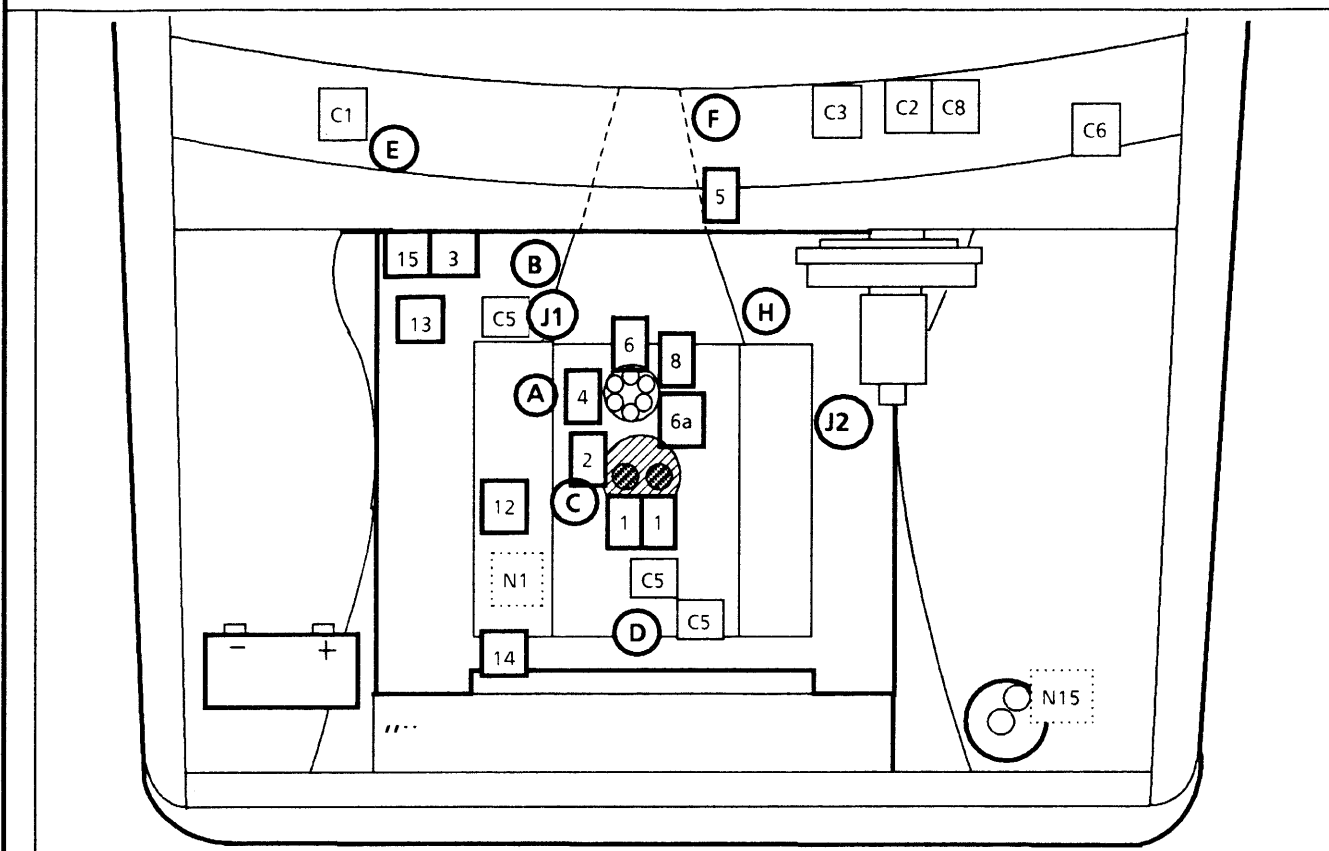
**EMISSION COMPONENTS (NOT PCM CONTROLLED)**

- N1 Crankcase vent valve
- N15 Fuel vapor canister

4-16-93  
MS 13354

Figure 1-3 - Component Locations - 4.3L "C/K" with Automatic Transmission (4L60E)

'C/K' SERIES RPO:LB4 ENGINE CODE: Z 4.3L V6



### CONTROL MODULE SYSTEM

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

### PCM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 5 Transmission connector
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) electronic vacuum regulator solenoid valve
- 13 A/C low pressure switch (pressure cycling)
- 14 A/C high pressure cutout switch
- 15 Fuel pump fuse

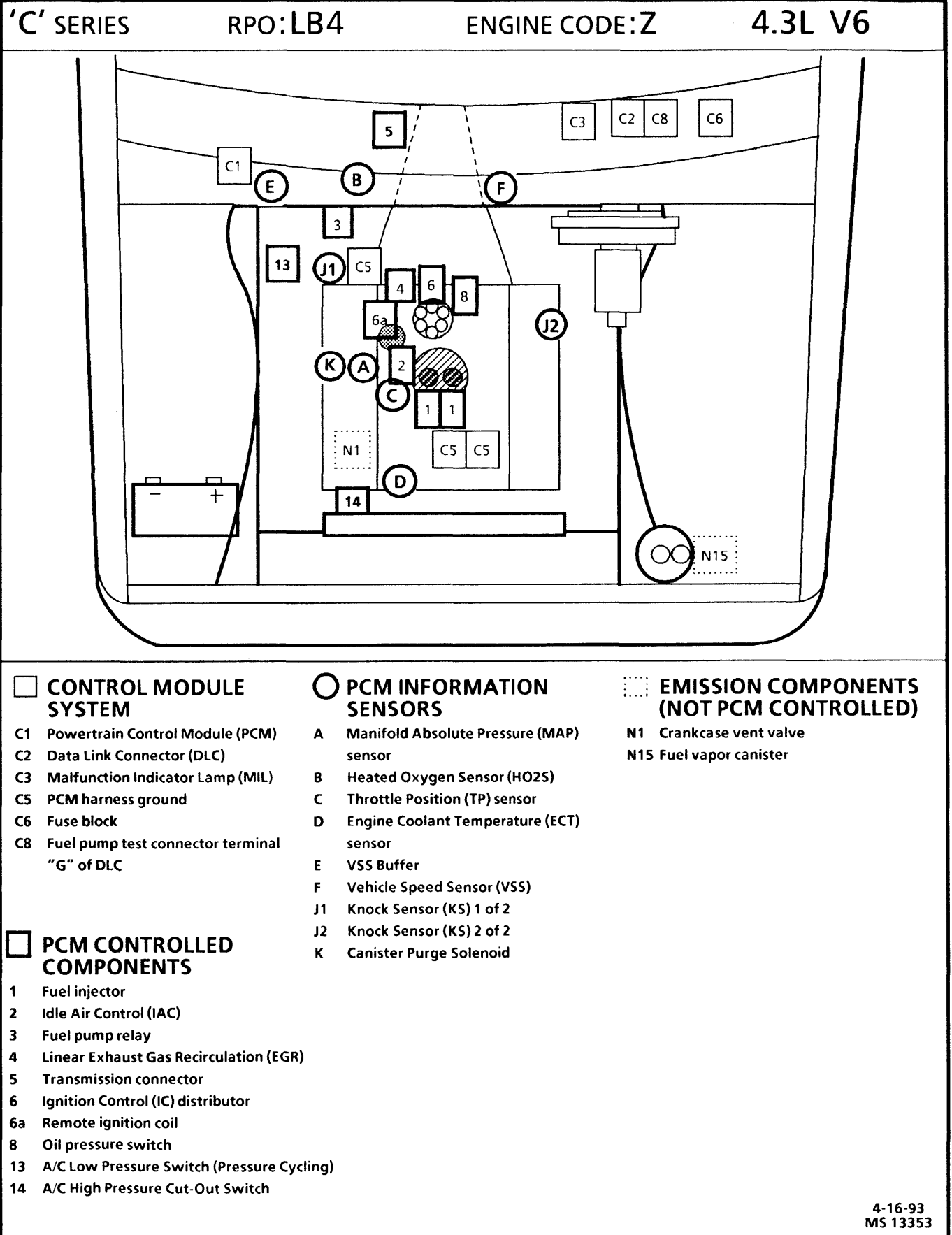
### PCM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP) sensor
- B Heated Oxygen Sensor (HO2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS) (output speed sensor)
- H Input speed sensor
- J1 Knock Sensor (KS) 1 of 2
- J2 Knock Sensor (KS) 2 of 2

### EMISSION COMPONENTS (NOT PCM CONTROLLED)

- N1 Crankcase vent valve
- N15 Fuel vapor canister

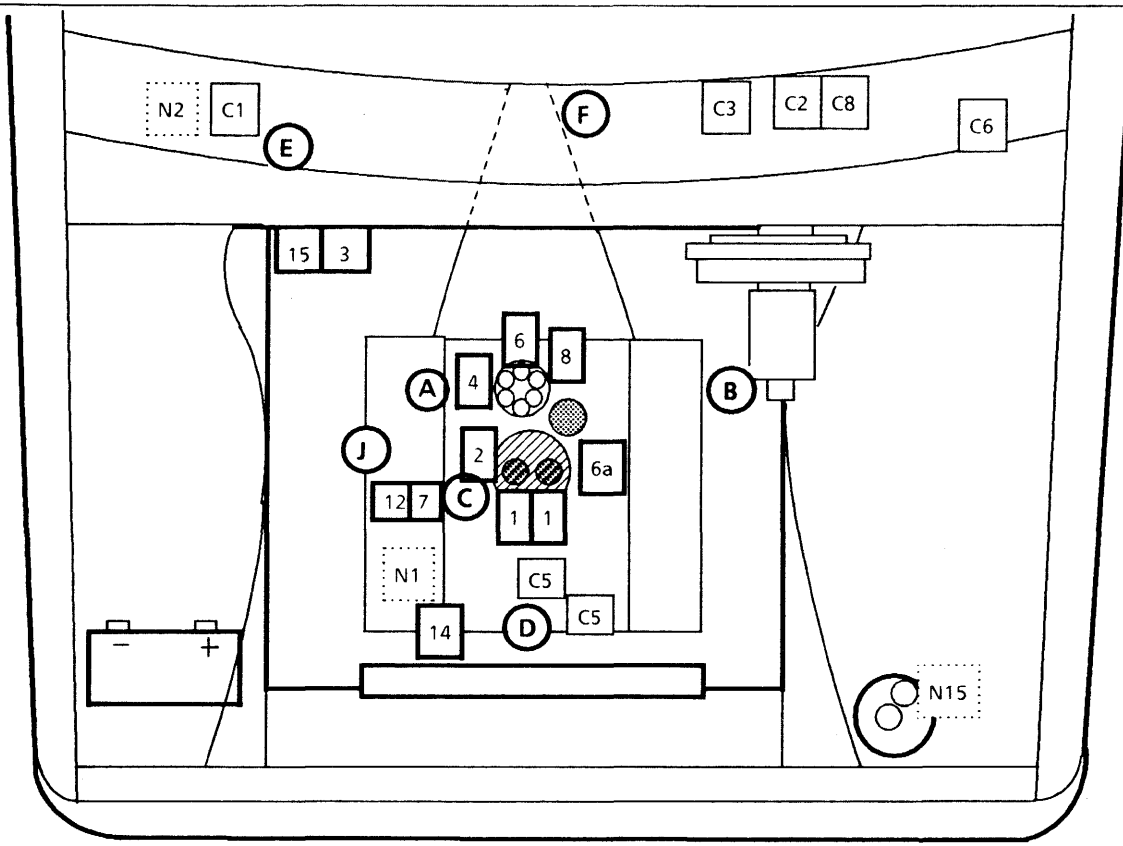
Figure 1-4 - Component Locations - 4.3L "C/K" with Automatic Transmission (4L80E)



4-16-93  
MS 13353

Figure 1-5 - Component Locations - 4.3L "C" with California Emissions

'C/K' SERIES RPO:L03/L05 ENGINE CODE:H/K 5.0L/5.7L V8



### CONTROL MODULE SYSTEM

- C1 Engine Control Module (ECM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 ECM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

### ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP) sensor
- B Oxygen Sensor (O2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS)
- J Knock Sensor (KS)

### EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase vent valve
- N2 Fuel module (5.7L H.D. only)
- N15 Fuel vapor canister

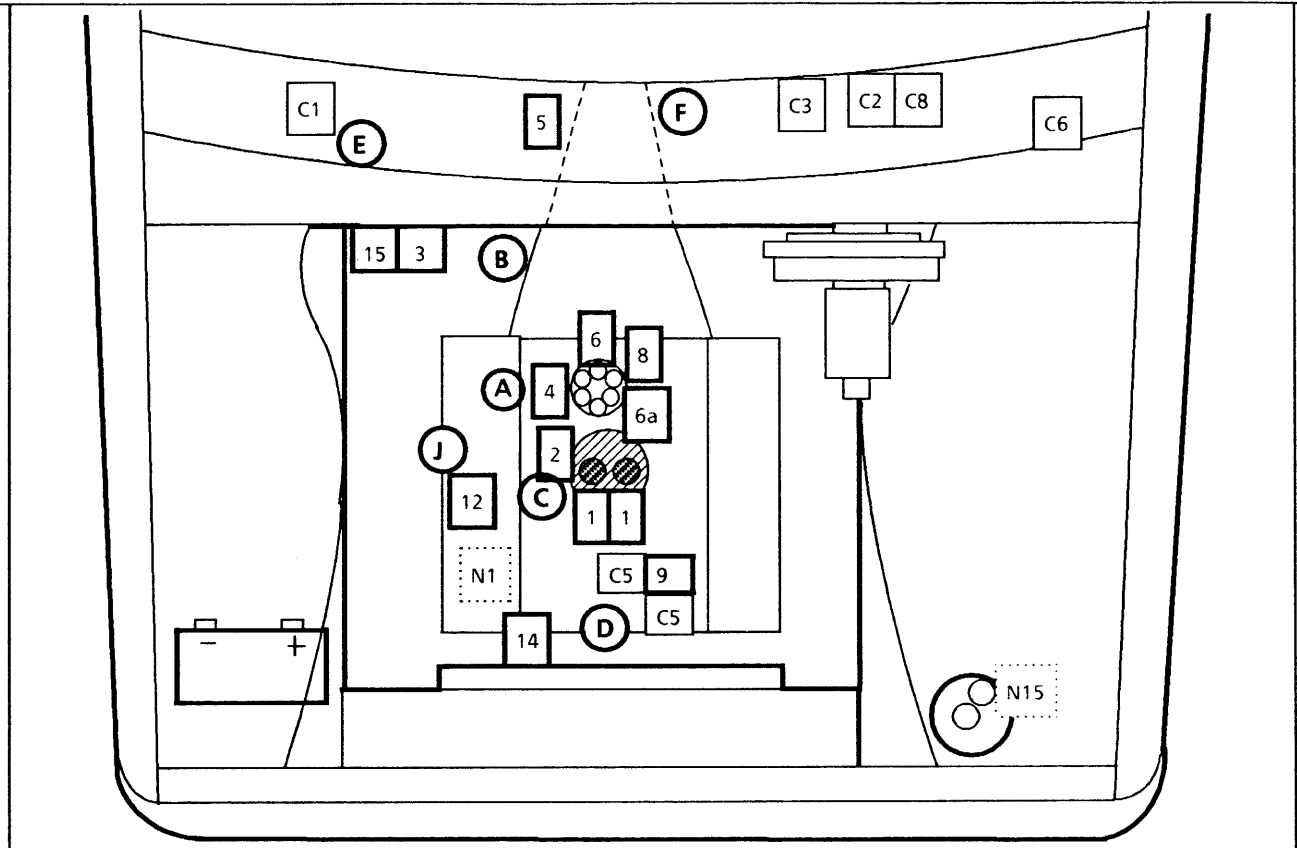
### ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 7 Knock Sensor (KS) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) vacuum solenoid
- 12 Exhaust Gas Recirculation (EGR) electronic vacuum Regulator Solenoid Valve (5.7L H.D. only)
- 13 A/C low pressure switch (pressure cycling)
- 14 A/C high pressure cutout switch
- 15 Fuel pump fuse

5-5-93  
7S 3303-6E

Figure 1-6 - Component Locations - 5.0L/5.7L "C/K" with Manual Transmission

'C/K' SERIES RPO:L03/L05 ENGINE CODE:H/K 5.0L/5.7L V8



**CONTROL MODULE SYSTEM**

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

**PCM CONTROLLED COMPONENTS**

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 5 Transmission connector
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 9 Canister purge solenoid
- 12 Exhaust Gas Recirculation (EGR) vacuum solenoid
- 13 A/C low pressure switch (pressure cycling)
- 14 A/C high pressure cutout switch
- 15 Fuel pump fuse

**PCM INFORMATION SENSORS**

- A Manifold Absolute Pressure (MAP) sensor
- B Heated Oxygen Sensor (HO2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS)
- J Knock Sensor (KS)

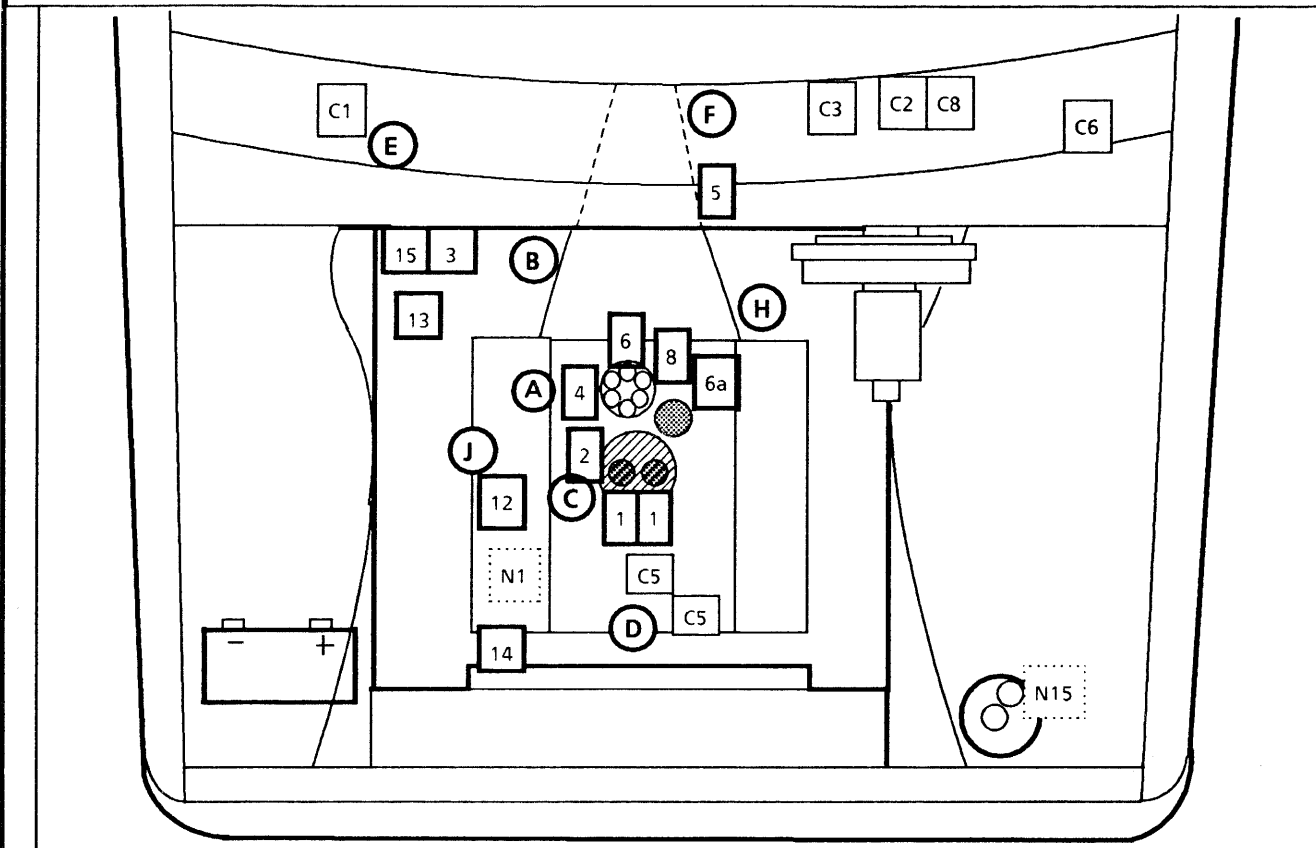
**EMISSION COMPONENTS (NOT PCM CONTROLLED)**

- N1 Crankcase vent valve
- N15 Fuel vapor canister

5-5-93  
MS 13356

Figure 1-7 - Component Locations - 5.0L/5.7L "C/K" with Automatic Transmission (4L60E)

'C/K' SERIES RPO:L05 ENGINE CODE:K 5.7L V8



### CONTROL MODULE SYSTEM

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

### PCM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 EGR valve
- 5 Transmission connector
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) electronic vacuum regulator solenoid valve
- 13 A/C low pressure switch (pressure cycling)
- 14 A/C high pressure cutout switch
- 15 Fuel pump fuse

### PCM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP) sensor
- B Oxygen Sensor (O2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS) (output speed sensor)
- H Input speed sensor
- J Knock Sensor (KS)

### EMISSION COMPONENTS (NOT PCM CONTROLLED)

- N1 Crankcase vent valve
- N15 Fuel vapor canister

5-5-93  
PS 17474

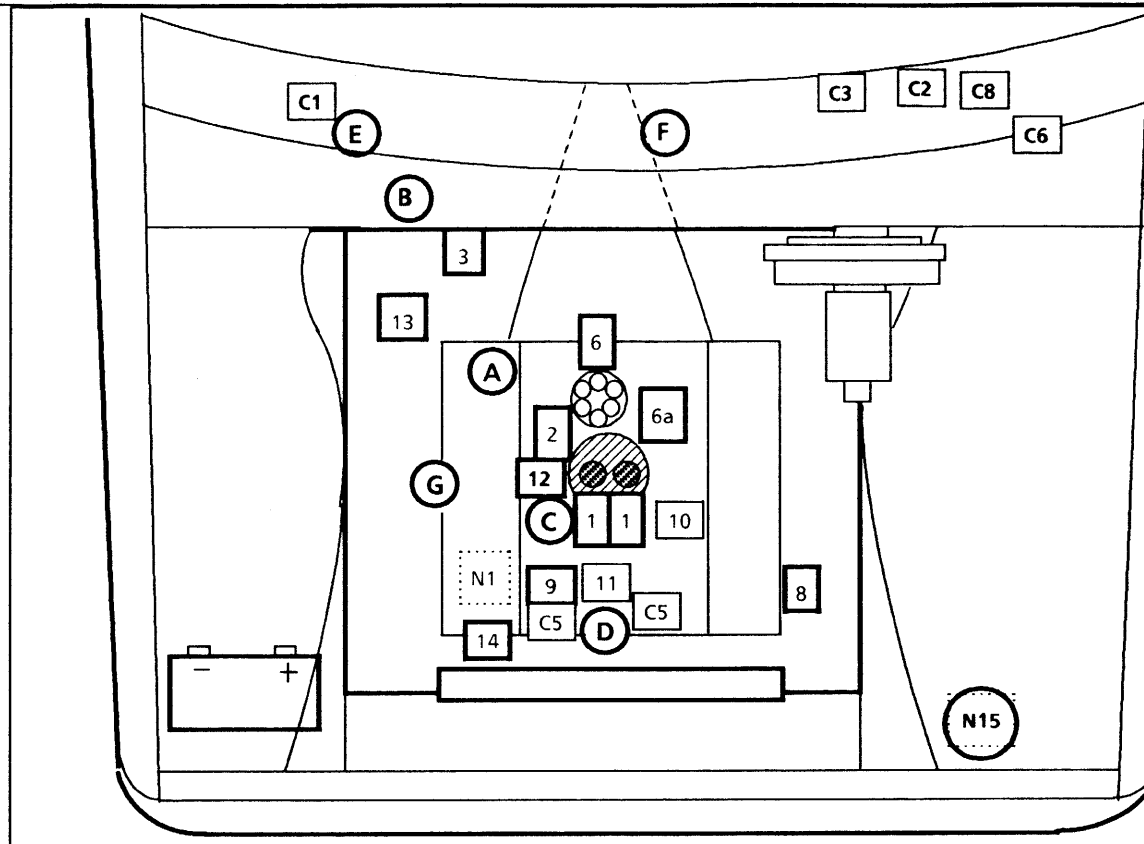
Figure 1-8 - Component Locations - 5.7L "C/K" with Automatic Transmission (4L80E)

C/K SERIES

RPO:L19

ENGINE CODE:N

7.4L V8



**CONTROL MODULE SYSTEM**

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector terminal "G" of DLC

**ECM INFORMATION SENSORS**

- A Manifold Absolute Pressure (MAP) sensor
- B Oxygen Sensor (O2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS)
- G Knock Sensor (KS)

**EMISSION COMPONENTS (NOT ECM CONTROLLED)**

- N1 Crankcase vent valve
- N15 Fuel vapor canister

**PCM CONTROLLED COMPONENTS**

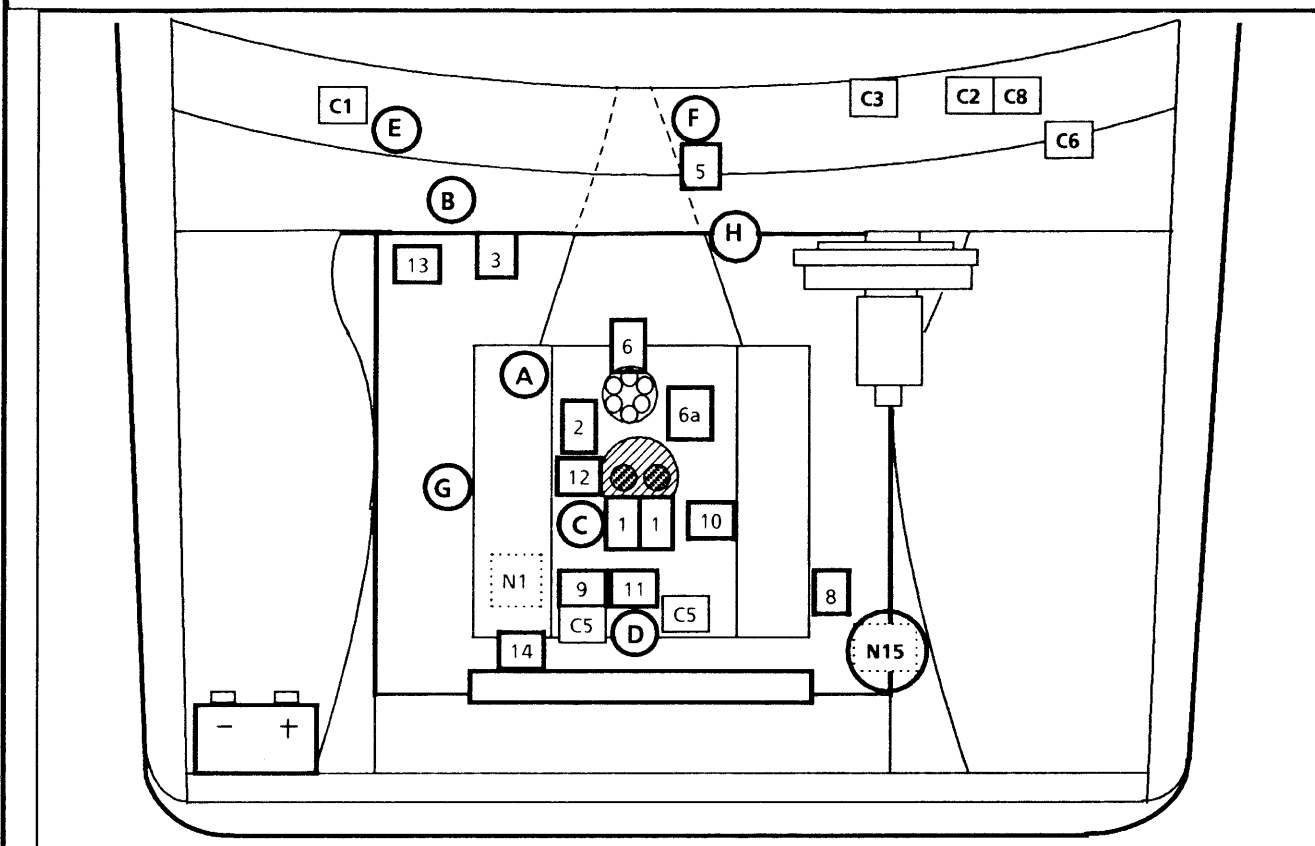
- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 9 Idle speed control actuator solenoid
- 10 Idle speed control actuator
- 11 Canister purge solenoid
- 12 Linear Exhaust Gas Recirculation (EGR) valve
- 13 A/C low pressure switch (pressure cycling)
- 14 A/C high pressure cutout switch

5-5-93  
7S 3306-6E

Figure 1-9 - Component Locations - 7.4L "C/K" with Manual Transmission



C/K SERIES RPO:L19 ENGINE CODE:N 7.4L V8



### CONTROL MODULE SYSTEM

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL)
- C5 PCM harness ground
- C6 Fuse block
- C8 Fuel pump test connector (DLC terminal "G")

### PCM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission connector
- 6 Ignition Control (IC) distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 9 Idle Speed Actuator Solenoid
- 10 Idle Speed Actuator
- 11 Canister Purge Solenoid
- 12 Linear Exhaust Gas Recirculation (EGR) valve
- 13 A/C Low Pressure Switch (pressure cycling)
- 14 A/C High Pressure Cut-out Switch

### PCM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP) sensor
- B Oxygen Sensor (O2S)
- C Throttle Position (TP) sensor
- D Engine Coolant Temperature (ECT) sensor
- E VSS buffer
- F Vehicle Speed Sensor (VSS) (output speed sensor)
- G Knock Sensor (KS)
- H Input speed sensor

### EMISSION COMPONENTS (NOT PCM CONTROLLED)

- N1 Crankcase vent valve
- N15 Fuel vapor canister

5-5-93  
MS 13359

Figure 1-10 - Component Locations - 7.4L "C/K" with Automatic Transmission (4L80E)

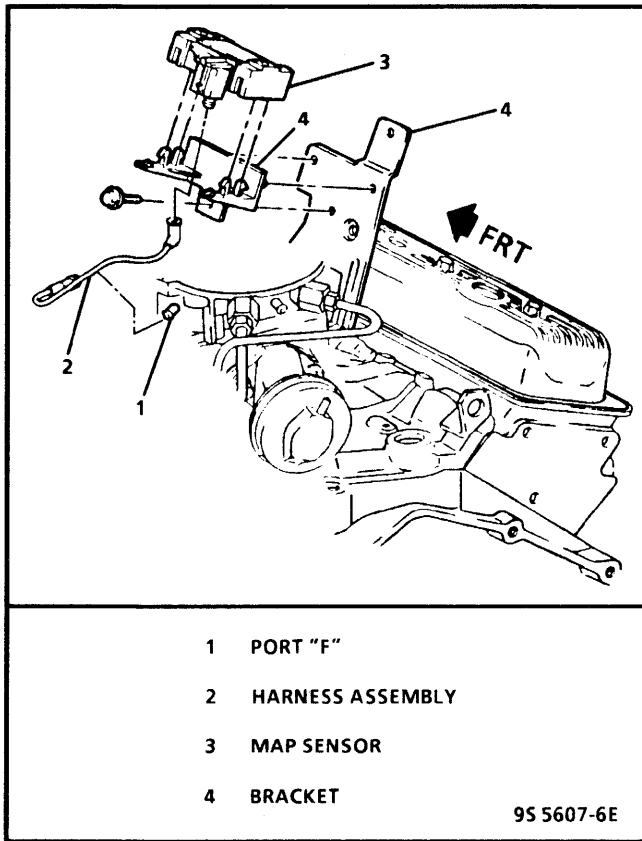


Figure 1-11 - MAP Sensor Typical

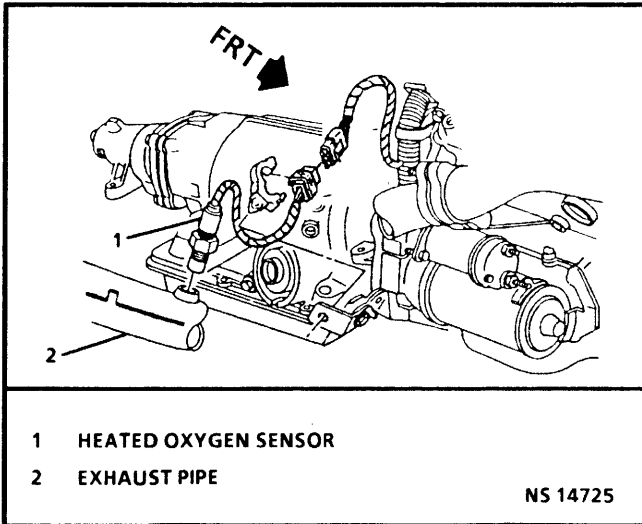


Figure 1-12 - Heated Oxygen Sensor (HO2S)

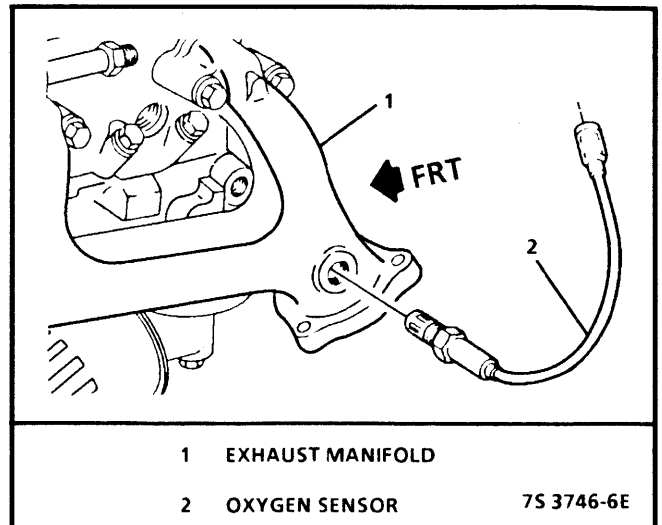


Figure 1-13 - Oxygen Sensor (O2S) 5.0L, 5.7L Manual Trans

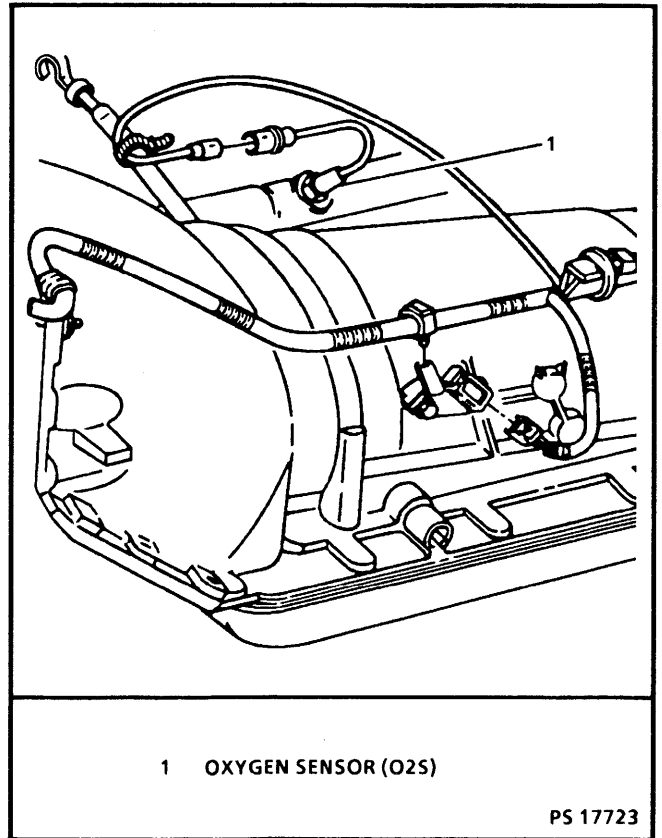


Figure 1-14 - Oxygen Sensor (O2S) (C/K)

## 1-16 DRIVEABILITY AND EMISSIONS (GASOLINE)

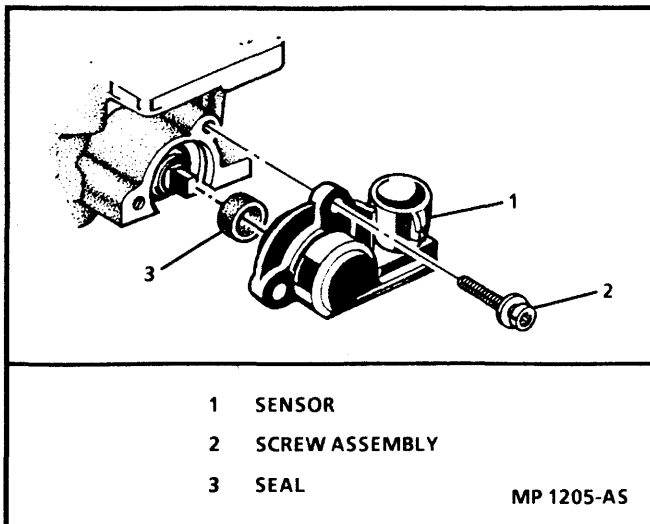


Figure 1-15 - Throttle Position (TP) Sensor

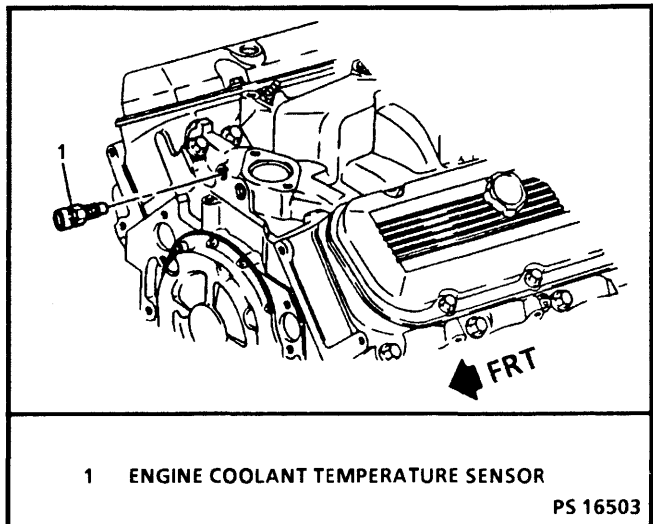


Figure 1-17 - Engine Coolant Temperature (ECT) Sensor 7.4L

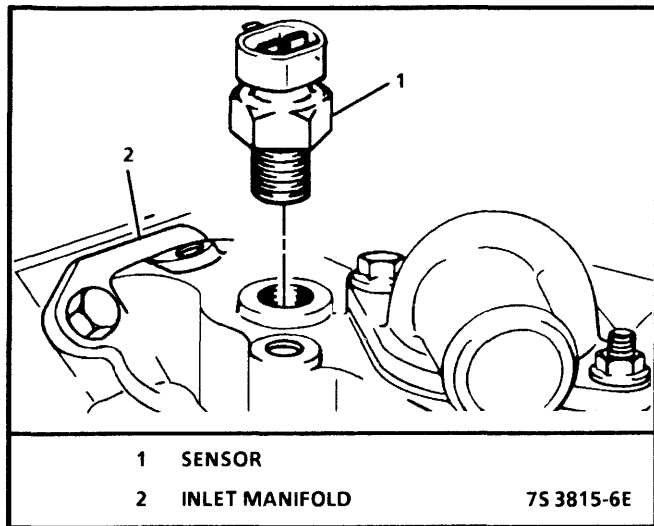


Figure 1-16 - Engine Coolant Temperature (ECT) Sensor (TBI) 4.3L, 5.0L, 5.7L

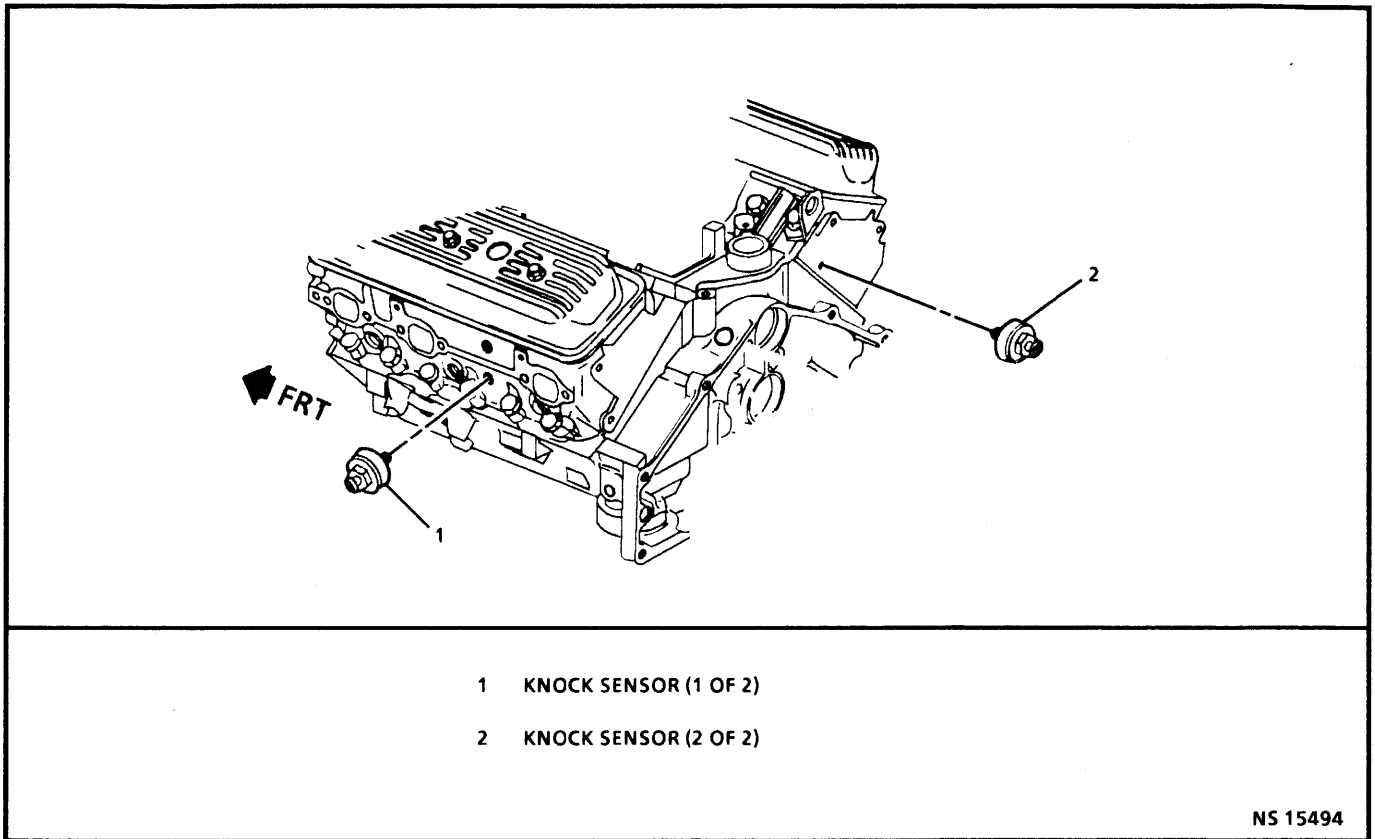


Figure 1-18 - Knock Sensors (KS) 4.3L

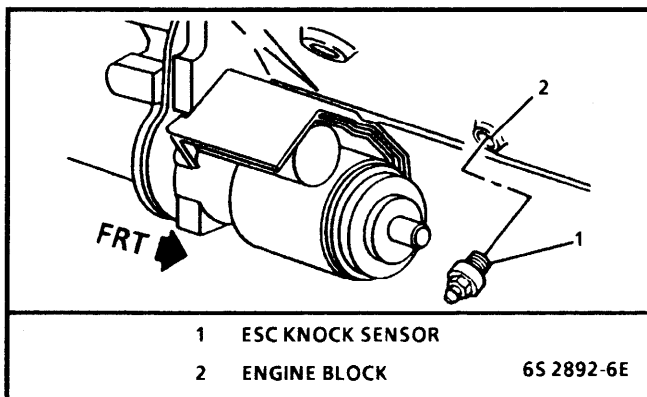


Figure 1-19 - Knock Sensor (KS) 5.0L, 5.7L, 7.4L

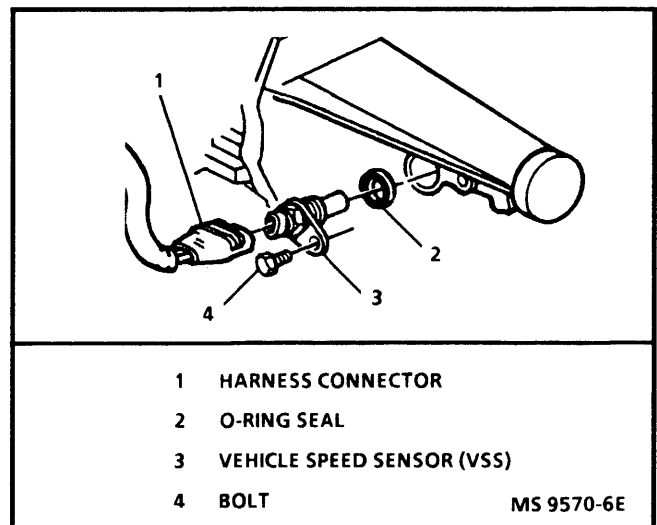
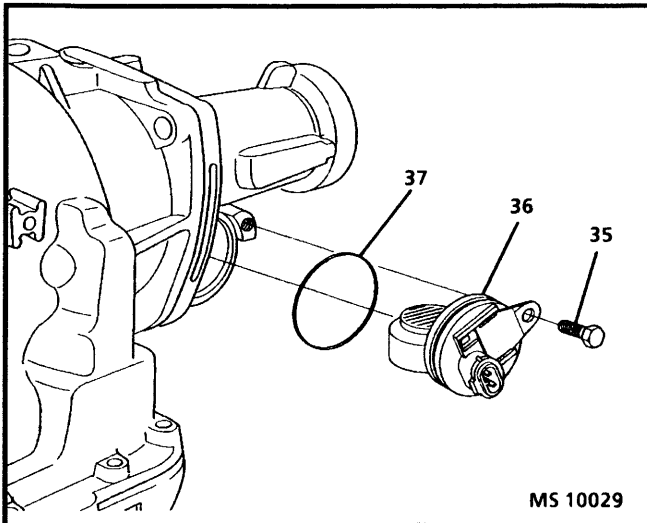


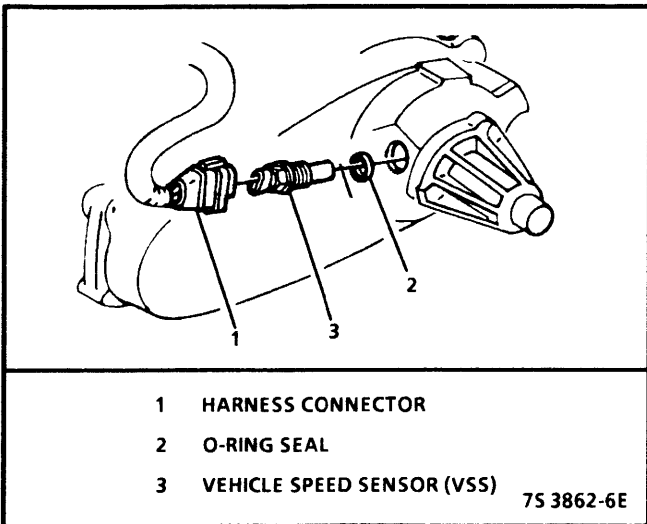
Figure 1-20 - Vehicle Speed Sensor (VSS) 2WD (M/T)

## 1-18 DRIVEABILITY AND EMISSIONS (GASOLINE)



MS 10029

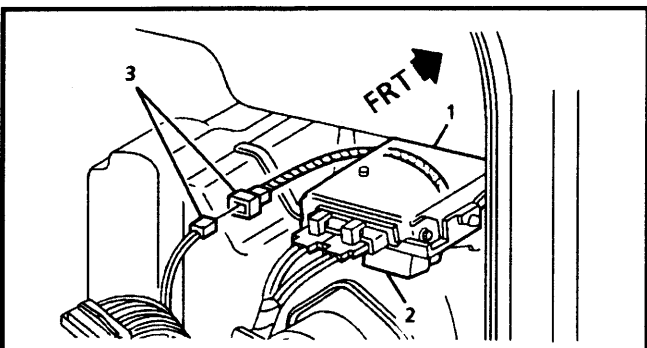
Figure 1-21 - Vehicle Speed Sensor (VSS) 2WD (A/T)



- 1 HARNESS CONNECTOR
- 2 O-RING SEAL
- 3 VEHICLE SPEED SENSOR (VSS)

75 3862-6E

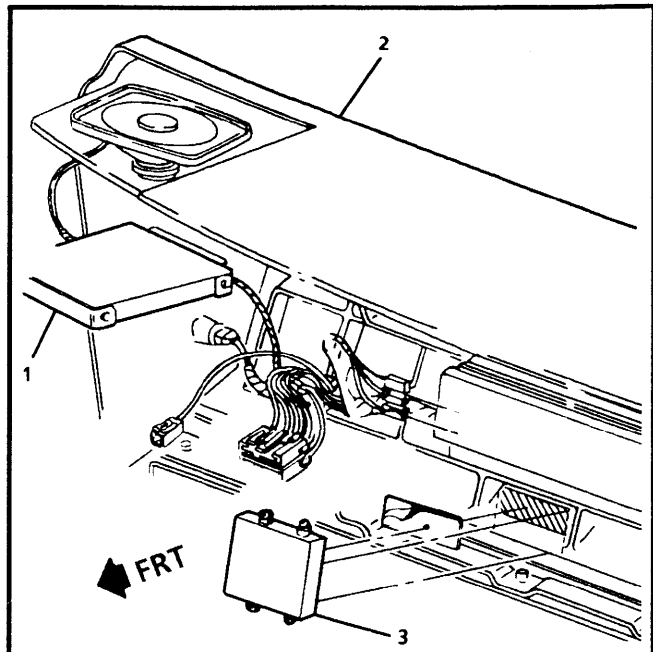
Figure 1-22 - Vehicle Speed Sensor (VSS) 4WD



- 1 CONTROL MODULE
- 2 FUEL MODULE
- 3 ELECTRONIC CONNECTOR

85 4613-6E

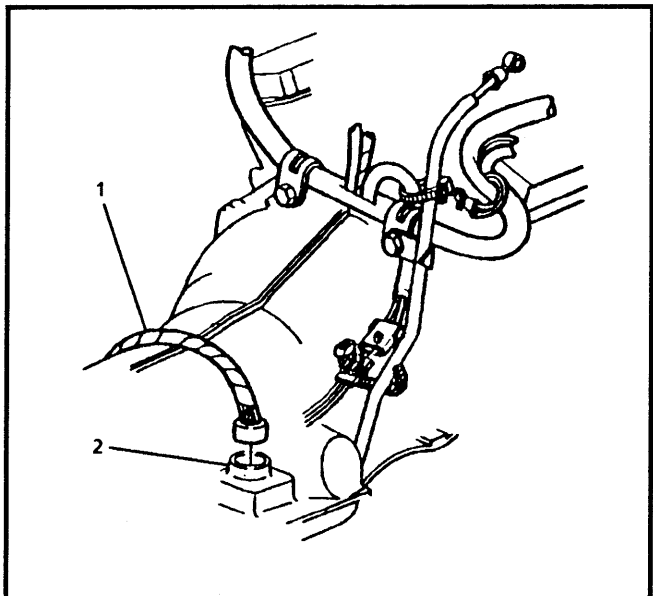
Figure 1-23 - Control Module



- 1 CONTROL MODULE
- 2 INSTRUMENT PANEL
- 3 VSS BUFFER MODULE

MS 12398

Figure 1-24 - VSS Buffer



- 1 TRANSMISSION WIRING HARNESS
- 2 TRANSMISSION CONNECTOR

PS 16949

Figure 1-25 - Trans Connector - 4L60E

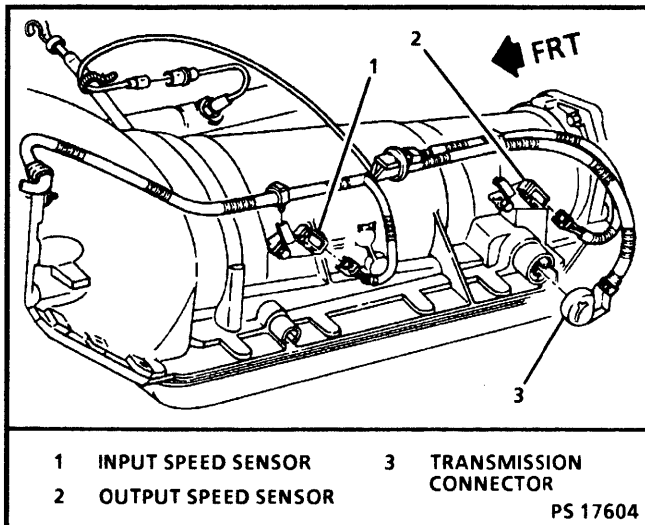


Figure 1-26 - Trans Connector - 4L80E

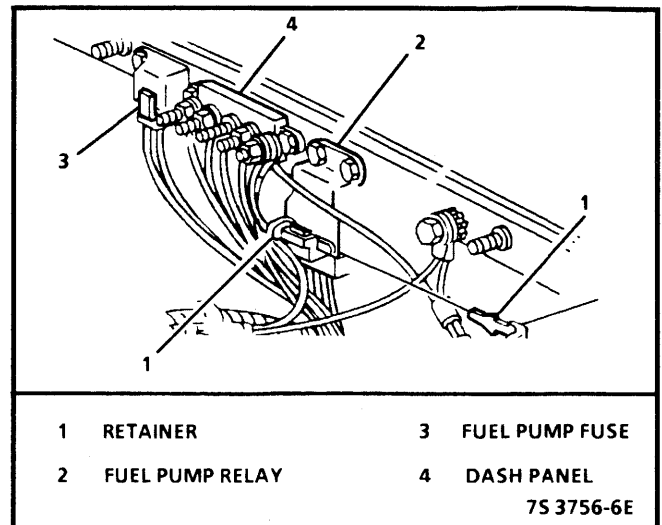


Figure 1-28 - Fuel Pump Relay (C/K)

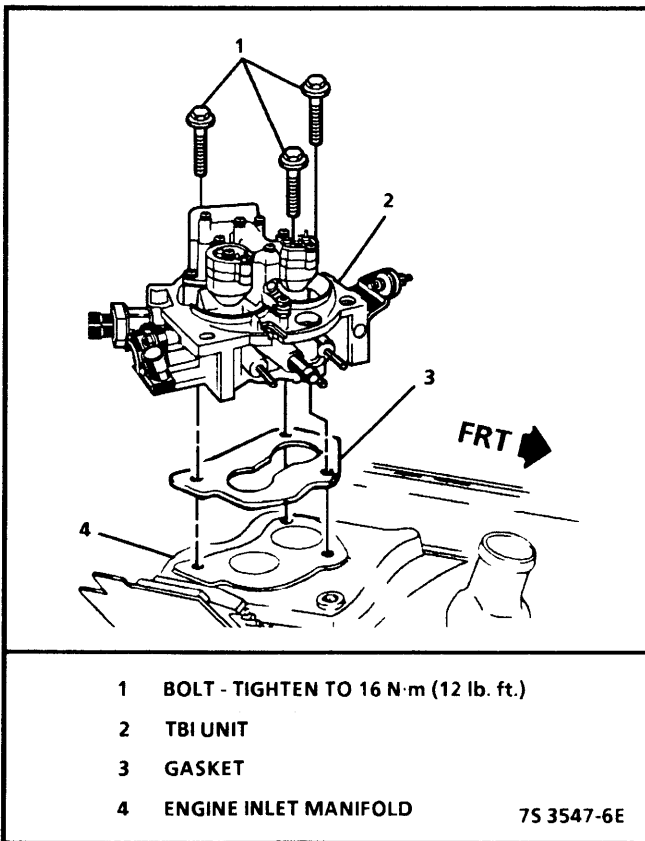


Figure 1-27 - TBI 220 Unit Typical

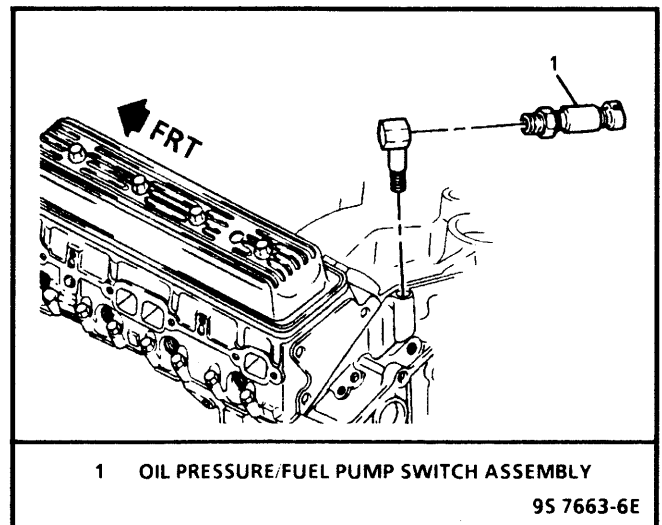


Figure 1-29 - Oil Pressure Switch 4.3L, 5.0L, 5.7L

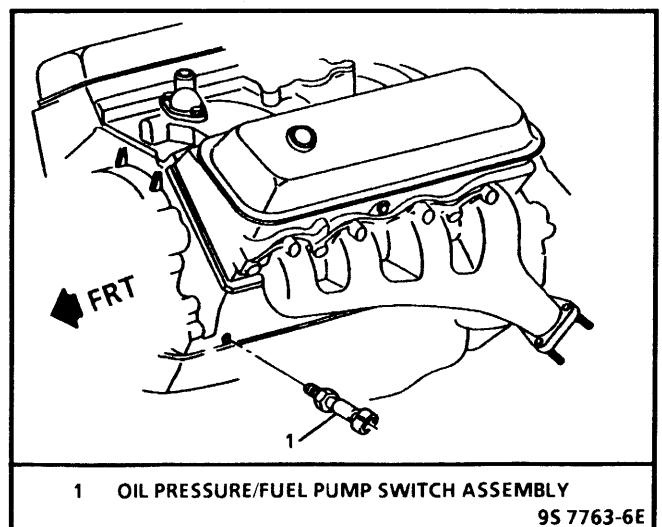


Figure 1-30 - Oil Pressure Switch 7.4L

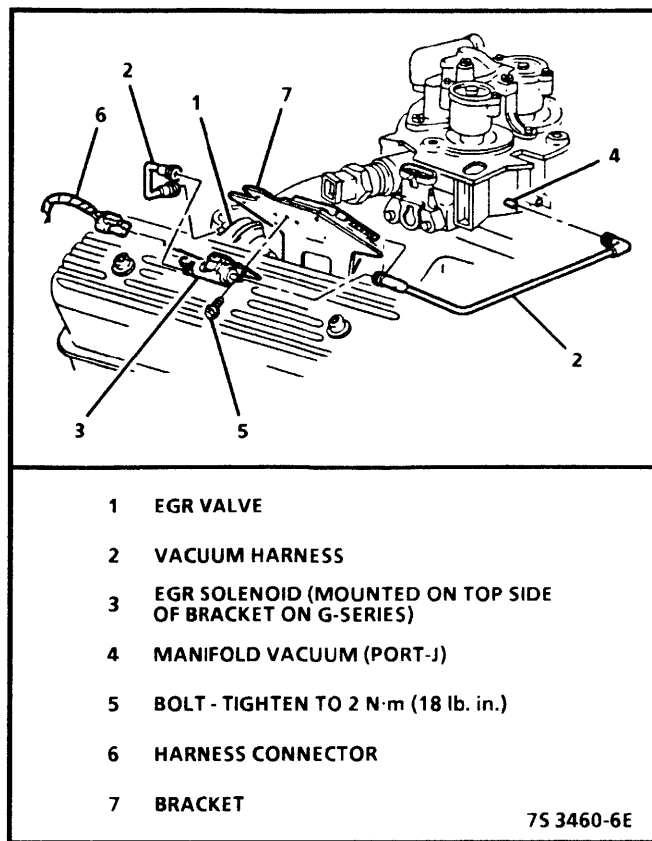


Figure 1-31 - EGR and Solenoid 5.0L & 5.7L

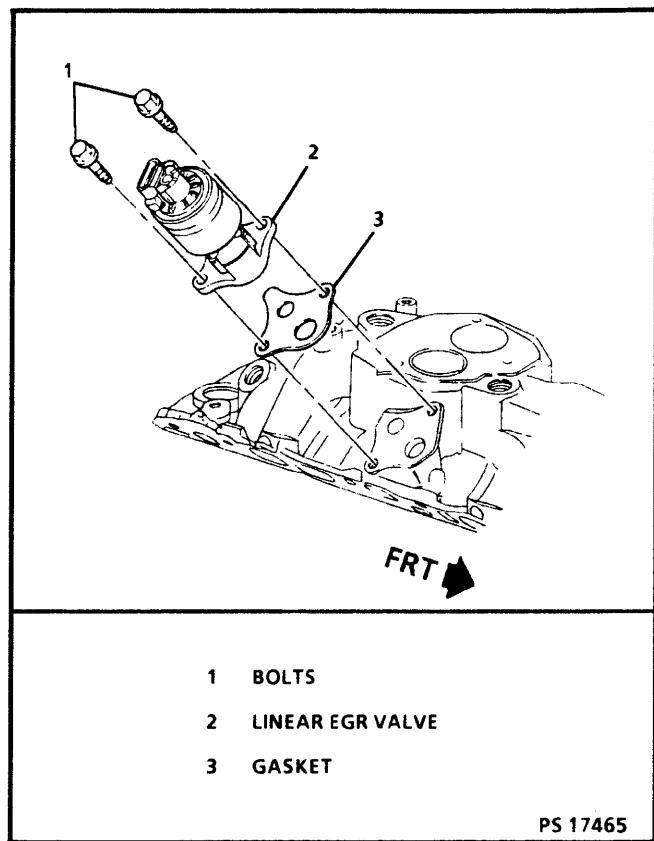


Figure 1-33 - Linear EGR

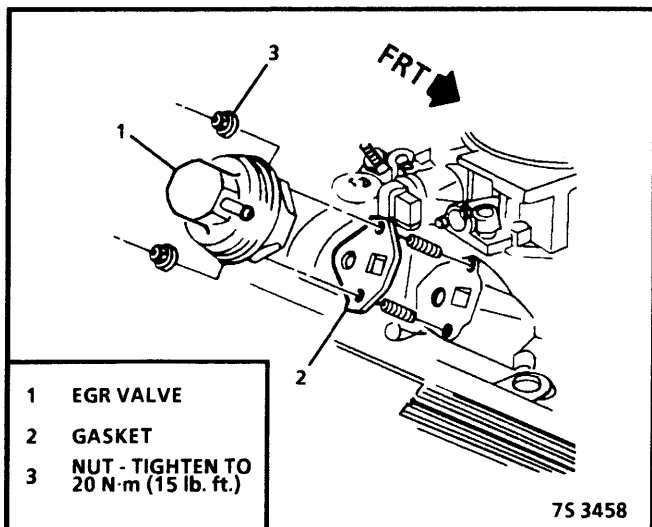


Figure 1-32 - EGR and (EVRV) Solenoid 5.7L

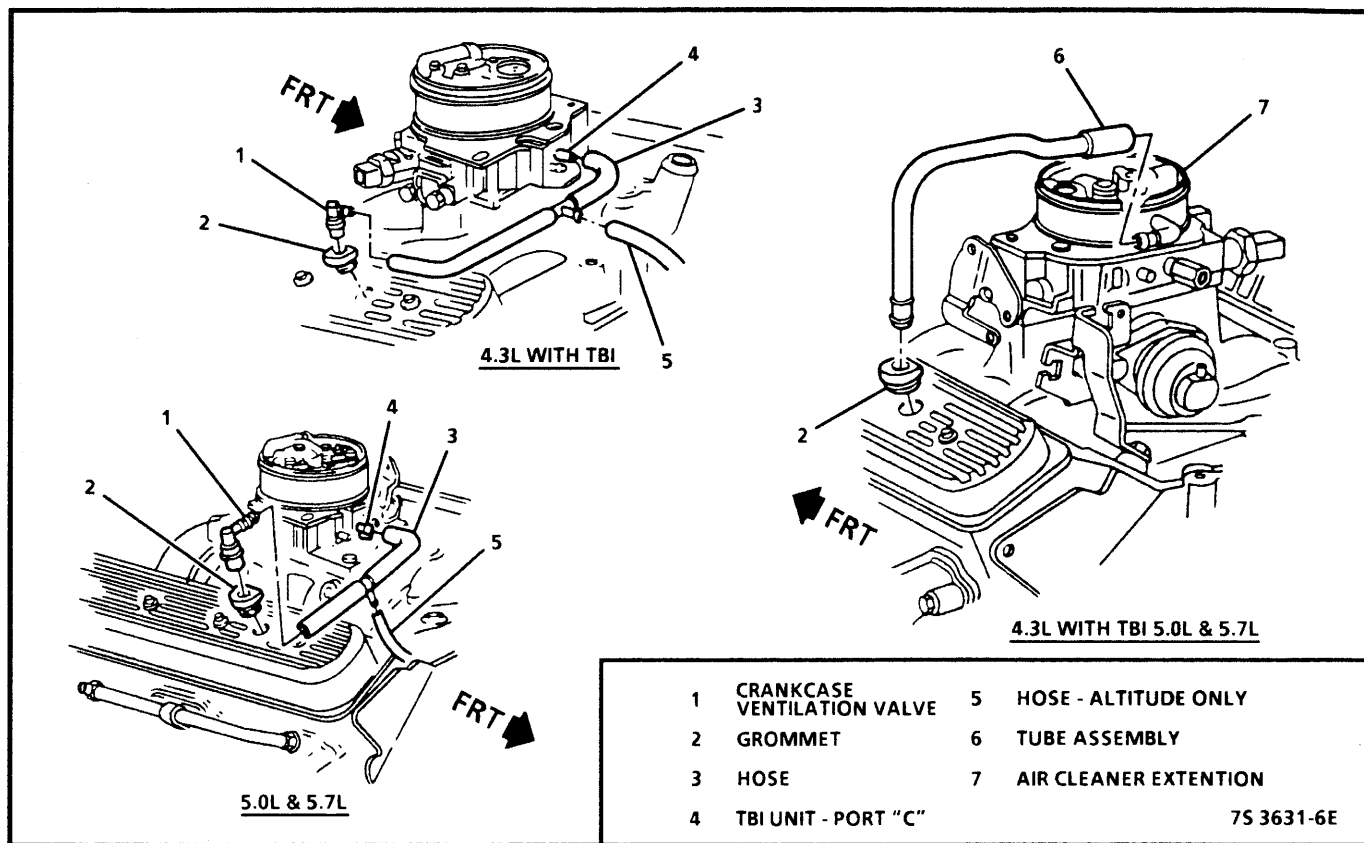


Figure 1-34 - Crankcase Ventilation System 4.3L, 5.0L & 5.7L

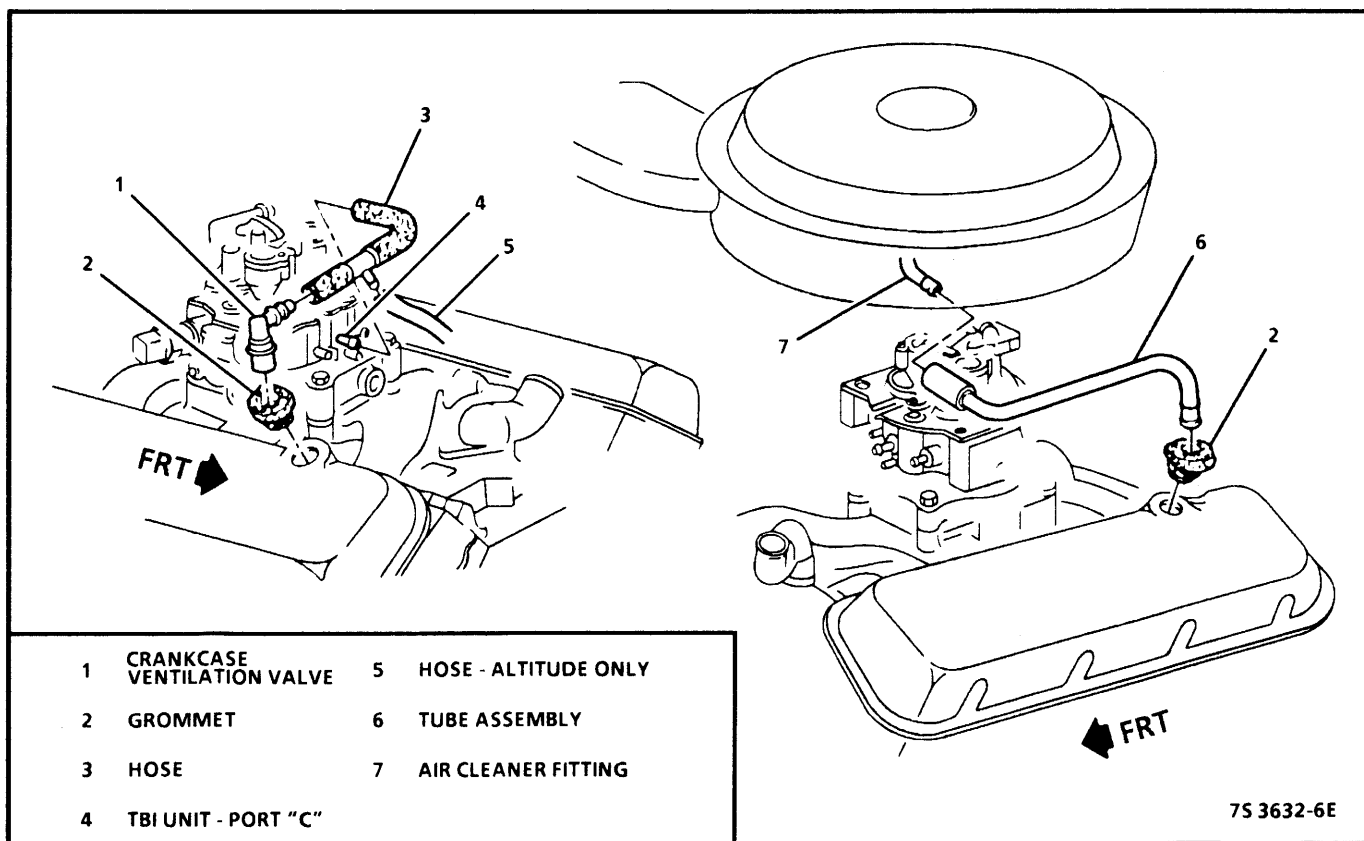


Figure 1-35 - Crankcase Ventilation System 7.4L



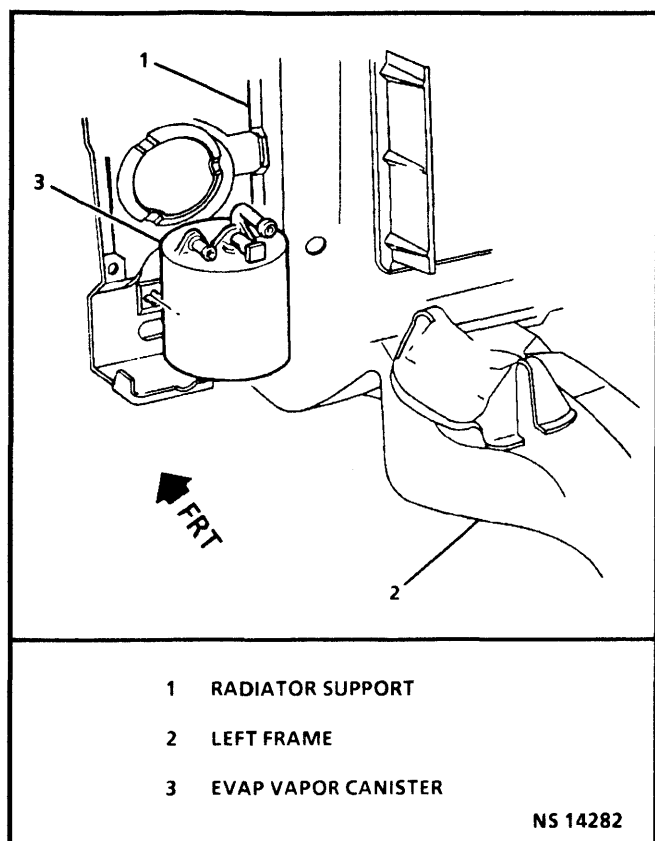


Figure 1-36 - Vapor Canister - Typical 5.0L, 5.7L, 4.3L, 7.4L

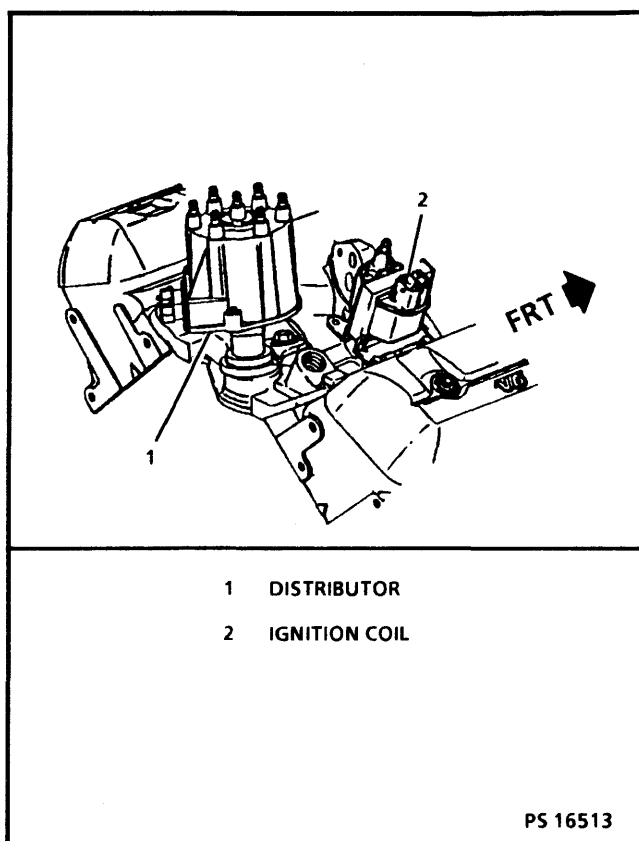


Figure 1-38 - Distributor and Coil

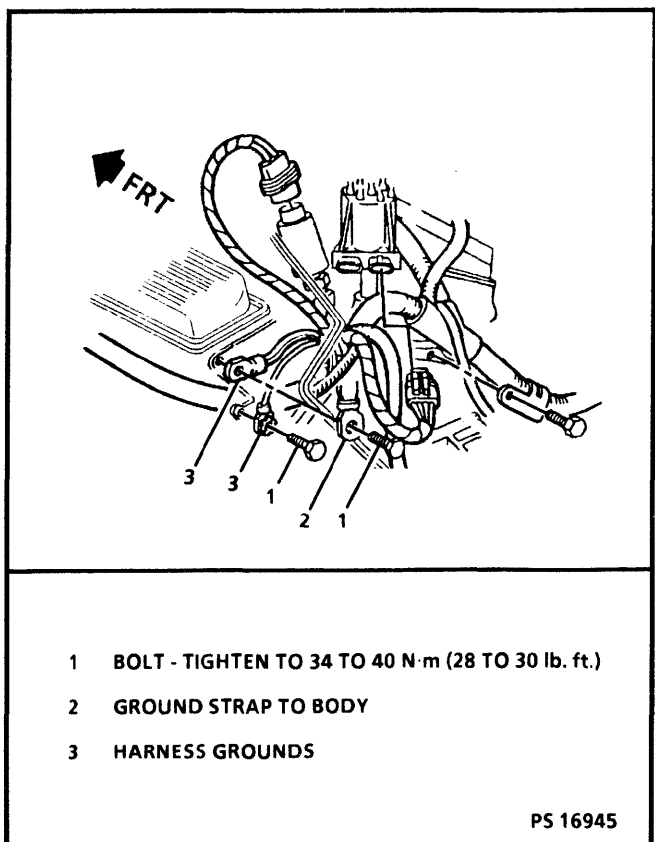


Figure 1-37 - Harness Grounds - Typical

## SECTION 2

# DRIVEABILITY SYMPTOMS

## CONTENTS

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| Poor Fuel Economy .....                                    | Page 2-14 |
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### IMPORTANT PRELIMINARY CHECKS

#### BEFORE USING THIS SECTION

Before using this section you should have performed the "On-Board Diagnostic System Check" and determined that:

1. The control module and MIL (Service Engine Soon) are operating correctly.
  2. There are no diagnostic trouble codes stored, or there is a diagnostic code but no MIL (Service Engine Soon).
- Several of the following symptom procedures call for a careful visual/physical check. The importance of visual/physical checks cannot be over stressed, because they can lead to correcting a problem without further checks and can save valuable time.

#### VISUAL/PHYSICAL CHECK

This check should include:

- Control module grounds for being clean, tight, and in their proper location. Refer to SECTION 1.
- Vacuum hoses for splits, kinks and proper connections, as shown on "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air leaks at all mounting areas of the intake manifold sealing surfaces.
- Ignition wires for cracking, hardness, proper routing, or carbon tracking.
- Wiring for proper connections, pinches, and cuts. Refer to SECTION 3A or 3B.
- The following symptom charts contain groups of possible causes for each symptom and cover several engines. **These procedures are not necessarily meant to be done in consecutive order.** If Tech 1 scan tool readings do not indicate the problems, then proceed in a logical order, easiest to check or most likely cause first. To determine if a particular system or component is used on a specific vehicle, refer to the "Control Module Wiring Diagrams" for application.

#### SYMPTOM

Verify the customer complaint, and locate the correct symptom in the table of contents. Check the items indicated under that symptom.

**INTERMITTENTS****(Page 1 of 2)**

**Definition:** Problem may or may not turn "ON" the Malfunction Indicator Lamp (MIL) or store a Diagnostic Trouble Code (DTC).

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- DO NOT use the Diagnostic Trouble Code (DTC) charts in SECTION 3A or 3B for intermittent problems. The fault must be present to locate the problem. If a fault is intermittent, use of diagnostic trouble code charts may result in replacement of good parts.

**FAULTY ELECTRICAL CONNECTIONS OR WIRING**

- Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful check of suspect circuits for:
  - Poor mating of the connector halves, or terminals, not fully seated in the connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed or replaced to insure proper contact tension.
  - Poor terminal to wire connection. This requires removing the terminal from the connector body to check. Refer to "On-Vehicle Service" in SECTION 3A or 3B.

**ROAD TEST**

- If a visual/physical check does not locate the cause of the problem, the vehicle can be driven with J 39200 voltmeter connected to a suspected circuit or a Tech 1 scan tool may be used. An abnormal voltage or scan reading, when the problem occurs, indicates the problem may be in that circuit. If the wiring and connectors check OK, and a diagnostic trouble code was stored for a circuit having a sensor, except for DTCs 44 and 45, replace the sensor.

### INTERMITTENTS

(Page 2 of 2)

**Definition:** Problem may or may not turn "ON" the Malfunction Indicator Lamp (MIL), or store a Diagnostic Trouble Code (DTC).

#### INTERMITTENT "MALFUNCTION INDICATOR LAMP (MIL)"

- An intermittent MIL and No Diagnostic Trouble Codes (DTCs), may be caused by:
  - Electrical system interference caused by a defective relay, control module driven solenoid, or switch. They can cause a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
  - Improper installation of electrical devices, such as lights, 2-way radios, electric motors, etc.
  - Ignition Control (IC) wires should be routed away from spark plug wires, ignition system components and generator. Wire for CKT 453 from control module to ignition system should be a good ground.
  - Ignition secondary shorted to ground.
  - CKT 419 Malfunction Indicator Lamp (MIL) or CKT 451 (diagnostic "test" terminal) intermittently shorted to ground.
  - Control module grounds. Refer to "Component Locations," in SECTION 1.

#### LOSS OF DIAGNOSTIC TROUBLE CODE MEMORY

- To check, disconnect Throttle Position (TP) sensor and idle engine until the "Malfunction Indicator Lamp" comes "ON." DTC 22 should be stored, and kept in memory when the ignition is turned "OFF" for at least 10 seconds. If not, the control module is faulty.

**HARD START****(Page 1 of 2)**

**Definition:** Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Make sure the driver is using the correct starting procedure.

**SENSORS**

- **CHECK:** Engine Coolant Temperature (ECT) sensor - Using a scan tool, compare engine coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reading is 5 degrees greater than or less than ambient air temperature on a cold engine, check for high resistance in coolant sensor circuit or sensor itself. Refer to "DTC 15" in SECTION 3A or 3B and compare resistance values.
- **CHECK:** Throttle Position (TP) sensor - If a sticking throttle shaft or binding linkage causes a high TP sensor voltage (open throttle indication), the control module will not control idle. Monitoring TP sensor voltage. Scan tool and/or voltmeter should display less than .85 volt with throttle closed. Refer to SECTION 4A.

**FUEL SYSTEM**

- **CHECK:** Fuel pump relay operation. Fuel pump should operate for 20 seconds on vehicles with a fuel module and for 2 seconds on all other vehicles when ignition is turned "ON." Refer to "CHART A-5" in SECTION 3A or 3B.
- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3A or 3B.
- **CHECK:** For water contaminated fuel.
- **CHECK:** Fuel pump relay - Connect test light between fuel pump "test" terminal and ground. Test light should be "ON" for 2 seconds following ignition "ON." If not, refer to "CHART A-5" in SECTION 3A or 3B.

### HARD START

(Page 2 of 2)

**Definition:** Engine cranks OK, but does not start for a long time. Does eventually operate, or may start but immediately stalls.

### IGNITION SYSTEM

- **CHECK:** Ignition system for:
  - Proper ignition voltage output with spark tester J 26792 or equivalent (ST-125).
  - Spark plugs; wet plugs, cracks, wear, improper gap, burned electrodes or heavy deposits.
  - Bare and shorted wires.
  - Moisture in distributor cap.
  - Worn distributor shaft.
  - Pickup coil resistance and connections.
  - Loose ignition coil connections.
- **CHECK:** CKT 423 (ignition control) for short to ground. Refer to SECTION 6A.

### ADDITIONAL CHECKS

- **CHECK:** IAC operation - refer to "DTC 35" in SECTION 3A or 3B, and "Diagnosis" in SECTION 4A.
- **CHECK:** EGR operation - refer to SECTION 9A, 9B or 9C.
- **CHECK:** Service Bulletins for PROM updates.

**SURGES AND/OR CHUGGLES**

**Definition:** Engine power variation, under steady throttle or cruise. Feels like the vehicle speeds up and slows down, with no change in the accelerator pedal.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Be sure driver understands Torque Converter Clutch (TCC) and A/C compressor operation in owner's manual.
- Use a scan tool to make sure reading of VSS matches vehicle speedometer except vehicles with electronic transmissions where some variation between VSS and speedometer is normal. Refer to "DTC 16 Diagnostic Aids" in SECTION 3A.

**SENSORS**

- **CHECK:** Oxygen Sensor (O2S) for silicon contamination from fuel, or use of improper sealant (never use any sealant on waterproof connectors). The sensor may have a white, powdery coating and result in a high but false signal voltage (rich exhaust indication). The control module will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.

**FUEL SYSTEM**

- **CHECK:** To determine if the condition is caused by a rich or lean system, the vehicle should be driven at the speed of the complaint. Monitoring fuel trim will help identify a problem.  
Lean - Long term fuel trim greater than 150. Refer to "DTC 44 Diagnostic Aids" in SECTION 3A or 3B.  
Rich - Long term fuel trim less than 115. Refer to "DTC 45 Diagnostic Aids" in SECTION 3A or 3B.
- **CHECK:** Fuel pressure while condition exists, refer to "CHART A-6" in SECTION 3A or 3B.

**IGNITION SYSTEM**

- **CHECK:** For proper ignition voltage output voltage using spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition timing. Refer to SECTION 6A.

**ADDITIONAL CHECKS**

- **CHECK:** Control module grounds for being clean, tight, and in their proper locations.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.
- **CHECK:** Vacuum lines for kinks or leaks.
- **CHECK:** For intermittent EGR. Refer to SECTION 9A, 9B or 9C.
- **CHECK:** TCC operation. Refer to SECTION 10A or 10B.



### LACK OF POWER, SLUGGISH, OR SPONGY

(Page 1 of 2)

**Definition:** Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is partially applied.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Compare customer's vehicle with a similar unit. Make sure the customer has an actual problem.
- Remove air filter and check for dirt, or for being plugged, replace as necessary.
- Transmission shift pattern and down shift operation.
- If there is spray from only one injector on the TBI unit, then, there may be a malfunction in the injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits. Refer to "CHART A-3" in SECTION 3A or 3B.

#### FUEL SYSTEM

- **CHECK:** For contaminated fuel.
- **CHECK:** For restricted fuel filter, contaminated fuel or improper fuel pressure. Refer to "CHART A-6" in SECTION 3A or 3B.

#### IGNITION SYSTEM

- **CHECK:** Proper ignition voltage output with spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Ignition timing and proper operation of ignition control. Refer to SECTION 6A.

#### EXHAUST SYSTEM

- **CHECK:** Exhaust system for possible restriction: Refer to SECTION 3A, 3B or SECTION 6F of the appropriate service manual.  
Inspect exhaust system for damaged or collapsed pipes. Inspect muffler for heat distress or possible internal failure.
  1. With engine at normal operating temperature, connect a vacuum gage to any convenient vacuum port on intake manifold.
  2. Operate engine at 1000 RPM and record vacuum reading.
  3. Increase RPM slowly to 2500 RPM. Note vacuum reading at a steady 2500 RPM.
  4. If vacuum at 2500 RPM decreases more than 10 kPa (3" Hg) from reading at 1000 RPM, the exhaust system should be inspected for restrictions.
  5. Disconnect exhaust pipe from engine and repeat Steps 3 and 4. If vacuum still drops more than 10 kPa (3" Hg) with exhaust disconnected, check for exhaust manifold restriction and valve timing.

## **LACK OF POWER, SLUGGISH, OR SPONGY**

**(Page 2 of 2)**

**Definition:** Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is pushed down part way.

### **ADDITIONAL CHECKS**

- **CHECK:** Control module grounds for being clean, tight, and in their proper location. Refer to "Component Locations" in SECTION 1.
- **CHECK:** EGR operation for being open or partly open all the time. Refer to SECTION 9A, 9B or 9C.
- **CHECK:** Torque Converter Clutch (TCC) operation. Refer to SECTION 10.
- **CHECK:** A/C operation. Refer to "A/C Chart" in SECTION 3A or 3B.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.

### **ENGINE MECHANICAL**

- **CHECK:** Engine compression, valve timing, and for proper or worn camshaft. Refer to SECTION 6A of the appropriate service manual.

### DETONATION/SPARK KNOCK

(Page 1 of 2)

**Definition:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Make sure the customer has an actual problem.
- If there is spray from only one injector on the TBI unit, there may be a malfunction in the injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits. Refer to "CHART A-3" in SECTION 3A or 3B.
- Trans Range (TR) pressure switch assembly operation. Refer to SECTION 10A or 10B.

#### COOLING SYSTEM

- **CHECK:** For obvious over heating problems. Refer to SECTION 6B1 of appropriate service manual.
- **CHECK:** Low engine coolant.
- **CHECK:** Loose water pump belt
- **CHECK:** Restricted air flow to radiator, or restricted coolant flow.
- **CHECK:** Faulty or incorrect thermostat.
- **CHECK:** Correct coolant solution.

#### SENSOR

- **CHECK:** Engine Coolant Temperature (ECT) sensor, which has shifted in value. Refer to "DTC 15 Diagnostic Aids" in SECTION 3A or 3B.

#### FUEL SYSTEM

- **CHECK:** To determine if the condition is caused by a lean system, the vehicle should be driven at the speed of the complaint. Monitoring fuel trim will help identify the problem.  
Lean - Long term fuel trim greater than 150. Refer to "DTC 44 Diagnostic Aids" in SECTION 3A or 3B.
- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3A or 3B.
- **CHECK:** For poor fuel quality and proper octane rating.
- If scan tool readings are normal and there are no engine mechanical faults, fill fuel tank with a premium gasoline that has a minimum octane rating of 92 and re-evaluate vehicle performance.

## DETONATION/SPARK KNOCK

(Page 2 of 2)

**Definition:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

### IGNITION SYSTEM

- **CHECK:** Spark plugs for proper heat range and gap.
- **CHECK:** Knock Sensor (KS) system operation. Refer to SECTION 7.
- **CHECK:** Ignition timing. Refer to SECTION 6A.

### ENGINE MECHANICAL

- **CHECK:** For carbon buildup. Remove carbon with top engine cleaner. Follow instructions on can.
- **CHECK:** For incorrect basic engine parts such as cam, heads, pistons, etc.

### ADDITIONAL CHECKS

- **CHECK:** Proper operation of EGR valve.
- **CHECK:** Proper operation of air intake system. Refer to SECTION 12.
- **CHECK:** For proper transmission shift points. Refer to SECTION 10A or 10B.
- **CHECK:** Torque Converter Clutch (TCC) operation. Refer to SECTION 10A or 10B.
- **CHECK:** Service Bulletins for PROM updates.

### HESITATION, SAG, STUMBLE

**Definition:** Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most severe when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."

#### FUEL SYSTEM

- **CHECK:** Fuel pressure. Refer to SECTION 3A or 3B and SECTION 4A.
- **CHECK:** Throttle Position (TP) sensor - Check TP sensor for binding or sticking. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).
- **CHECK:** MAP sensor response and accuracy. Refer to "Manifold Absolute Pressure (MAP) Output Check" in SECTION 3A or 3B.
- **CHECK:** Water/contaminated fuel. Refer to SECTION 4A.
- **CHECK:** Canister purge system for proper operation. Refer to SECTION 5.

#### IGNITION SYSTEM

- **CHECK:** Spark plug wires for being faulty.
- **CHECK:** Spark plugs for being fouled.
- **CHECK:** Open ignition system ground CKT 453 or ignition timing. Refer to SECTION 6A.

#### ADDITIONAL CHECKS

- **CHECK:** Service Bulletins for PROM updates.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.
- **CHECK:** EGR valve operation. Refer to SECTION 9A, 9B or 9C.

**CUTS OUT, MISSES**

**Definition:** Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- If there is spray from only one injector on a TBI system, then, there may be a malfunctioning injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits. Refer to "CHART A-3" in SECTION 3A or 3B.

**IGNITION SYSTEM**

- **CHECK:** For cylinder miss by:
  1. Start engine, allow engine to stabilize then disconnect IAC motor. Remove one spark plug wire at a time, using insulated pliers.

**NOTICE:** Do not perform this test for more than 2 minutes, as this may cause damage to the catalytic converter.

2. If there is a RPM drop, on all cylinders, (equal to within 50 RPM), go to "Rough, Unstable Or Incorrect Idle, Stalling" symptom. Reconnect IAC motor with ignition "OFF."
  3. If there is no RPM drop on one or more cylinders, or excessive variation in drop, check for spark, on the suspected cylinder(s) with J 26792 (ST-125) Spark Tester or equivalent.
  4. If no spark, refer to SECTION 6A.
  5. If there is spark, remove spark plug(s) in these cylinders and check for:
    - Insulation cracks.
    - Wear.
    - Improper gap.
    - Burned electrodes.
    - Heavy deposits.
- **CHECK:** Spark plug wire resistance (should not exceed 30,000 ohms), also, check rotor and distributor cap.
  - **CHECK:** If the previous checks did not find the problem:
    - Visually inspect ignition system for moisture, dust, cracks, burns, etc. With engine running, spray plug wires with fine water mist to check for shorts.

**FUEL SYSTEM**

- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3A, 3B or SECTION 4A.
- **CHECK:** For contaminated fuel or restricted fuel filter.

**ENGINE MECHANICAL**

- **CHECK:** For proper valve timing, low compression, bent pushrods, worn rocker arms, broken or weak valve springs, worn camshaft lobes. Refer to SECTION 6A of appropriate service manual.
- **CHECK:** Intake and exhaust manifold passages for casting flash.

### POOR FUEL ECONOMY

**Definition:** Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Check air cleaner element (filter) for dirt or being plugged and operation of thermostatic air cleaner.
- Visually (physically) check: Vacuum hoses for splits, kinks, and proper connections as shown on "Vehicle Emission Control Information" label.
- Perform "On-Board Diagnostic System Check."
- Check owner's driving habits.
  - Is A/C "ON" full time (Defroster mode "ON")?
  - Are tires at correct pressure?
  - Are excessively heavy loads being carried?
  - Is acceleration too much, too often?
- Suggest owner fill fuel tank and recheck fuel economy.
- Suggest driver read "Important Facts on Fuel Economy" in Owner's Manual.

#### FUEL SYSTEM

- **CHECK:** Fuel type, quality and alcohol content.
- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3A or 3B.

#### IGNITION SYSTEM

- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition wires for cracking, hardness, and proper connections.
- **CHECK:** KS system operation. Refer to SECTION 7.
- **CHECK:** Ignition timing. Refer to SECTION 6A.

#### COOLING SYSTEM

- **CHECK:** Engine coolant level.
- **CHECK:** Engine thermostat for faulty part (always open) or for wrong heat range. Refer to SECTION 6B1 of appropriate service manual.

#### ADDITIONAL CHECKS

- **CHECK:** Transmission shift pattern.
- **CHECK:** TCC operation - Refer to SECTION 10A or 10B. A scan tool should indicate a RPM drop when the TCC is commanded "ON."
- **CHECK:** For proper calibration of speedometer.
- **CHECK:** For dragging brakes. Refer to SECTION 5 of the appropriate service manual.

**ROUGH, UNSTABLE OR INCORRECT IDLE, STALLING**

(Page 1 of 2)

**Definition:** The engine runs unevenly at idle. If bad enough, the vehicle may shake. Also, the idle may vary in RPM (called "hunting"). Either condition may be severe enough to cause stalling. Engine idles at incorrect speed.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."

**SENSORS**

- **CHECK:** Oxygen Sensor (O2S) - Inspect sensor for silicon contamination from fuel, or use of improper sealant (never use sealant on any waterproof connectors). The sensor will have a white, powdery coating, and will result in a high but false signal voltage (rich exhaust indication). The control module will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- **CHECK:** Throttle Position (TP) sensor - If a sticking throttle shaft or binding linkage causes a high TP sensor voltage open throttle indication, the control module will not control idle. Monitor TP sensor voltage. A scan tool and/or voltmeter should read less than .85 volt with throttle closed. Refer to SECTION 4A.
- **CHECK:** Engine Coolant Temperature (ECT) sensor - Using a scan tool, compare engine coolant temperature with ambient temperature on a cold engine.
  - If engine coolant temperature reads 5 degrees greater than or less than ambient air temperature. Check for high resistance in coolant sensor circuit or sensor itself. Refer to "DTC 15 Diagnostic Aids" in SECTION 3A or 3B.
- **CHECK:** MAP sensor response and accuracy - Refer to "Manifold Absolute Pressure (MAP) Output Check" in SECTION 3A or 3B.

**FUEL SYSTEM**

- **CHECK:** To determine if the condition is caused by a rich or lean system, the vehicle should be driven at the speed of the complaint. Monitoring fuel trim will help identify problem.
  - Lean - Long term fuel trim greater than 150. Refer to "DTC 44 Diagnostic Aids" in SECTION 3A or 3B.
  - Rich - Long term fuel trim less than 115. Refer to "DTC 45 Diagnostic Aids" in SECTION 3A or 3B.
- **CHECK:** Evaporative emission control system. Refer to SECTION 5.
- **CHECK:** Perform a cylinder compression check. Refer to SECTION 6A of appropriate service manual.
- **CHECK:** For injector(s) leaking. Check fuel pressure. Refer to "CHART A-6" in SECTION 3A, 3B or SECTION 4A.
- **CHECK:** Idle speed actuator operation SECTION 4A (7.4L only).

**IGNITION SYSTEM**

- **CHECK:** Ignition system and ignition timing. Refer to SECTION 6A.



### ROUGH, UNSTABLE OR INCORRECT IDLE, STALLING

(Page 2 of 2)

**Definition:** The engine runs unevenly at idle. If bad enough, the vehicle may shake. Also, the idle may vary in RPM (called "hunting"). Either condition may be severe enough to cause stalling. Engine idles at incorrect speed.

#### ADDITIONAL CHECKS

- **CHECK:** Vacuum leaks can cause higher than normal idle and low IAC counts.
- **CHECK:** IAC operation - refer to "DTC 35" in SECTION 3A or 3B, and "Diagnosis" in SECTION 4A.
- **CHECK:** Control module grounds for clean, tight, and proper routing. Refer to "Component Locations" in SECTION 1.
- **CHECK:** Trans Range (TR) pressure switch assembly operation. Refer to SECTION 10.
- **CHECK:** Use scan tool to determine if control module is receiving A/C signal. Whenever A/C is selected refer to SECTION 3A or 3B. If problem exists with A/C "ON," check A/C system operation. Refer to SECTION 1B.
- **CHECK:** EGR "ON," while idling, will cause roughness, stalling and hard starting. Refer to SECTION 9.
- **CHECK:** Battery cables and ground straps should be clean and secure. Erratic voltage will cause IAC to change its position, resulting in poor idle quality.
- **CHECK:** IAC valve will not move if system voltage is below 9 or greater than 16 volts.
- **CHECK:** A/C refrigerant pressure too high or faulty high pressure switch.
- **CHECK:** Crankcase ventilation valve for proper operation by placing finger over inlet hole in valve end several times. Valve should snap back. If not, replace valve. Refer to SECTION 11.

#### ENGINE MECHANICAL

- **CHECK:** For broken motor mounts or low compression. Refer to SECTION 6A of appropriate service manual.

**EXCESSIVE EXHAUST EMISSIONS OR ODORS**

**Definition:** Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. Excessive odors do not necessarily indicate excessive emissions.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Perform "On-Board Diagnostic System Check."
- Make sure engine is at normal operating temperature.
- If EMISSION TEST shows excessive CO and HC check items which cause vehicle to run RICH. Long term fuel trim memory less than 115 refer to "DTC 45 Diagnostic Aids" in SECTION 3A or 3B.
- If EMISSION TEST shows excessive NOx check items which cause engine to operate LEAN or too hot.

**SENSORS**

- **CHECK:** If the scan tool indicates a very high coolant temperature and the system is running LEAN: check the cooling system and cooling fan for proper operation. Refer to SECTION 6B1 of the appropriate service manual.

**FUEL SYSTEM**

- **CHECK:** If the system is running rich, (long term fuel trim less than 115), refer to "DTC 45 Diagnostic Aids" or if the system is running lean, (long term fuel trim greater than 150), refer to "DTC 44 Diagnostic Aids" in SECTION 3A or 3B.
- **CHECK:** For properly installed fuel cap.
- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3A, 3B or SECTION 4A.
- **CHECK:** If test shows excessive NOx, check items which cause engine to operate LEAN or too hot.
- **CHECK:** Canister for fuel loading. Refer to SECTION 5.

**IGNITION SYSTEM**

- **CHECK:** Ignition system, incorrect timing, or excessive advance. Refer to SECTION 6A.
- **CHECK:** Spark plugs, plug wires, and ignition components. Refer to SECTION 6D of appropriate service manual.

**ADDITIONAL CHECKS**

- **CHECK:** For vacuum leaks.
- **CHECK:** For lead contamination of catalytic converter (look for the removal of fuel filler neck restrictor).
- **CHECK:** Carbon buildup. Remove carbon with top engine cleaner. Follow instructions on can.
- **CHECK:** EGR valve for not opening. Refer to SECTION 9A, 9B or 9C.
- **CHECK:** Crankcase ventilation valve for being plugged, stuck, or blocked PCV hose. Refer to SECTION 11.

### DIESELING, RUN-ON

**Definition:** Engine continues to run after key is turned "OFF," but runs very roughly. If engine runs smoothly, check ignition switch and adjustment.

### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."

### FUEL SYSTEM

- **CHECK:** Evaporative system and fuel tank venting.
- **CHECK:** Fuel injector(s) for leakage. For TBI injector diagnosis, refer to "CHART A-3 TBI," SECTION 3A or 3B.
- **CHECK:** Idle speed control actuator operation. Refer to SECTION 4A (7.4L only).

## BACKFIRE

**Definition:** Fuel ignites in intake manifold, or in exhaust system, making a loud popping noise.

### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."

### IGNITION SYSTEM

- **CHECK:** Proper ignition coil output voltage with spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition system and ignition timing. Refer to SECTION 6A.
- **CHECK:** For crossfire between spark plugs (distributor cap, spark plug wires, and proper routing of plug wires). Refer to SECTION 6D of appropriate service manual.

### ENGINE MECHANICAL

- **CHECK:** Compression, valve timing, manifold gaskets, sticking or leaking valves. Refer to SECTION 6A.
- **CHECK:** EGR operation for being open all the time. Refer to SECTION 9A, 9B or 9C.
- **CHECK:** Intake and exhaust system for casting flash or other restrictions.

**BLANK**

## SECTION 3

# CONTROL MODULE SYSTEMS

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**NOTICE:** Before attempting any welding on the vehicle, disconnect the negative battery lead and the control module connectors. This action will prevent damage to the control module itself, and to its system components, as well.

## GENERAL DESCRIPTION

The Engine Control Module (ECM) and the Powertrain Control Module (PCM) will both be commonly referred to as a control module. The control module is designed to maintain exhaust emission levels to Federal or California standards, while providing good driveability and fuel efficiency. It is important to review the component sections and wiring diagrams to determine which systems are controlled by each specific control module. The control module monitors numerous engine and vehicle functions (Figure 3-1) and controls the following operations:

- Fuel control.
- Ignition Control (IC).
- Knock Sensor (KS) system.
- Exhaust gas recirculation.
- Automatic transmission shift functions.  
(Specific transmission control diagnostics are covered in SECTION 10.)

## 3-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

### CONTROL MODULE APPLICATION

**Figure 3-1**

The 93 PCM6 is the Powertrain Control Module (PCM) used in the C/K Truck. It controls engine as well as transmission functions.

#### SECTION 3A Control Module System.

- 4.3L (VIN Z) C/K Truck Auto/Man.
- 5.0L (VIN H) C/K Truck Auto.
- 5.7L (VIN K) C/K Truck Auto.
- 7.4L (VIN N) C/K Truck Auto.

The GMCM is the Engine Control Module (ECM) used in the C/K Truck. It controls engine functions and shift 1 amp for most manual transmission applications.

#### Section 3B Control Module System.

- 5.0L (VIN H) Truck Manual.
- 5.7L (VIN K) Truck Manual.

### What Section 3A Contains

#### SECTION 3A Control Module System (PCM).

- General Description.
- Diagnosis.
- On-Board Diagnostic System Check.
- Diagnostic Charts.
- Diagnostic Trouble Codes.
- Wiring Diagrams.

- PCM Terminal End View and Terminal Definitions.
- On-Vehicle Service.
- Parts Information.

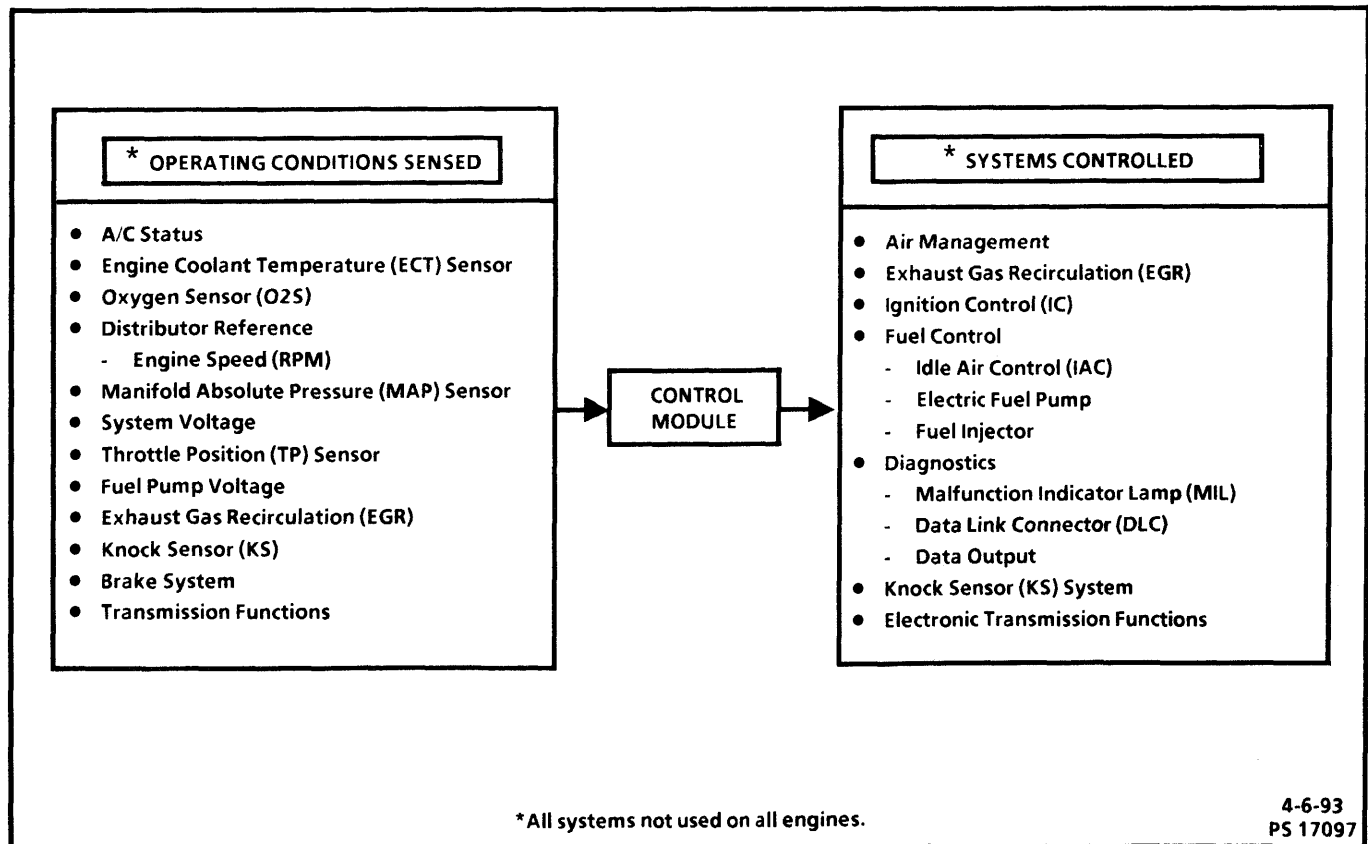
### What Section 3B Contains

#### SECTION 3B Control Module System (ECM/GMCM).

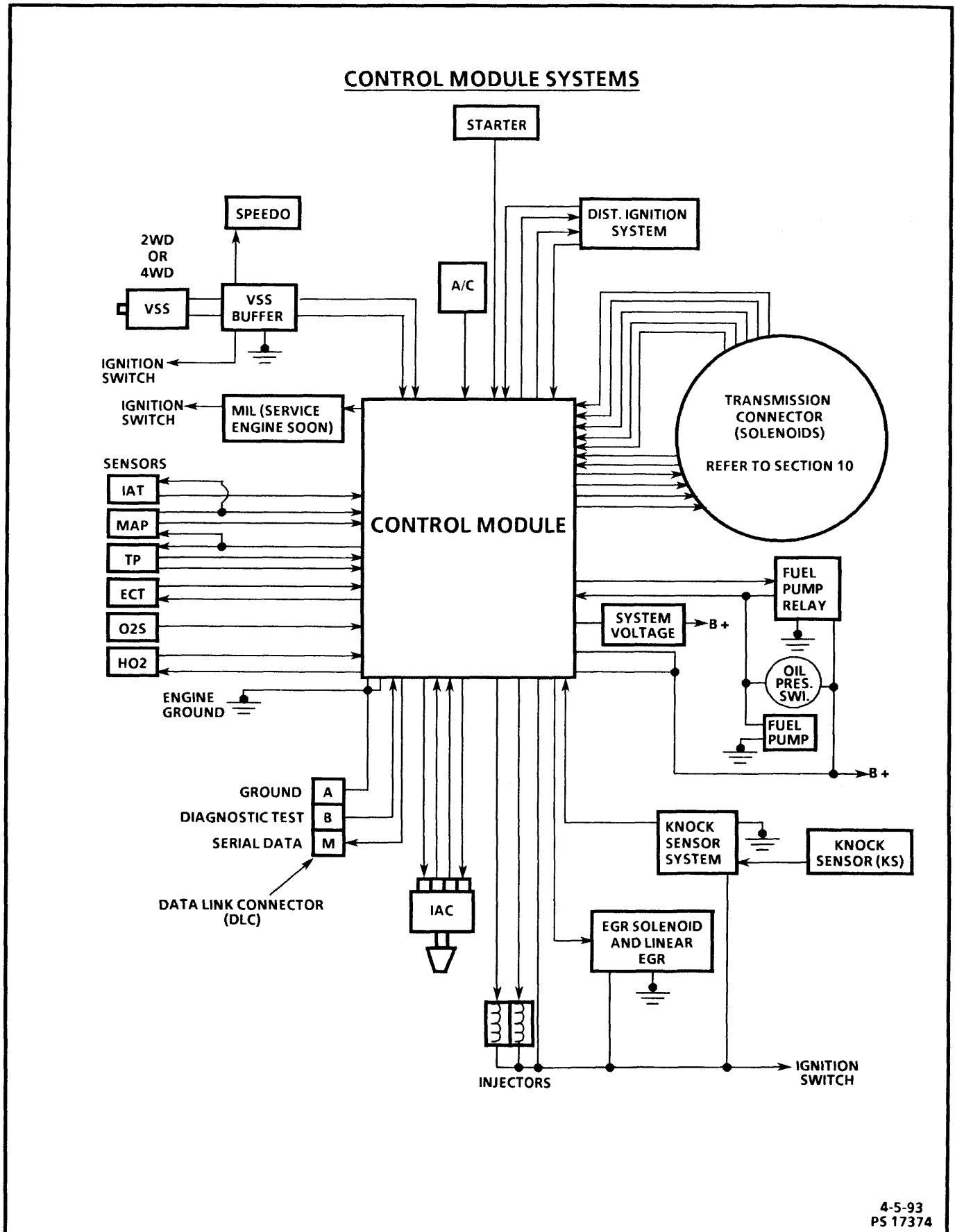
- General Description.
- Diagnosis.
- On-Board Diagnostic System Check.
- Diagnostic Charts.
- ECM Quad-Driver Check.
- Diagnostic Trouble Codes.
- Wiring Diagrams.
- ECM Terminal End View and Terminal Definitions.
- On-Vehicle Service.
- Parts Information.

### ELECTROSTATIC DISCHARGE DAMAGE

Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components.



**Figure 3-1 - Control Module System**



4-5-93  
PS 17374

Figure 3-2 - Block Diagram



### 3-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat by which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

**NOTICE:** To prevent possible Electrostatic Discharge damage:

- Do Not touch the control module connector pins or soldered components on the control module circuit board.
- When handling a PROM (MEM-CAL) Do Not touch the component leads, and Do Not remove integrated circuit from carrier.
- Be sure to follow the guidelines listed below if servicing any of these electronic components.
  1. Do not open the replacement part package until it is time to install the part.
  2. Avoid touching electrical terminals of the part.
  3. Before removing the part from its package, ground the package to a known good ground on the vehicle.
  4. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance.

#### CONTROL MODULE FUNCTION

The control module supplies a buffered 5 or 12 volts of power to various sensors or switches. This is done through resistance in the control module which is so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, the use of a 10 megohm input impedance digital voltmeter J 39200 is necessary to assure accurate voltage readings.

The input/output devices in the control module include analog to digital converters, signal buffers, counters, and special drivers. The control module controls output circuits such as the injectors, EGR A/C clutch relay, etc. by controlling the ground circuit through transistors or a device called a Quad-Driver Module (QDM) in the control module.

#### DATA LINK CONNECTOR (DLC)

##### Figure 3-3

The twelve terminal Data Link Connector (DLC) is wired to the control module and is located under the left side of the instrument panel. This connector has terminals that diagnose the system by means of a jumper wire or a Tech 1 scan tool.

#### DIAGNOSTIC INFORMATION

The diagnostic trouble code charts and functional checks in SECTION 3A and 3B are designed to locate a faulty circuit or component through logic based on the process of elimination. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly or without multiple failures.

The control module performs a continual self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The control module's ability for displaying the source of a malfunction in the system is called Diagnostic Trouble Codes [DTC(s)]. The Diagnostic Trouble Codes [DTC(s)] are two digit numbers that can range from 12 to 82. When a malfunction is detected by the control module, a Diagnostic Trouble Code (DTC) will set, and the Malfunction Indicator Lamp (MIL) "Service Engine Soon" is illuminated.

#### MALFUNCTION INDICATOR LAMP (MIL) "SERVICE ENGINE SOON"

The Malfunction Indicator Lamp (MIL) "Service Engine Soon" is in the instrument panel and has the following functions:

- It informs the driver that a fault has occurred, and the vehicle should be taken for service as soon as reasonably possible.
- It displays DTC stored by the control module, helping the technician diagnose system faults.
- It indicates "Open Loop" or "Closed Loop" operation.

As a bulb and system check, the lamp will come "ON" with the ignition "ON" and the engine not operating. When the engine is started, the lamp will go "OFF." If the light remains "ON," the self-diagnostic system has detected a problem. If the fault goes away, the light will go out in most cases after 10 seconds, but a DTC will remain stored in the control module memory.

When the lamp remains "ON" while the engine is operating, or when a malfunction is suspected due to a driveability or emissions problem, the "On-Board Diagnostic System Check" must be performed. The procedures for these checks are given in SECTION 3A and 3B.

These checks can expose malfunctions which may not be detected if other diagnostics are performed prematurely.

### Intermittent Malfunction Indicator Lamp (MIL) "Service Engine Soon"

In the case of an "Intermittent" problem, the MIL will light for ten (10) seconds and then will go out. However, the corresponding Diagnostic Trouble Code (DTC) will be stored in the memory of the control module unless the battery voltage to the control module has been removed. When unexpected DTC(s) appear during the code displaying process, assume that these DTC(s) were set by an intermittent malfunction and can be helpful in diagnosing the system.

An intermittent DTC may or may not reset. If it is an intermittent failure, a Diagnostic Trouble Code Chart will not be used. Consult the "Diagnostic Aids" on the page facing the diagnostic trouble code chart corresponding to the intermittent code. SECTION 2 also covers the topic of "Intermittents." A physical inspection of the applicable sub-system most often will resolve the fault.

### Short Term Fuel Trim (Integrator)

The short term fuel trim (integrator) is a control module volatile memory register that contains a number between 0 and 255. The neutral value for the short term fuel trim is 128; any deviation from this value indicates the short term fuel trim is changing the injector pulse width. The amount of pulse width change depends on how far the short term fuel trim value is from 128. The short term fuel trim changes the pulse width by varying the "Closed Loop" factor of the base pulse width equation.

As the control module monitors the oxygen sensor input, it is constantly varying the short term fuel trim value. The value is updated very quickly, and therefore, the short term fuel trim only corrects for short term mixture trends.

The correction of long term mixture trends is the function of the long term fuel trim.

### Long Term Fuel Trim (Block Learn)

The long term fuel trim (block learn) is a matrix of cells arranged by RPM and MAP. Each cell of the long term fuel trim is a register like the short term fuel trim. As the engine operating conditions change, the control module will switch from cell to cell to determine what "long term fuel trim" factor to use in the base pulse width equation.

While in any given cell(s), the control module also monitors the short term fuel trim. If the short term fuel trim is far enough from 128, the control module will change the long term fuel trim value. Once the long term fuel trim value is changed, it should force the short term fuel trim back toward 128.

If the mixture is still not correct (as judged by the oxygen sensor), the short term fuel trim will continue to have a large deviation from the ideal 128. In this case, the long term fuel trim value will continue to change until the short term fuel trim becomes balanced.

Both the short term fuel trim and long term fuel trim have limits which will vary with each PROM. If the mixture is off enough so that long term fuel trim reaches the limit of its control and still cannot correct the condition, the short term fuel trim will also go to its limit of control in the same direction. If the mixture is still not corrected by both short term fuel trim and long term fuel trim at their extreme values, a DTC 44, or DTC 45 will likely result. Under the conditions of power enrichment, the control module sets the short term fuel trim to 128 and freezes it there until power enrichment is no longer in effect. This is done so the "Closed Loop" factor and the long term fuel trim will not try to correct for the commanded richness of power enrichment.

### SPEED DENSITY SYSTEM

The Throttle Body Fuel Injection (TBI) is a speed and air density system. This system is based on "speed density" fuel management.

Three specific data sensors provide the control module with the basic information for the fuel management portion of its operation. That is, three specific signals to the control module establish the engine speed and air density factors.

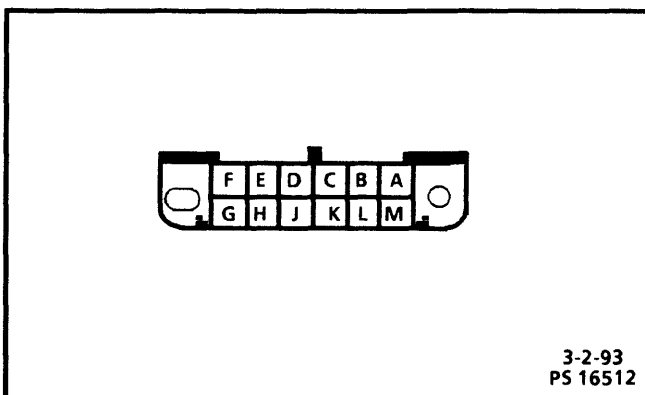


Figure 3-3 - Data Link Connector

### 3-6 DRIVEABILITY AND EMISSIONS (GASOLINE)

#### Speed

The engine speed signal comes from the Distributor Ignition (DI) control module to the control module on the crank reference high, CKT 430. The control module uses this information to determine the "speed" or RPM factor for fuel and ignition management.

#### Density

Two sensors are used for the density factor, the Engine Coolant Temperature (ECT) and the Manifold Absolute Pressure (MAP) sensors.

The ECT sensor is a 2-wire sensor that measures the temperature of the engine coolant. The ECT sensor is a thermistor which changes its resistance based on temperature. When the temperature is low, the resistance is high, and when the temperature is high, the resistance is low.

The Manifold Absolute Pressure (MAP) sensor is a 3-wire sensor that monitors the changes in intake manifold pressure which result from changes in engine load. These pressure changes are supplied to the control module in the form of analog electrical signals.

As intake manifold pressure increases, the air density in the intake manifold also increases, and additional fuel is required. The MAP sensor sends this pressure information to the control module, and the control module increases the amount of fuel injected by increasing the injector pulse width. Conversely, as manifold pressure decreases, the amount of fuel is decreased.

These three inputs MAP, ECT, and RPM are the major determinants of the air/fuel mixture delivered by the fuel injection system.

The remaining sensors and switches provide electrical inputs to the control module which are used for modification of the air/fuel mixture, as well as for other control module control functions, such as Idle Air Control (IAC).

#### Reading Diagnostic Trouble Codes

The means of communicating with the control module is the Data Link Connector (DLC) (refer to Figure 3-3) located under the instrument panel and is sometimes covered by a plastic cover labeled "DIAGNOSTIC CONNECTOR." The DLC is used in the assembly plant to receive engine information to determine proper operation before it leaves the plant.

The DTC(s) stored in the control module memory can be displayed either through the Tech 1 Diagnostic Computer, a hand-held diagnostic scanner plugged into the DLC connector, or by counting the number of flashes of the Malfunction Indicator Lamp (MIL) "Service Engine Soon" when the diagnostic terminal of the DLC is grounded. The DLC terminal "B" (diagnostic terminal) is the second terminal from the right of the DLC top row. The terminal is most easily grounded by connecting it to terminal "A" (internal control module ground), which is located to the right of terminal "B" on the top row of the DLC.

When terminals "A" and "B" have been connected, the ignition switch must be turned to the "ON" position with the engine not operating. The MIL (Service Engine Soon) should flash DTC 12 three times consecutively. This would be the following flash sequence: "flash, pause, flash-flash, long pause, flash, pause, flash-flash, long pause, flash, pause, flash-flash." DTC 12 indicates that the control module diagnostic system is operating properly. If DTC 12 is not indicated, a fault is present within the diagnostic system itself, and should be addressed by consulting the appropriate diagnostic chart in SECTION 3A and 3B.

Following the output of DTC 12, the malfunction indicator lamp will indicate a Diagnostic Trouble Code (DTC) three times if a DTC is present, or it will simply continue to output DTC 12. If more than one diagnostic trouble code has been stored in the control module memory, the DTC(s) will be displayed from the lowest to the highest with each DTC being displayed three times.

#### Clearing Diagnostic Trouble Codes

To clear the DTC(s) from the memory of the control module, either to determine if the malfunction will occur again or because repair has been completed, the control module power feed must be disconnected for at least 30 seconds. Depending on how the vehicle is equipped, the control module power feed can be disconnected at the positive battery terminal fuse in the fuse block. (The negative battery terminal may be disconnected, but other on-board memory data, such as preset radio tuning, will also be lost.)

**NOTICE:** To prevent control module damage, the key must be "OFF" when disconnecting or reconnecting control module power.

Also, a Tech 1 scan tool can be used to clear diagnostic trouble codes.

## Diagnostic Mode

When the diagnostic terminal is grounded with the ignition "ON" and the engine "OFF," the system will enter the diagnostic mode. In this mode, the control module will:

1. Display a DTC 12 by flashing the Malfunction Indicator Lamp (MIL) "Service Engine Soon" (indicating the system is operating properly).
2. Display any stored DTC(s) by flashing the Malfunction Indicator Lamp (MIL) "Service Engine Soon." Each DTC will be flashed three times, then DTC 12 will be flashed again.
3. Energize all control module controlled relays and solenoids except the fuel pump relay. This allows checking circuits which may be difficult to energize without driving the vehicle and being under particular operating conditions.
4. The IAC valve moves to its fully extended position on most models, blocking the idle air passage. This is useful in checking the minimum idle speed.

## Field Service Mode

If the diagnostic terminal is grounded with the engine operating, the system will enter the "Field Service" mode. In this mode, the MIL (Service Engine Soon) will indicate whether the system is in "Open Loop" or "Closed Loop."

In "Open Loop" the malfunction indicator lamp flashes two and one-half times per second.

In "Closed Loop," the light flashes once per second. Also, in "Closed Loop," the light will stay "OFF" most of the time if the system is running lean. It will stay "ON" most of the time if the system is running rich.

While the system is in "Field Service" mode, new codes cannot be stored in the control module and the "Closed Loop" timer is bypassed.

## Control Module Learning Ability

The control module has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected to clear diagnostic trouble codes or for other repairs, the "learning" process resets and begins again. A change may be noted in the vehicle's performance. To "teach" the vehicle, ensure that the engine is at operating temperature. The vehicle should be driven at part throttle, with moderate acceleration and idle conditions until normal performance returns.

## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

After the visual/physical underhood inspection, the On-Board Diagnostic (OBD) system check is the starting point for all diagnostic procedures and for locating the cause of an emissions test failure. Refer to SECTION 3A and 3B.

The correct procedure to diagnose a fault is to follow three basic steps.

1. Are the on-board diagnostics working? This is determined by performing the On-Board Diagnostic (OBD) system check. This is the starting point for the diagnostic procedures and for finding the cause of an emissions test failure. If the on-board diagnostics are not working, the On-Board Diagnostic (OBD) system check will lead to diagnostic charts in SECTION 3A and 3B. If the on-board diagnostics are working properly, the next step will be:
2. Is there a Diagnostic Trouble Code (DTC) stored? If a DTC is stored, go directly to the numbered DTC chart in the applicable subsection. This will determine if the fault is still present. If no DTC is stored, the next step will be:
3. Scan tool serial data transmitted by the control module. This involves displaying the information available on the serial data stream with a Tech 1 or one of the tools available for that purpose. Information on these tools and the meaning of the various displays can be found in the succeeding paragraphs. Normal readings under a particular operating condition can be found on the facing page of the On-Board Diagnostic (OBD) system check.

## DATA LINK CONNECTOR SCAN TOOLS

The control module will communicate a variety of information through the DLC terminal "M" on PCM equipped vehicles and through terminal "E" on ECM equipped vehicles. This data is transmitted at a high frequency which requires a Tech 1 diagnostic (scan) tool for interpretation. There are several other scan tools available for displaying this same information.

The Tech 1 scan tool can be very useful in obtaining information which would be difficult or impossible to obtain with other equipment.

Tech 1 and scan tools do not make the use of diagnostic charts unnecessary, or indicate exactly where a problem is in a particular circuit. These charts incorporate diagnostic procedures using a scan tool where possible and most charts require the use of a Tech 1 scan tool when it is applicable.

### 3-8 DRIVEABILITY AND EMISSIONS (GASOLINE)

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**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

#### CONTROL MODULE INFORMATION MODES

The control module has three modes for transmitting information. The following information will describe the system operation in each of the three modes.

##### Road Test (Open) Mode

On engines that can be monitored in the "Open" mode, certain parameters can be observed without changing the engine operating characteristics. The parameters capable of being read vary with engine families. Most scan tools are programmed so that the system will go directly into the DLC mode if the "Open" mode is not available.

##### Diagnostic Mode (Also Called 10K)

In this mode, all obtainable data is readable. However, in this mode, the system operating characteristics are modified as follows:

- "Closed Loop" timers are bypassed.
- Ignition is advanced.
- IAC valve controls engine idle to 1000 RPM  $\pm$  50 RPM (if applicable).

##### Back-Up Fuel (Also Called Back-Up or 3.9K)

In this mode, the control module is operating on the fuel back-up logic used to control the fuel delivery if the control module fails. This mode verifies that the back-up feature is OK. The parameters that can be read on a scan tool in this mode are not of much use for service.

#### SCAN TOOL USE WITH INTERMITTENTS

In some scan tool applications, the data update rate makes the scan tool less effective than a voltmeter when trying to detect an intermittent problem which lasts for a very short time. However, the Tech 1 scan tool allows manipulation of wiring harnesses or components under the hood with the engine not operating, while observing the readouts.

The Tech 1 scan tool can be plugged in with data displayed while driving the vehicle when the malfunction indicator lamp turns "ON" momentarily or when engine driveability is momentarily poor.

If the problem is related to certain parameters that can be checked by the Tech 1, this should be done while driving the vehicle. If there does not seem to be any correlation between the problem and any specific circuit, the Tech 1 scan tool can display each parameter, for any period of time to observe any change in the readings which might indicate an intermittent operation.

The Tech 1 scan tool is used to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a diagnostic trouble code. Comparing the sensor's readings with those of a known good vehicle may locate the fault.

The Tech 1 scan tool has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the Tech 1 scan tool successfully for diagnosis is in the technician's ability to understand the system he is trying to diagnose, as well as, an understanding of the Tech 1 scan tool's operation and limitations. The technician should use the tool manufacturer's operating manual to become familiar with the tool's operation.

#### TOOLS NEEDED TO SERVICE THE SYSTEM

The system requires a Tech 1, test light, digital multimeter with 10 megohms impedance J 39200, vacuum gage and jumper wires for diagnosis. A test light or voltmeter must be used when specified in the procedures.

Refer to SECTION 13 for special tools needed to diagnose or repair a system. For more complete information on the operation of these tools, consult the tool manufacturer's instructions.

#### INPUT INFORMATION

##### Engine Coolant Temperature (ECT) Sensor *Figure 3-4*

The Engine Coolant Temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) which is mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at -40°C/-40°F) and high coolant temperature produces low resistance (70 ohms at 130°C/266°F).

The control module supplies a 5 volt signal to the Engine Coolant Temperature (ECT) sensor through a resistor in the control module and measures the voltage. The voltage will be high when the engine is cold, and low when the engine is hot. Engine coolant temperature affects most systems controlled by the control module.

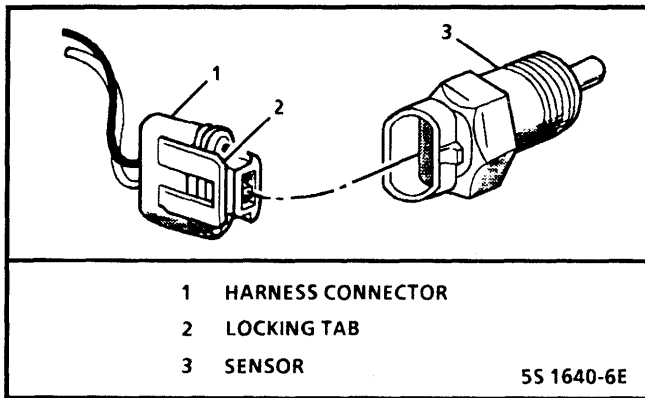


Figure 3-4 - Engine Coolant Temperature (ECT) Sensor

### Manifold Absolute Pressure (MAP) Sensor Figure 3-5

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure, resulting from changes in engine load and speed changes, and converts this to a voltage output.

A closed throttle on engine decel will produce a relatively low MAP output. A Wide Open Throttle (WOT) will produce a high output. The high output produced by the pressure inside the manifold is the same as outside the manifold so 100% of the outside air pressure is being measured.

The MAP sensor reading is the opposite of what you would measure on a vacuum gage. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure under certain conditions, which allows the control module to automatically adjust for different altitudes.

The control module sends a 5 volt reference signal to the MAP sensor. As the manifold pressure changes, the electrical resistance of the MAP sensor also changes. By monitoring the sensor output voltage, the control module knows the manifold pressure. A higher pressure, low vacuum (high voltage) requires more fuel, while a lower pressure, higher vacuum (low voltage) requires less fuel.

The control module uses the MAP sensor to control fuel delivery and ignition timing.

### Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) Figure 3-6

The Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) is essentially a small variable battery; it has the ability to produce a low voltage signal that feeds information on engine exhaust oxygen content to the control module.

The Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) is constructed from a zirconia/platinum electrolytic element. Zirconia is an electrolyte that conducts electricity under certain chemical conditions.

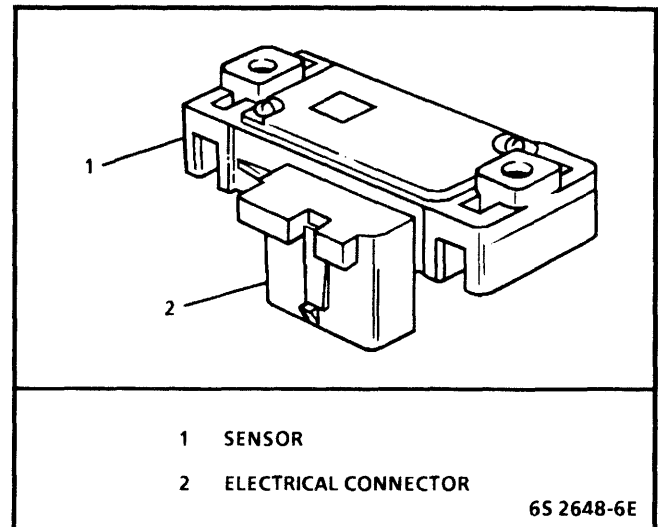


Figure 3-5 - MAP Sensor

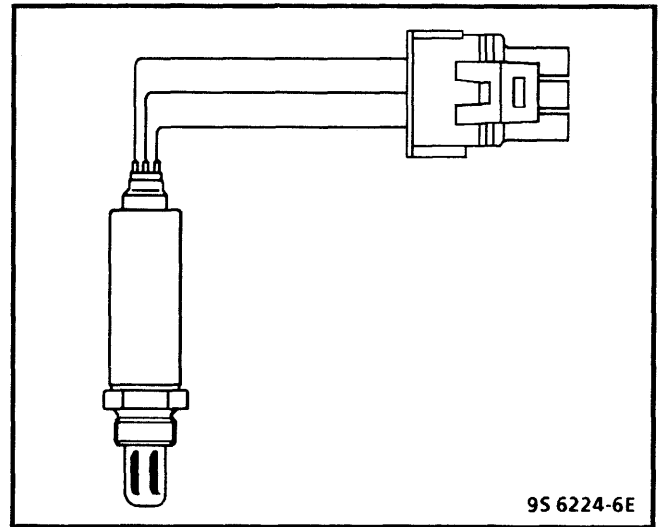


Figure 3-6 - Heated Oxygen Sensor (HO2S)

The element is made of a ceramic material and is an insulator when cold. At operating temperature, 315°C (600°F), the element becomes a semiconductor. A platinum coating on the outer surface of the element stimulates further combustion of the exhaust gases right at the surface and this helps keep the element up to the desired temperature. Also a heating element is incorporated into the sensor to aid in warm up to the operating temperature and also to maintain that temperature. The Heated Oxygen Sensor (HO2S) has an inner cavity which is supplied with atmospheric (reference) air from the sensor wires. The atmosphere has approximately 21% oxygen in it. In the electrical circuit this inner cavity is the positive (+) terminal. The outer surface of the element is exposed to the exhaust gas stream. It is the negative (-) or ground terminal.

### 3-10 DRIVEABILITY AND EMISSIONS (GASOLINE)

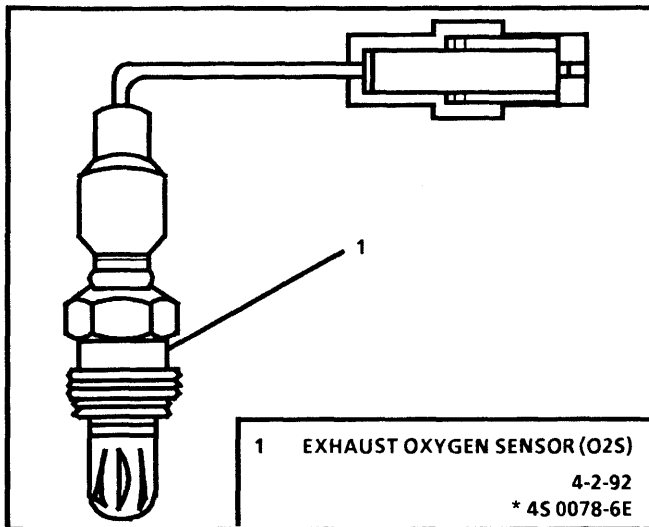


Figure 3-7 - Oxygen Sensor (O2S)

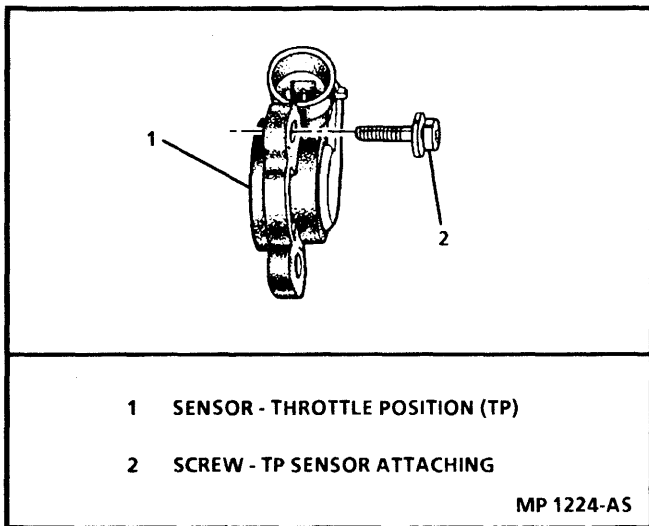


Figure 3-8 - Throttle Position (TP) Sensor

If the heated oxygen sensor pigtail wiring connector or terminal is damaged, the entire oxygen sensor assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have provided to it a clean air reference. This clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degraded oxygen sensor performance.

Due to the electrolytic properties of the element, the oxygen concentration differences between the reference air and exhaust gases produce small voltages.

A rich exhaust (excessive fuel) has almost no oxygen. When there is a large difference in the amount of oxygen touching the inside and outside surfaces, there is more conduction, and the sensor puts out a voltage signal above 0.6 volt (600 mV). With lean exhaust (excessive oxygen) there is about two percent oxygen in the exhaust.

This is a smaller difference in oxygen from the outside surfaces which results in less conduction and a voltage signal below 0.3 volt (300 mV). The voltages are monitored and used by the control module to "fine tune" the air/fuel ratio to achieve the ideal mixture desired.

The control module puts out a reference signal of 0.45 volt (450 mV). The reference signal serves two purposes. The first is to run the engine when it is in "Open Loop" mode of operation. When the air/fuel ratio is correct the control module "senses" 450 mV. When the engine is operating with a rich air/fuel ratio there is a reduction of free oxygen in the exhaust stream and the oxygen sensor voltage rises above the reference voltage.

When the engine is running lean the voltage drops below the reference voltage due to excess oxygen in the exhaust stream. The oxygen sensor provides the feedback information for the "Closed Loop" operating mode of the fuel delivery system. The oxygen sensor indicates to the control module what is happening in the exhaust. It does not cause things to happen. It is a type of gage: Low voltage output = lean mixture = high oxygen content in exhaust; high voltage output = rich mixture = low oxygen content in the exhaust.

An open oxygen sensor, should set a DTC 13. A constant low voltage in the oxygen sensor circuit should set a DTC 44. A constant high voltage in the circuit should set a DTC 45. DTC 44 and DTC 45 could also be set as a result of fuel system problems. Refer to "DTC Charts" for conditions that can cause a lean or rich system. The integral heater in the sensor will not set a DTC but is diagnosed in DTC 13 trouble chart and "Diagnostic Aids."

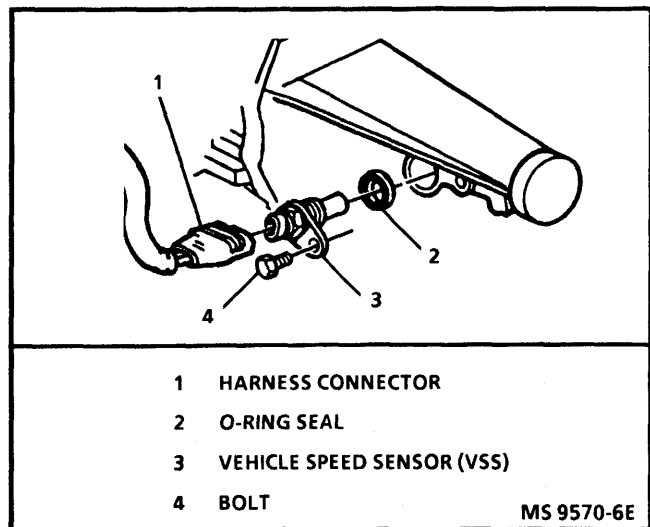


Figure 3-9 - VSS (Manual Transmission)

## Throttle Position (TP) Sensor

**Figure 3-8**

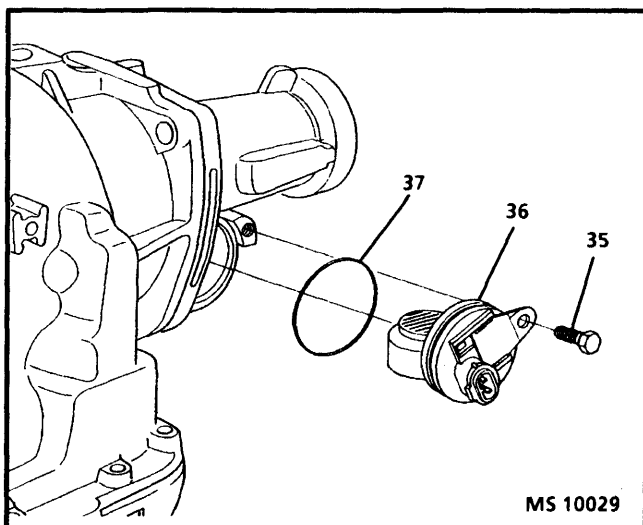
The Throttle Position (TP) sensor is connected to the throttle shaft on the throttle body unit. It is a potentiometer with one end connected to 5 volts from the control module and the other to ground. A third wire is connected to the control module to measure the voltage from the TP sensor. As the throttle valve angle is changed (accelerator pedal moved), the output of the TP sensor also changes. At a closed throttle position, the output of the TP signal is low (approximately .5 volt). As the throttle valve opens, the output increases so that, at Wide Open Throttle (WOT), the output voltage should be approximately 4.5 volts.

By monitoring the output voltage from the TP sensor, the control module can determine fuel delivery based on throttle valve angle (driver demand).

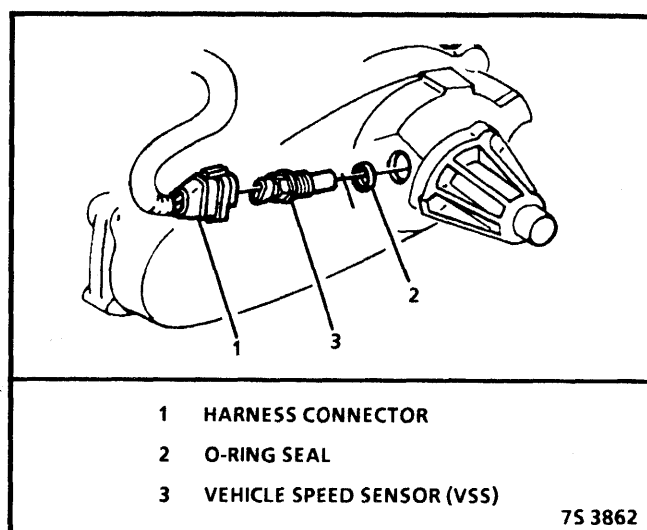
## Vehicle Speed Sensor (VSS)

**Figures 3-9 through 3-11**

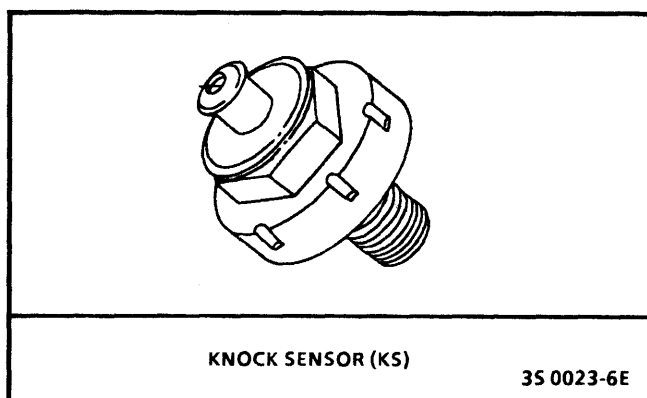
The Vehicle Speed Sensor (VSS) is made up of a coil mounted on the transmission and a tooth rotor mounted to the output shaft in the transmission. As each rotor tooth nears the coil, the coil produces an AC voltage pulse. As the vehicle speed increases the number of AC voltage pulses per second increases. The vehicle speed signal buffer processes inputs from the VSS and output signal to the speedometer control module, and cruise control module. The VSS buffer signal takes the voltage pulses from the VSS and uses them to open and close four solid state output switches to ground at a rate proportional to vehicle speed. The VSS buffer is matched to the vehicle based on final drive ratio and tire size. It is important to ensure that the correct VSS buffer is installed in the vehicle if replacement is necessary.



**Figure 3-10 - VSS (2WD)**



**Figure 3-11 - VSS (4WD)**



**Figure 3-12 - Knock Sensor**

## Knock Sensor (KS)

**Figure 3-12**

Located on the cylinder heads and engine block, depending on application, the knock sensor(s) signal retards ignition timing during a spark knock condition to allow the control module to maintain maximum timing advance under most conditions. Refer to SECTION 7 for further information.

## Distributor Reference Signal

The distributor sends a signal to the control module to indicate engine RPM. Refer to SECTION 6 for further information.

## A/C Signal

This signal indicates that the A/C control switch is turned "ON" and the pressure switch is closed. The control module uses this signal to adjust the idle speed.



## WIRING HARNESS REPAIR

### WIRE HARNESS

The control module harness electrically connects the control module to the various solenoids, switches, and sensors in the vehicle engine and passenger compartment.

Wire harnesses should be replaced with proper part number harnesses. When signal wires are spliced in a harness, use wire(s) with high temperature insulation only.

With the low current and voltage levels found in the system, it is important that the best possible bond at all wire splices be made by soldering the splices, as shown in Figure 3-13.

Molded on connectors require complete replacement of the connector. This means splicing a new connector assembly into the harness.

Refer to Figure 3-13 for wiring diagrams.

Replacement connectors and terminals are listed in Group 8.965, of the Standard Parts Catalog.

### CONNECTORS AND TERMINALS

Use care when probing a connector or replacing terminals in them. It is possible to short between opposite terminals.

If this happens to the wrong terminal pair, it is possible to damage certain components. Always use jumper wires between connectors for circuit checking. **NEVER** probe through the Weather-Pack seals. Use tachometer adapter J 35812, or equivalent, which provides an easy hook up of the tach. lead. The connector test adapter kit J 35616, or equivalent, contains an assortment of flexible connectors used to probe terminals during diagnosis. Fuse remover and test tool BT-8616, or equivalent, is used for removing a fuse and to adapt fuse holder with a meter for diagnosis.

When diagnosing, open circuits are often difficult to locate by sight, because oxidation, or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may correct the open circuit condition. This should always be considered when an open circuit, or failed sensor is indicated. Intermittent problems may, also, be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar, but are serviced differently.

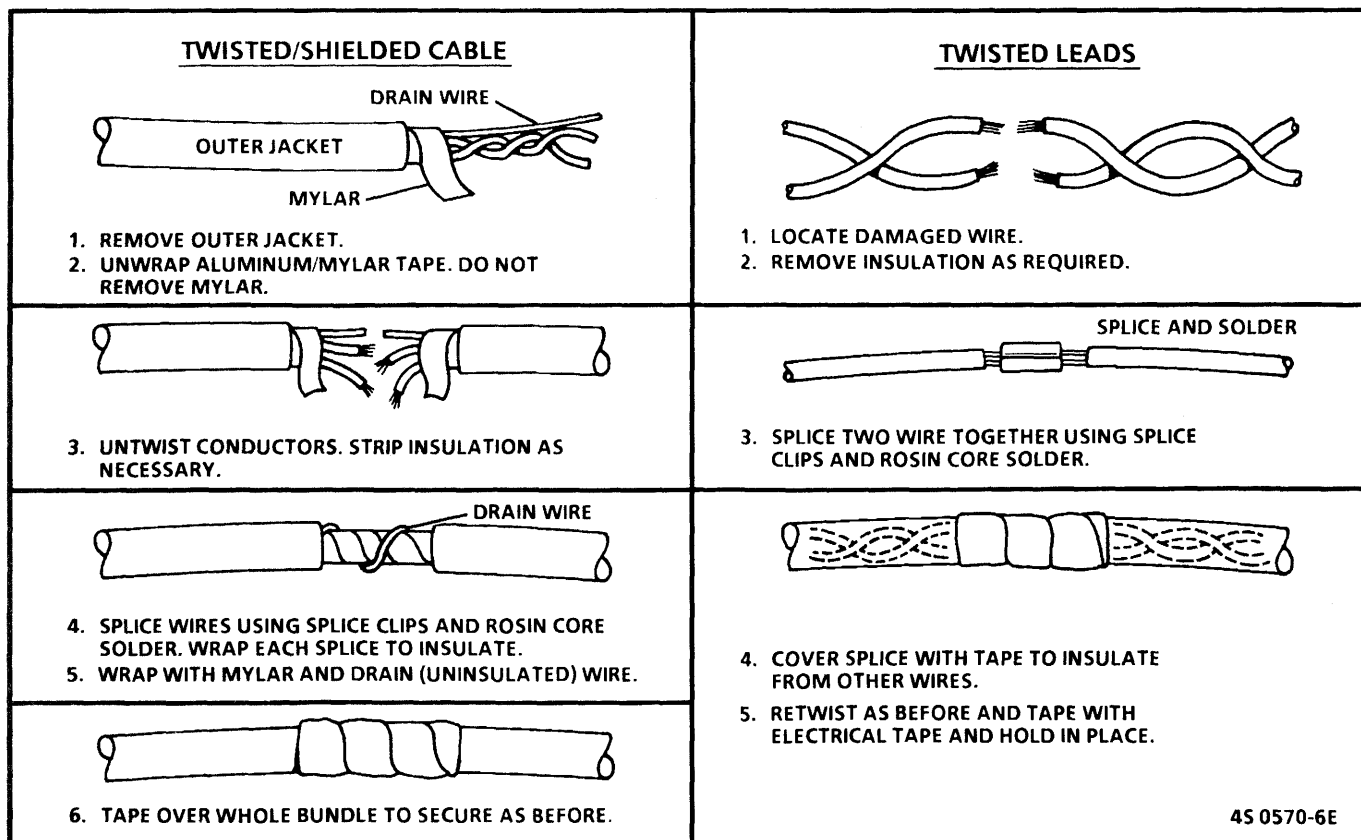


Figure 3-13 - Wire Harness Repair

## Micro-Pack

Refer to Figure 3-14 and repair procedure for replacement of a Micro-Pack terminal.

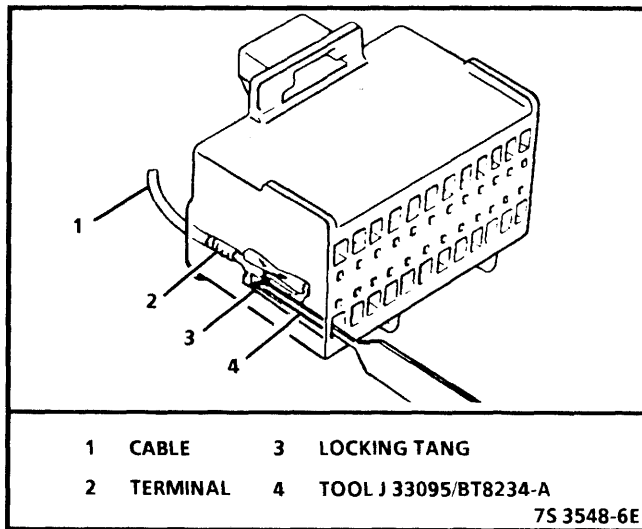


Figure 3-14 - Micro-Pack Connector

## Metri-Pack

Some connectors use terminals called Metri-Pack Series 150 (Figure 3-15). These may be used at the coolant sensor.

They are also called "Pull-To-Seat" terminals, because to install a terminal on a wire, the wire is first inserted through the seal (5) and connector (4). The terminal is then crimped on the wire and the terminal pulled back into the connector to seat it in place. To remove a terminal:

1. Slide the seal back on the wire.

2. Insert tool (3) BT-8518, or J 35689, as shown in insert "A" and "B", to release the terminal locking tab (2).
3. Push the wire and terminal out through the connector.

If reusing the terminal, reshape the locking tang (2).

## Weather-Pack

A Weather-Pack connector can be identified by a rubber seal, at the rear of the connector. This connector, which is used in the engine compartment, protects against moisture and dirt, which could create oxidation and deposits on the terminals. This protection is important, because of the very low voltage and current levels found in the electronic system.

Repair of a Weather-Pack terminal is shown in Figure 3-16. Use tool J 28742-A, or BT-8234-A to remove the pin and sleeve terminals.

If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent, or deformed. Unlike standard blade type terminals, these terminals cannot be straightened once they are bent.

Make certain that the connectors are properly seated and all of the sealing rings in place when connecting leads. The hinge type flap provides a backup, or secondary locking feature for the connector. They are used to improve the connector reliability by retaining the terminals, if the small terminal lock tangs are not positioned properly.

Weather-Pack connections cannot be replaced with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

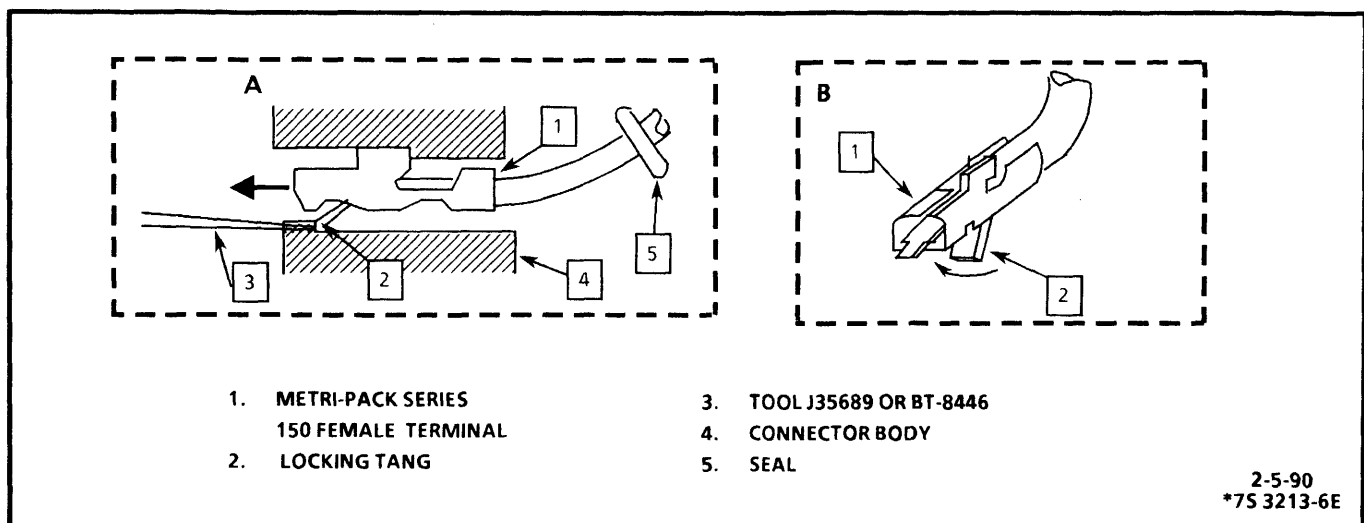


Figure 3-15 - Metri-Pack Series 150 Terminal Removal

### 3-14 DRIVEABILITY AND EMISSIONS (GASOLINE)

#### Compact Three

The Compact Three connector, which looks similar to a Weather-Pack connector, is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A, or BT-8234-A, as these will damage the terminals.

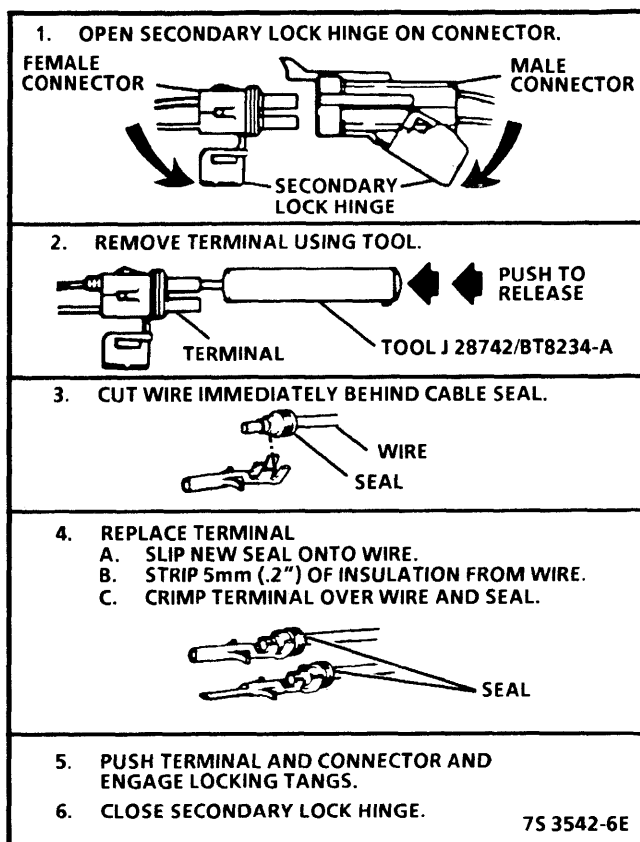


Figure 3-16 - Weather-Pack Terminal Repair

## SECTION 3A

# CONTROL MODULE SYSTEM (93 PCM6)

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## 3A-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

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## GENERAL DESCRIPTION

This section applies to:

- 4.3L (VIN Z) C/K Truck Auto/Manual.
- 5.0L (VIN H) C/K Truck Auto.
- 5.7L (VIN K) C/K Truck Auto.
- 7.4L (VIN N) C/K Truck Auto/Manual.

These engines have controls to reduce exhaust emissions, while maintaining good driveability and fuel economy.

A Powertrain Control Module (PCM) is the main control system and constantly monitors sensors used to provide information about engine operation and the various systems. Details of basic operation, diagnosis, functional checks, and on-vehicle service are covered in this section.

The PCM has the ability to perform some diagnosis of itself, and of other parts of the system. When a fault is detected, it lights a Malfunction Indicator Lamp (MIL) "Service Engine Soon" on the instrument panel and a Diagnostic Trouble Code (DTC) will be stored in the PCM's memory. This does not mean that the engine should be stopped right away, but that the cause of the lamp coming "ON" should be checked as soon as reasonably possible.

Diagnostic charts incorporate diagnosis procedures using a scan tool, such as the Tech 1, where possible. The scan tool has the ability to save time in diagnosis and prevent the replacement of good parts. **The key to using the scan tool successfully for diagnosis lies in the technician's ability to understand the system being diagnosed, as well as an understanding of the scan tool's limitations. See SECTION 3 for more information.**

### POWERTRAIN CONTROL MODULE (PCM)

The Powertrain Control Module (PCM) is located in the passenger compartment and is the control center of the control module system.

The PCM constantly interprets the information from various sensors, and controls the systems that affect vehicle performance and performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) "Service Engine Soon" and store a Diagnostic Trouble Code (DTC) which identify the problem areas to aid the technician in making repairs. Refer to diagnosis section for further information.

The PCM is designed to process the various input information and then send the necessary electrical responses to control fuel delivery, spark timing, and other emission control systems. The input information has an interrelation to more than one output, therefore, if the one input failed it can affect more than one system's operation.

### PROM (MEM-CAL)

This assembly contains the calibrations needed for a specific vehicle, as well as the back-up fuel control circuitry required if the rest of the PCM becomes damaged or faulty.

### PCM Learning Ability

The PCM has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected, to clear diagnostic trouble codes or for other repairs, the "learning" process resets and begins again. A change may be noted in the vehicle's performance. To "teach" the vehicle, ensure that the engine is at operating temperature. The vehicle should be driven at part throttle, with moderate acceleration and idle conditions until normal performance returns.

**NOTICE:** The PCM must be maintained at a temperature below 85°C (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85°C (185°F). It is recommended that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature processes.

### DIAGNOSIS

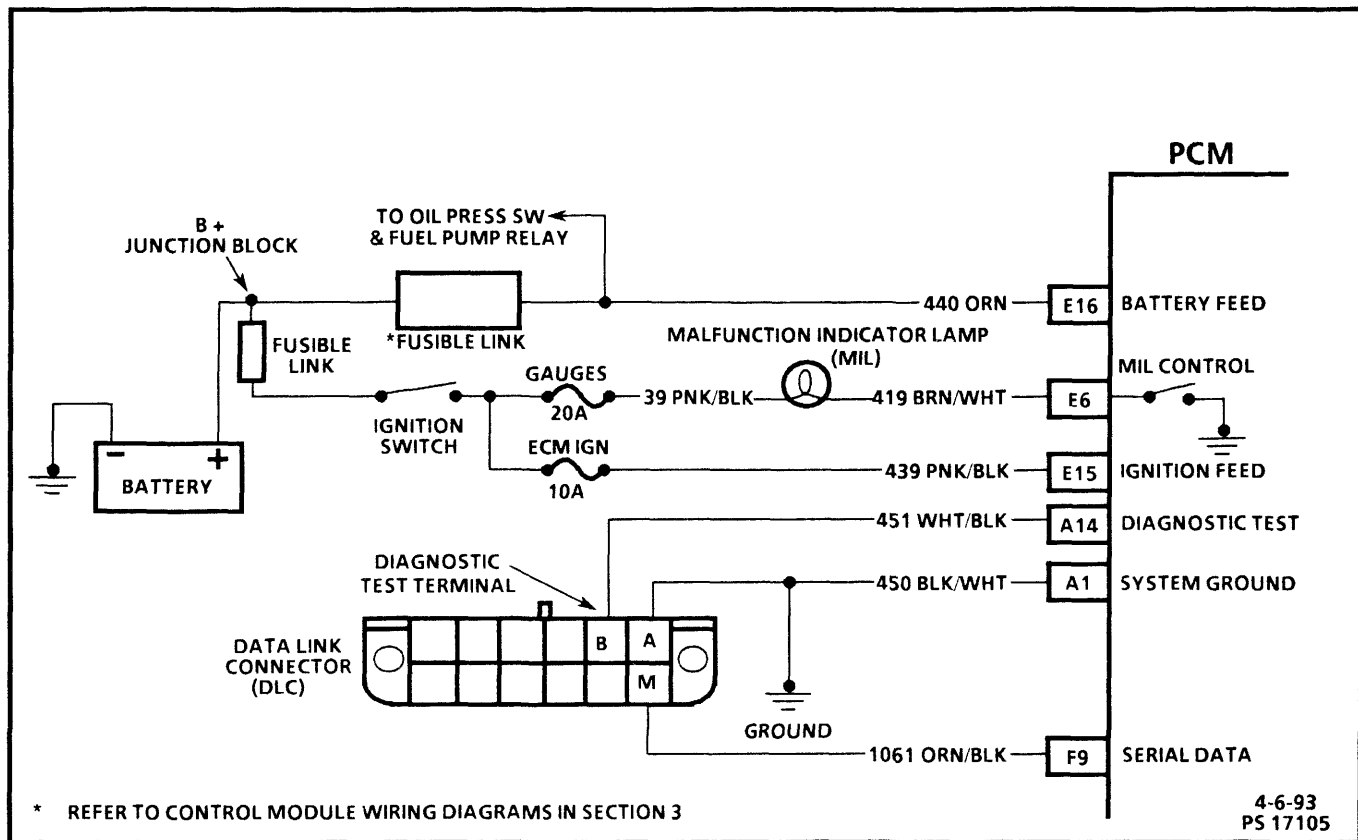
Before using this section of the manual, you should be familiar with the information and the proper diagnosing procedures as described in SECTION 3. If the proper diagnosis procedures are not followed, as described in SECTION 3, it may result in unnecessary replacement of good parts.

If a diagnostic chart indicates that a PCM connection or PCM is the cause of a problem and the PCM is replaced, but does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections - The terminals may need to be removed from the connector in order to check them properly.
- The PCM is not correct for the application - The incorrect components may cause a malfunction and may, or may not set a DTC.
- The problem is intermittent - This means that the problem is not present at the time the system is being checked. In this case, refer to SECTION 2 of the manual and make a careful physical inspection of all portions of the system involved.
- Shorted solenoid, relay coil, or harness - Solenoids and relays are turned "ON" and "OFF" by the PCM using internal electronic switches called "drivers." Each driver is part of a group of four called "quad-drivers." Failure of one driver can damage any other driver in the set.  
A shorted solenoid, relay coil, or harness will not damage the "quad-drivers" in this PCM, but will cause the circuit and controlled component to be inoperative. When the circuit fault is not present or has been repaired, the "quad-driver" will again operate in a normal manner due to its fault protected design. If a fault has been repaired in a circuit, controlled by a "quad-driver," the original PCM should be reinstalled and the circuit checked for proper operation. PCM replacement will not be necessary if the repaired circuit or component operates correctly.  
The J 39200 tester, or equivalent, provides a fast, accurate means of checking for a shorted coil, or a short to battery voltage.
- The replacement PCM may be faulty - After the PCM is replaced, the system should be rechecked for proper operation. If the diagnostic chart again indicates that the PCM is the problem, substitute a known good PCM.

**BLANK**





## ON-BOARD DIAGNOSTIC SYSTEM CHECK

(With Tech 1 Scan Tool)

### Circuit Description:

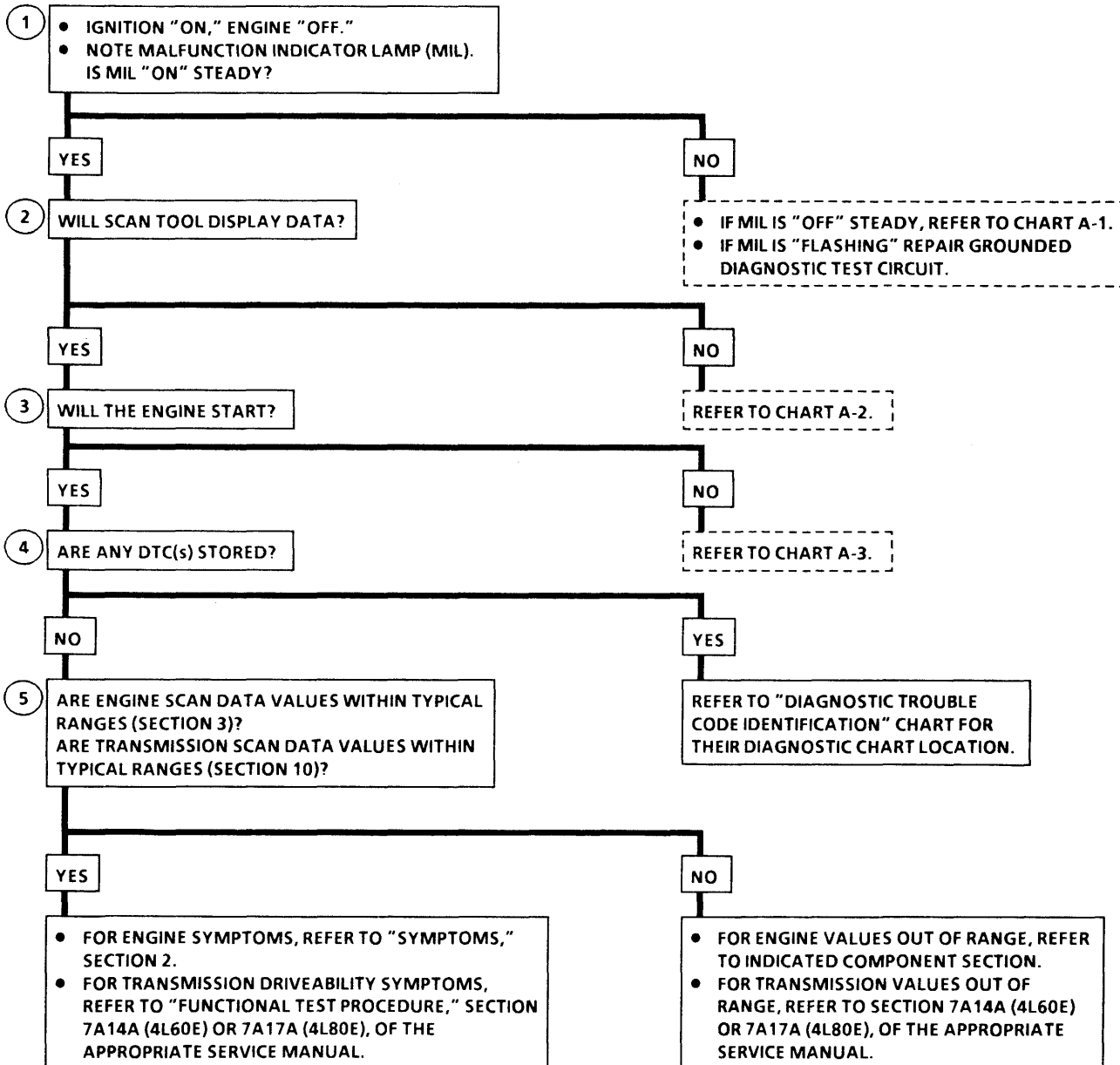
The on-board diagnostic system check is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, because it directs the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it correctly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step is a check for the proper operation of the MIL (Service Engine Soon). The MIL should be "ON" steady.
2. Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
3. Although the PCM is powered up, a "Cranks But Will Not Run" symptom could exist because of a PCM or system problem.
4. This step will isolate if the customer complaint is a MIL or a driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM (MEM-CAL) or PCM.
5. Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. Keep in mind that a base engine problem (i.e., advanced cam timing) may substantially alter sensor values.

# ON-BOARD DIAGNOSTIC SYSTEM CHECK

(With Tech 1 Scan Tool)



**TYPICAL TECH 1 SCAN DATA VALUES**

The Tech 1 scan data listed in this table may be used for comparison after completing the "On-Board Diagnostic (OBD) System Check" and finding the on-board diagnostics functioning properly with no Diagnostic Trouble Codes [DTC(s)] displayed. The "Typical Tech 1 Data Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display. The values you get may vary due to low battery charge or other reasons, but they should be very close.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosis. If a scan tool reads other parameters, the values are not recommended by General Motors for use in diagnosis. For more description on the values and use of the Tech 1 tool to diagnosis PCM inputs, refer to the applicable "Diagnosis"; in applicable section diagnosis. If all values are within the range illustrated, refer to SECTION 2.

**TECH 1 TOOL DATA****Test Under Following Conditions:**

**Engine at Operating Temperature/Engine Idling in "Closed Loop"/Closed Throttle/  
Park/Neutral/All Accessories "OFF"**

| <u>SCAN Position</u>    | <u>Units Displayed</u> | <u>Typical Data Value</u>                                                                     | <u>Refer to Section</u> |
|-------------------------|------------------------|-----------------------------------------------------------------------------------------------|-------------------------|
| ENGINE SPEED            | RPM                    | ± 50 RPM from desired<br>RPM in drive (A/T)<br>± 100 RPM from desired<br>RPM in neutral (M/T) | "4"                     |
| DESIRED IDLE            | RPM                    | PCM idle command<br>(varies with temp)                                                        | "3A"                    |
| ENGINE COOL<br>TEMP     | °C, °F                 | 85°C - 105°C/190°F - 210°F                                                                    | "3A"                    |
| LOOP STATUS             | Open/Closed            | "Closed Loop"                                                                                 | "3A"                    |
| MAP                     | kPa/Volts              | 29-48 kPa/1 - 2 volts (varies with<br>manifold and barometric pressures)                      | "3A"                    |
| BARO                    | kPa/Volts              | 60 - 105 kPa                                                                                  | "3A"*                   |
| THROT POSITION          | Volts                  | .35 - 1.28                                                                                    | "3A"                    |
| THROTTLE ANGLE          | 0 - 100%               | 0%                                                                                            | "3A"                    |
| O2S                     | Millivolts             | 100-999 (varies continuously)                                                                 | "3A"                    |
| INJ PULSE WIDTH         | Milliseconds           | .8 - 3.0                                                                                      | "3A"                    |
| SHORT TERM FUEL<br>TRIM | Counts                 | 110 - 145                                                                                     | "3A"                    |
| LONG TERM FUEL<br>TRIM  | Counts                 | 118 - 138                                                                                     | "3A"                    |
| FUEL TRIM CELL          | Cell #                 | 0                                                                                             | "3A"                    |
| FUEL TRIM ENABLE        | No/Yes                 | No                                                                                            | "3A"                    |
| SPARK ADVANCE           | Degrees                | 0° TO 20°, varies continuously                                                                | "3A"                    |
| IDLE SPARK              | Enable/Disable         | Enable                                                                                        | "3"                     |

\* Varies with manifold and barometric pressures.

\*\* SECTION 4 or SECTION 6D (Engine Electrical) of appropriate service manual.

† The PROM (MEM-CAL) identification parameter describes the particular PROM (MEM-CAL) used in the PCM being tested.

(1) If not equipped with purge solenoid scan tool will display 0% or 99%.

**TECH 1 TOOL DATA (Continued)****Test Under Following Conditions:**

**Engine at Operating Temperature/Engine Idling in "Closed Loop"/  
Closed Throttle/Park-Neutral/All Accessories "OFF"**

| <u>SCAN Position</u> | <u>Units Displayed</u> | <u>Typical Data Value</u> | <u>Refer to Section</u> |
|----------------------|------------------------|---------------------------|-------------------------|
| KS ACTIVITY          | Yes/No                 | No                        | "3A"                    |
| KS RETARD            | Degrees                | 0°                        | "3A"                    |
| IDLE SPEED CONTROL   |                        |                           |                         |
| ACTUATOR             | Off/On                 | On                        | "4A"                    |
| 4WD LOW SWITCH       | Yes/No                 | No                        | "10A"                   |
| CONVERTER            |                        |                           |                         |
| HI TEMP              | No/Yes                 | No                        | "3A"                    |
| FUEL EVAP            |                        |                           |                         |
| PURGE                | 0 - 100%               | 0% (1)                    | "5"                     |
| EGR DESIRED POS      | 0-100%                 | 0%                        | "3A"                    |
| EGR ACTUAL POS       | 0-100%                 | 0%                        | "3A"                    |
| EGR PINTLE POS       | Volts                  | .74 volts                 | "3A"                    |
| EGR DUTY CYCLE       | 0-100%                 | 0%                        | "3A"                    |
| MPH/km/h             | MPH/KPH                | 0/0                       | "3A"                    |
| 1-2 SOL/2-3 SOL      | Off/On Off/On          | Off                       | "10A"                   |
| TCC SOLENOID         | Off/On                 | Off                       | "10A"                   |
| TRANS RANGE SW       | Drive 4/Drive 3        | P-N                       | "10A"                   |
|                      | Drive 2/Low            | P-N                       | "10A"                   |
|                      | Reverse/P-N            | P-N                       | "10A"                   |
| A/B/C RANGE          | On/Off                 | Off                       | "10A"                   |
| TCC BRAKE SWITCH     | On/Off                 | On                        | "10A"                   |
| FUEL SHUTOFF         | Yes/No                 | No                        | "3A"                    |
| IDLE AIR CONTROL     | Counts (Steps)         | 1 - 50                    | "4A, 4B"                |
| PARK/NEUTRAL POS     | PN/RDL                 | Park/Neutral              | "3A"                    |
| A/C REQUEST          | No/Yes                 | No                        | "3A"                    |
| A/C CLUTCH           | On/Off                 | Off                       | "3A"                    |
| SYSTEM VOLTAGE       | Volts                  | 13.5 - 14.5               | "3A"***                 |
| FUEL PUMP VOLTS      | Volts                  | 13.5 - 15.5               | "3"***                  |
| CALIBRATION ID       | 0 - 9999               | Internal ID only          | "3" (†)                 |
| TIME FROM START      | Minutes                | Varies                    | "3"                     |

\* Varies with manifold and barometric pressures.

\*\* SECTION 4 or SECTION 6D (Engine Electrical) of appropriate service manual.

† The PROM identification parameter describes the particular PROM (MEM-CAL) used in the PCM being tested.

(1) If not equipped with purge solenoid scan tool will display 0% or 99%.

### TYPICAL TECH 1 DATA DEFINITIONS

A list of each data message displayed on the Tech 1 scan tool will be explained in two groups; "Engine" or "Transmission." For transmission information refer to SECTION 10. This information will assist in emission or driveability problems. The displays can be viewed while the vehicle is being driven. Always perform the "On-Board Diagnostic (OBD) System Check" first. The "OBD System Check" will confirm proper system operation. The following positions may not be applicable to all engines:

**ENGINE SPEED** - Engine speed is computed by the PCM from the fuel control reference input. It should remain close to desired idle under various engine loads with engine idling.

**DESIRED IDLE** - The idle speed that is commanded by the PCM. The PCM will compensate for various engine loads to maintain the engine at the desired idle speed.

**ENGINE COOLANT TEMP** - The Engine Coolant Temperature (ECT) sensor is mounted in the intake manifold and sends engine temperature information to the PCM. The PCM supplies 5 volts to the coolant temperature sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the PCM monitors a high signal voltage which it interprets as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

**LOOP STATUS** - "Closed Loop" displayed indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In "Open Loop," the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAP sensor inputs only.

**MANIFOLD ABSOLUTE PRESSURE (MAP)** - The Manifold Absolute Pressure (MAP) sensor measures the change in the intake manifold pressure from engine load and speed changes. As intake manifold pressure increases, the air density in the intake manifold also increases and additional fuel is required.

**BAROMETRIC PRESSURE (BARO)** - The BARO reading displayed is determined from the MAP sensor at ignition "ON," engine "OFF," and WOT conditions. The BARO reading displayed represents barometric pressure and is used to compensate for altitude differences.

**THROT POSITION** - Used by the PCM to determine the amount of throttle demanded by the driver. Should read .45-65 volt at idle to above 4 volts at Wide Open Throttle (WOT).

**THROTTLE ANGLE** - Computed by the PCM from TP sensor voltage (throt position) and should display 0% at idle and 100% at wide open throttle. Refer to DTC 21 if TP sensor angle is not 0% at idle.

**O2S** - Represents the exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 100 mV (lean exhaust) and 1000 mV (rich exhaust) when operating in "Closed Loop."

**INJECTOR PULSE WIDTH** - In this position, the reading is given in milliseconds which is the "on-time" that the PCM is commanding to the injector(s).

**SHORT TERM FUEL TRIM (FUEL INTEGRATOR)** - Fuel integrator represents a short term correction to fuel delivery by the PCM in response to the amount of time the oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage has mainly been below 450 mV, indicating a lean air/fuel mixture, fuel integrator will increase to tell the PCM to add fuel. If the oxygen sensor voltage stays mainly above the threshold, the PCM will reduce fuel delivery to compensate for the indicated rich condition.

**LONG TERM FUEL TRIM (BLOCK LEARN)** - Long term fuel trim is derived from the short term fuel trim value and is used for long term correction of fuel delivery. A value of 128 counts indicates that fuel delivery requires no compensation to maintain a 14.7:1 air/fuel ratio. A value below 128 counts means that the fuel system is too rich and fuel delivery is being reduced (decreased injector pulse width). A value above 128 counts indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width).

**FUEL TRIM CELL** - Fuel trim cell is dependent upon engine speed and MAP sensor readings. A plot of RPM vs. MAP is broken into 16 cells. Fuel trim cell indicates which cell is currently active.

**FUEL TRIM ENABLE** - If air fuel system is learning (YES) then long term fuel trim is responding to short term fuel trim. If fuel trim enable reads (NO) then long term fuel trim will not respond to change in short term fuel trim normally, learning starts as soon as engine goes into "Closed Loop."

**SPARK ADVANCE** - This is a display of the spark advance Ignition Control (IC) calculation which the PCM is programming into the ignition system. It computes the desired spark advance using data such as engine temperature, RPM, load, vehicle speed and operating mode.

**IDLE SPARK** - Idle speed control by timing.

**K.S. ACTIVITY** - Indicates whether or not a knock signal is being detected by the PCM.

**K.S. RETARD** - Indicates the amount of spark advance the PCM is removing from IC in response to the Knock Sensor (KS) signal.

**IDLE SPEED CONTROL ACTUATOR** - Indicates whether the system is "OFF" or "ON."

**4WD LOW SWITCH** - Indicator to PCM when driver selects 4WD.

**CONVERTER HIGH TEMP** - Air fuel ratio enriches from 14.7 to 1 to 12 to 1 to help cool catalytic converter.

**FUEL EVAP PURGE** - Used to control EVAP canister purge function. 0% indicates the valve is commanded fully closed while 100% indicates that the valve is fully open.

**EGR DESIRED POSITION** - The PCM command for EGR valve position that is desired.

**EGR ACTUAL POSITION** - Current actual EGR position of the EGR valve.

**EGR PINTLE POSITION** - PCM command for linear EGR valve pintle position that is desired.

**EGR DUTY CYCLE** - The PCM cycles the EGR valve "ON" and "OFF." The "ON" time (duty cycle) of the EGR valve, expressed as a percent, determines how much the exhaust gas is recirculated.

**MPH/km/h** - Vehicle speed is a PCM internal parameter. It is computed by timing pulses coming from the Vehicle Speed Sensor (VSS). Vehicle speed is used in checking TCC lock-up speed or speedometer accuracy. Speed is displayed in both Miles Per Hour (mph) and Kilometer Per Hour (km/h).

**1 - 2 SHIFT SOL** - When the transmission is in first or fourth gear, the Tech 1 should display "ON." When the transmission is in second or third gear, the Tech 1 should indicate "OFF."

**2 - 3 SHIFT SOL** - When the automatic transmission is in first or second gear, the Tech 1 should indicate "ON." When the transmission is in third or fourth gear, the Tech 1 should display "OFF."

**TORQUE CONVERTER CLUTCH (TCC) SOLENOID** - In this position, the tool will indicate when the TCC has been commanded by the PCM to turn "ON." This does not necessarily mean that the clutch was engaged but only that the PCM grounded the circuit internally. The best way to determine if the clutch has engaged is to monitor engine RPM when the TCC comes "ON."

**TRANS RANGE SWITCH** - Displays Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, Low and Invalid - These values represent the decoded sequence of the Transmission Range (TR) pressure switch assembly circuits and are used to determine manual valve position.

**A/B/C RANGE** - "ON/OFF" they are used to detect which gear has been manually selected engine must be operating.

**TCC BRAKE SWITCH** - The brake switch is operated by brake pedal travel. The switch is normally closed when the brake is released. This applies battery voltage to the PCM signal line. When brakes are applied, the PCM receives a Zero (0) volt signal on the signal line which caused TCC to be released. Brake switch input is used for line pressure and TCC control.

## 3A-12 DRIVEABILITY AND EMISSIONS (GASOLINE)

---

**FUEL SHUTOFF** - Indicates when PCM goes into this mode of operation. It is either RPM or mph activated.

**IDLE AIR CONTROL** - Displays the commanded position of the idle air control pintle in counts. The greater the number of counts, the greater the idle air passages opened. Idle air control should respond fairly quickly to changes in engine load to maintain desired idle RPM.

**PARK/NEUTRAL POSITION** - Displays "P-N" or "R-D-L" - "P/N" indicates park or neutral has been selected. "R-D-L" indicates that reverse, or a forward gear has been selected. Engine must be operating.

**A/C REQUEST** - Displays the state of the A/C signal line to the PCM. Should read "YES" whenever the A/C is requested.

**A/C CLUTCH** - Displays "ON" when the A/C clutch is engaged.

**SYSTEM VOLTS** - Battery/Ignition voltage is an analog input signal read by the PCM. It is the ignition switched battery voltage and is mainly used for diagnostics. Certain PCM functions will be modified if the battery voltage falls below or rises above programmed thresholds.

**FUEL PUMP VOLTS** - This parameter is a reading of the voltage going to the fuel pump. It is used by the PCM as the system voltage. The PCM uses fuel pump volts as a reference.

**CALIBRATION ID** - The PROM identification parameter describes the particular PROM used in the PCM being tested. The PROM contains the PCM program. PROM ID is used when it is necessary to replace the PROM. PROM ID must be specified when ordering new PROMs. PROM ID should not be confused with "Part Number."

**TIME FROM START** - Time from start is a measure of how long the engine has been running. If the engine stops, time from start will reset to 0:00:00.

### FUEL CONTROL

Fuel delivery is controlled by the control module system.

The diagnosis of fuel control starts with "Engine Cranks But Will Not Run" CHART A-3. This chart will test the fuel system and if there is a problem, will lead you to checking the fuel pump relay circuit, diagnosing the injector circuit or diagnosing the fuel system.

### Fuel Injector

Testing the fuel injector circuit is in CHART A-3 with additional diagnosis in CHART A-4.

A fuel injector which does not open may cause a "no start" condition. An injector which is stuck partly open could cause loss of pressure after sitting so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

### Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3 and A-4.

If the pressure regulator in the TBI supplies pressure which is too low, poor performance could result. If the pressure is too high, unpleasant exhaust odor may result.

### Idle Air Control (IAC)

The diagnosis of Idle Air Control (IAC) can be found in SECTION 4.

If the IAC valve is disconnected or connected with the engine running, the idle RPM may be wrong. The IAC valve may be reset by disconnecting negative battery terminal for 10 seconds then reconnect battery cable, turn key "ON," engine "OFF" for 5 seconds then turn key "OFF" for 10 seconds.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed in the manifold and idle speed will be high. If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

### Fuel Pump Circuit

Diagnostic Trouble Code (DTC) 54 indicates a failure in the fuel pump circuit.

The fuel pump relay has a connector pigtail located near the relay to assist in testing the system. By applying voltage at this terminal, it can be determined if the fuel pump will operate. This terminal will also prime the fuel line to the TBI unit.

Refer to CHART A-5 for diagnosis of the fuel pump relay circuit.

An inoperative fuel pump will cause a "no start" condition. A fuel pump which does not provide enough pressure can result in poor performance.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn "ON" the fuel pump, as soon as oil pressure reaches about 28 kPa (4 psi).

### **ENGINE COOLANT TEMPERATURE (ECT) SENSOR**

Diagnostic Trouble Code (DTC) 14 or DTC 15 indicates a failure in the engine coolant temperature sensor circuit.

Most scan tools display engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

### **MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR**

Diagnostic Trouble Code (DTC) DTC 33 or DTC 34 indicates a failure in the MAP sensor circuit. Also refer to "MAP Output Check Diagnosis" to check the MAP sensor if there is no DTC.

### **OXYGEN SENSOR**

Diagnostic Trouble Code (DTC) 13 indicates an open in the oxygen sensor circuit. DTC 44 indicates a shorted oxygen sensor circuit. DTC 45 indicates a high voltage in the oxygen sensor circuit. If a DTC is set, the engine will always run in the "Open Loop" mode. On heated oxygen sensors the value will drop lower towards 0 as the sensor heater inside the sensor warms up.

Normal scan voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." DTC 13 sets in one minute if voltage remains between .35 and .55 volt, but the system will go "Open Loop" in about 15 seconds.

Using the scan, observe the long term fuel trim values at different RPM and air flow conditions to determine when DTC 44 or DTC 45 may have been set. If the condition for DTC 44 exists, the long term fuel trim values will be around 150. If the condition for DTC 45 exists, the long term fuel trim values will be around 115.

If the heated oxygen sensor pigtail wiring, connector or terminal is damaged, the entire oxygen sensor assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have provided to it a clean air reference. This clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degraded oxygen sensor performance.

### **THROTTLE POSITION (TP) SENSOR**

When a Diagnostic Trouble Code (DTC) 21 or 22 is set, the PCM will use an artificial value for throttle position and some engine performance will return.

A broken TP sensor can cause intermittent bursts of fuel from the injector(s) and an unstable idle because the PCM thinks the throttle is moving.

A scan tool reads throttle position in volts and should read about .60 with the throttle closed, ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Scan TP signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below .85 volt (850 mV) when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at wide open throttle position.

### **TP Sensor Output**

This check should be performed when TP sensor attaching parts have been replaced. A Tech 1 can be used to read the TP signal output voltage, or:

1. Connect digital voltmeter J 39200 or equivalent, from TP sensor connector terminal "B" (BLK wire) to terminal "C" (DK BLU wire). Jumpers for terminal access can be made using terminals "1214836" and "12014837".
2. With ignition "ON," engine stopped, the TP sensor voltage should be less than .85 volt if more than .85 volt verify free throttle movement. If still more than .85 volt, replace TP sensor.
3. Remove the voltmeter and jumpers, reconnect the TP sensor connector to the sensor.

### **VEHICLE SPEED SENSOR (VSS)**

Refer to SECTION 10 for "Diagnosis."



## 3A-14 DRIVEABILITY AND EMISSIONS (GASOLINE)

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### EGR SYSTEM

Diagnostic Trouble Code (DTC) 32 indicates that there is a failure in the EGR system circuit.

### IDLE SPEED

Refer to SECTION 4 for Idle Air Control (IAC) check.

- System too lean (High air/fuel ratio) - Idle speed may be too high or too low. Engine speed may vary up and down, disconnecting IAC does not help. May set DTC 44.  
Scan tool and/or voltmeter will read an oxygen sensor output less than 300 mV (.3 volt). Check for low regulated fuel pressure or water in fuel. A lean exhaust with a Heated Oxygen Sensor (HO2S) output fixed above 800 mV (.8 volt) will be a contaminated sensor, usually silicone. This may also set a DTC 45.
- System too rich (Low air/fuel ratio) - Idle speed too low. Scan counts usually above 80. System obviously rich and may exhibit black exhaust smoke. Scan tool and/or voltmeter will read a Heated Oxygen Sensor (HO2S) signal fixed above 800 mV (.8 volt).

### Ignition Control (IC)

When the system is running on the DI control module, that is, no voltage on the bypass line, the DI control module grounds the Ignition Control (IC) signal. The PCM expects to see no voltage on the IC line during this condition. If it sees a voltage, it sets DTC 42 and will not go into the IC mode.

When the RPM for IC is reached (about 400 RPM), and bypass voltage is applied, the IC should no longer be grounded in the DI control module so the IC voltage should be varying.

If the bypass line is open or grounded, the DI control module will not switch to IC mode so the IC voltage will be low and DTC 42 will be set.

If the IC line is grounded, the DI control module will switch to IC, but because the line is grounded there will be no IC signal. A DTC 42 will be set.

DTC 42 sets if there is an open or a short to ground in the IC or bypass circuit.

### KNOCK SENSOR (KS) SYSTEM

DTC 43 sets if there is an open or short to ground in the circuit.

If the conditions for DTC 43 are present, the scan will always display "YES." There should not be a knock at idle unless an internal engine problem, or a system problem exists.

### SYSTEM OVER VOLTAGE

DTC 53 sets if there is voltage greater than 17.1 volts for two seconds at PCM terminal "E16". This indicates that there is a basic generator problem.

### TRANSMISSION RANGE (TR) PRESSURE SWITCH

Refer to SECTION 10.

### DISTRIBUTOR REFERENCE SIGNAL

The distributor reference signal is covered in SECTION 6.

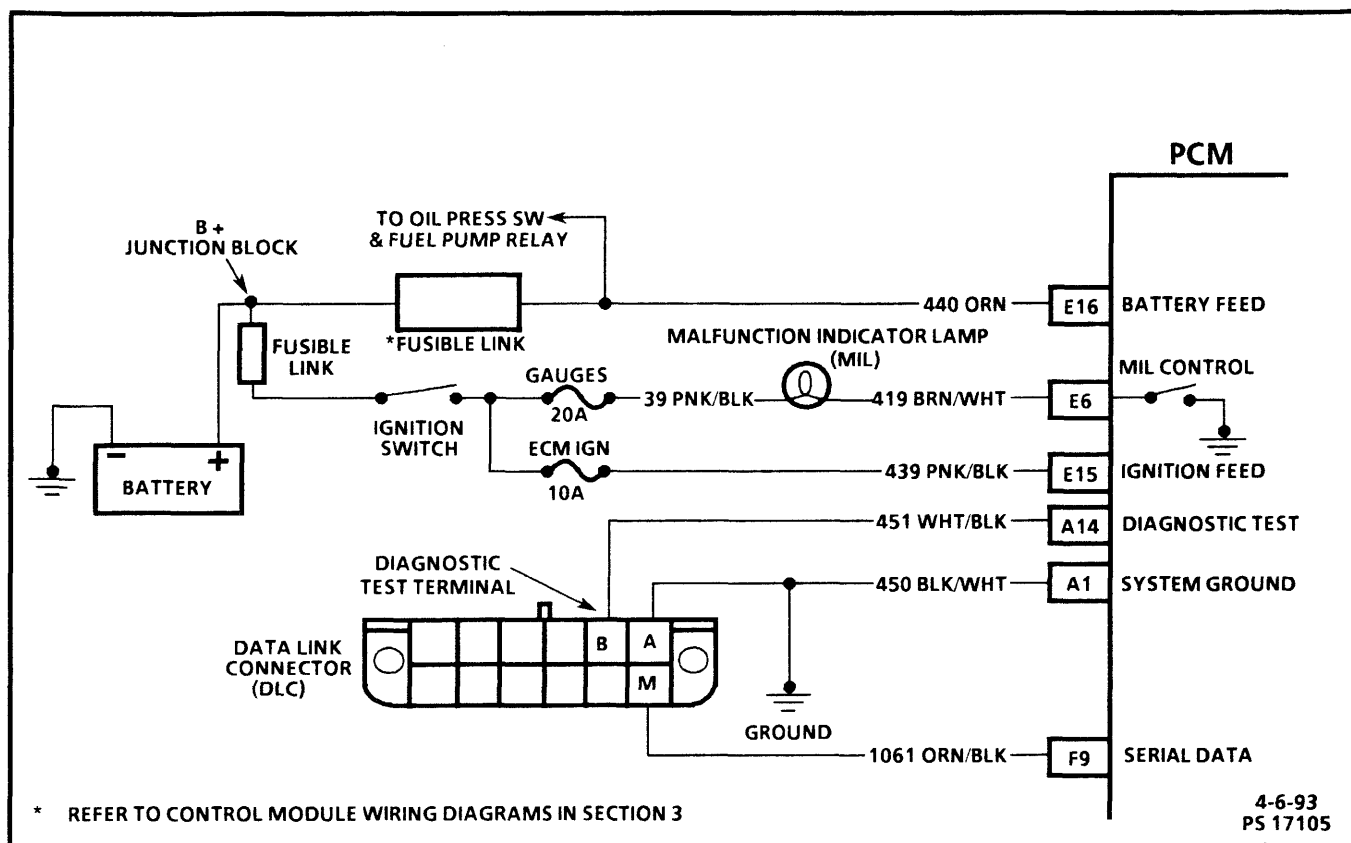
### A/C SIGNAL

Refer to "A/C Signal Diagnosis."

### EXHAUST SYSTEM

Refer to "Restricted Exhaust System Check."

**BLANK**



## CHART A-1

### NO MIL (SERVICE ENGINE SOON)

#### Circuit Description:

There should always be a steady Malfunction Indicator Lamp (MIL) when the ignition is "ON" and engine stopped. Battery voltage is supplied to the lamp. The PCM will control the lamp and turn it "ON" by providing a ground path through CKT 419 to the PCM.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will isolate the problem in CKT 419.
2. If CKTs 440 and 439 have voltage, the PCM connections, grounds, or PCM are faulty.
3. Using a test light connected to 12 volts, probe each of the system ground circuits to be sure a good ground is present. Refer to PCM terminal end view in this section for PCM pin locations of ground circuits.

**Diagnostic Aids:** If the engine runs OK, check:

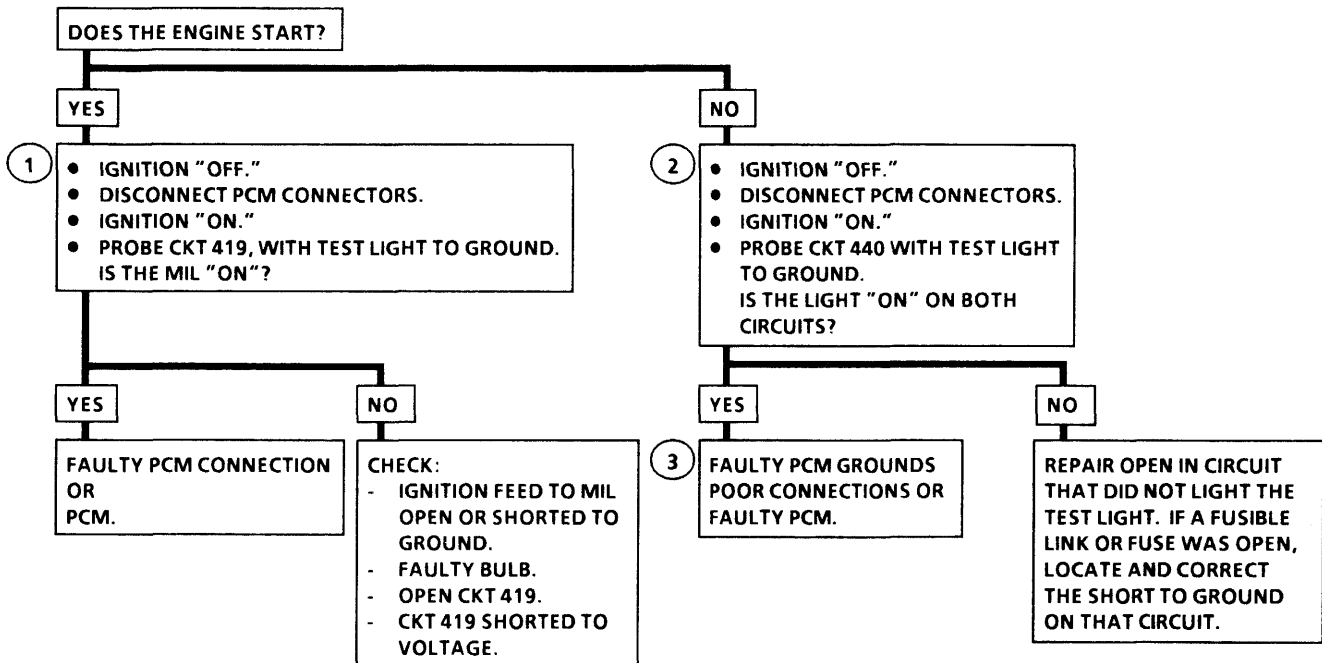
- Faulty light bulb.
- CKT 419 open, shorted to ground or open fuse.

If the engine cranks but will not run, check:

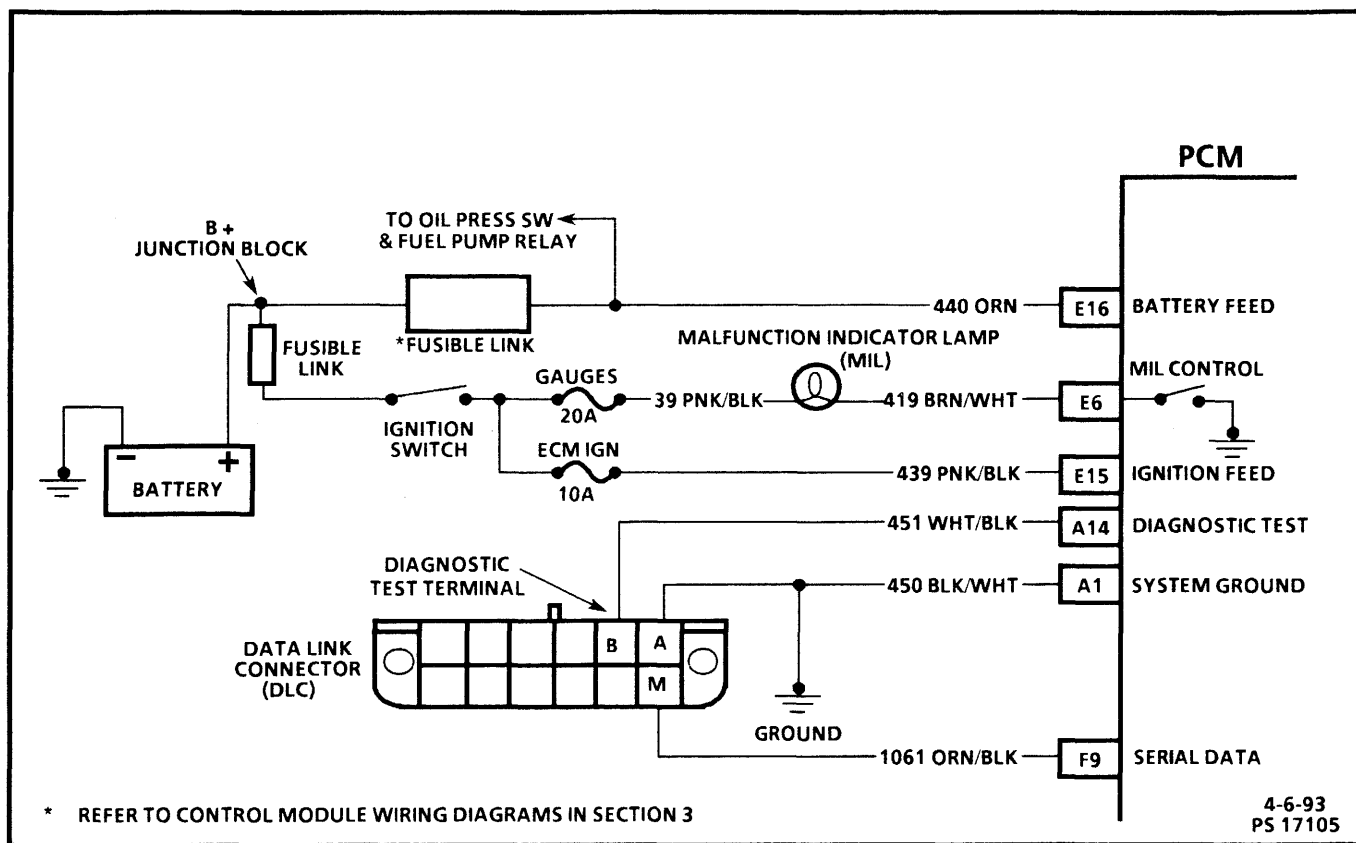
- Continuous battery-fuse or fusible link open.
- PCM ignition fuse open.
- Battery CKT 440 to PCM open.
- Ignition CKT 439 to PCM open.
- Poor connection to PCM.

## CHART A-1

### NO MIL (SERVICE ENGINE SOON)



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).



## CHART A-2

### NO SERIAL DATA OR WILL NOT FLASH DTC 12 MIL (SERVICE ENGINE SOON) "ON" STEADY

#### Circuit Description:

There should always be a steady Malfunction Indicator Lamp (MIL) when the ignition is "ON" and engine stopped. Battery voltage is supplied to the lamp. The PCM will turn the lamp "ON" by grounding CKT 419 at the PCM.

With the diagnostic terminal grounded, the MIL should flash a DTC 12, followed by any Diagnostic Trouble Code(s) [DTC(s)] stored in memory.

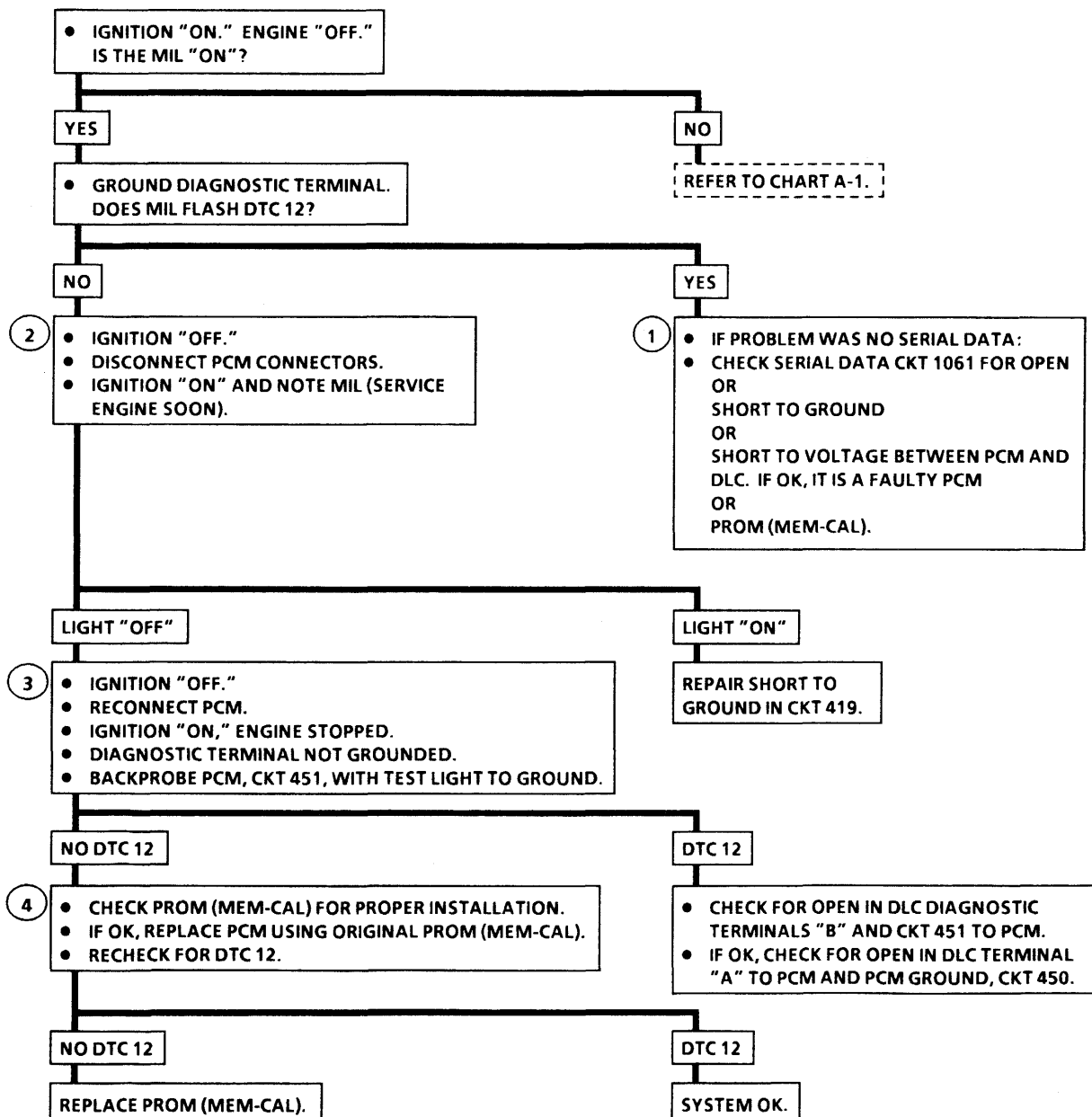
A steady MIL suggests a short to ground in the lamp control CKT 419, or an open in diagnostic CKT 451.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. If there is a problem with the PCM that causes a scan tool to not read serial data, then the PCM should not flash a DTC 12. If DTC 12 does flash, be sure that the Tech 1 scan tool is working properly on another vehicle. If the scan is functioning properly and CKT 1061 is OK, the PROM (MEM-CAL) may be at fault for the No serial data symptom.
2. If the lamp goes "OFF" when the PCM connector is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point the MIL (Service Engine Soon) wiring is OK. The problem is a faulty PCM or PROM (MEM-CAL). If DTC 12 does not flash, the PCM should be replaced using the original PROM (MEM-CAL). Replace the PROM (MEM-CAL) only after trying a new PCM, because a defective PROM (MEM-CAL) is an unlikely cause of the problem.

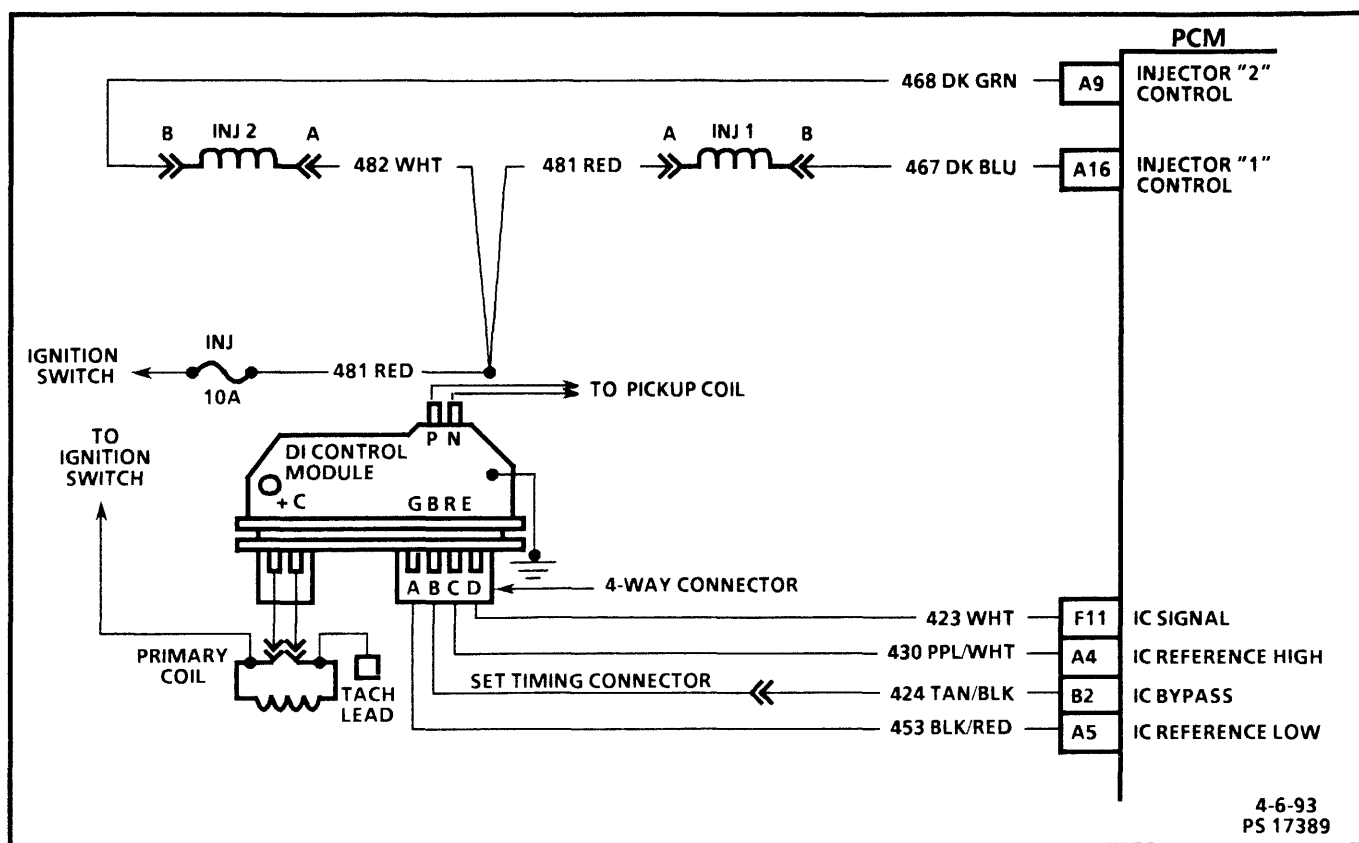
**CHART A-2**

**NO SERIAL DATA OR WILL NOT FLASH DTC 12  
MIL (SERVICE ENGINE SOON) "ON" STEADY**



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

4-8-93  
MS 9970-6E



## CHART A-3

### ENGINE CRANKS BUT WILL NOT RUN TBI

#### Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, and there is adequate fuel in the tank. This chart should be used on engines using the Model 220 throttle body.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. A MIL (Service Engine Soon) "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to PCM. No serial data may be due to a PCM problem and CHART A-2 will diagnose the PCM. If TP sensor is over 2.5 volts the engine may be in the clear flood mode which will cause starting problems. If coolant sensor is below -30°C, the PCM will provide fuel for this extremely cold temperature which will severely flood the engine.
2. Voltage at the spark plug is checked using spark tester tool (J 26792). No spark indicates a basic ignition problem.
3. While cranking engine there should be no fuel spray with injectors disconnected. Replace an injector if it sprays fuel or drips like a leaking water faucet.
4. Use an injector test light like BT-8320, to test each injector circuit. A blinking light indicates the PCM is controlling the injectors.
5. This test will determine if there is fuel pressure at the injectors and that the injectors are operating.

**Diagnostic Aids:** If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

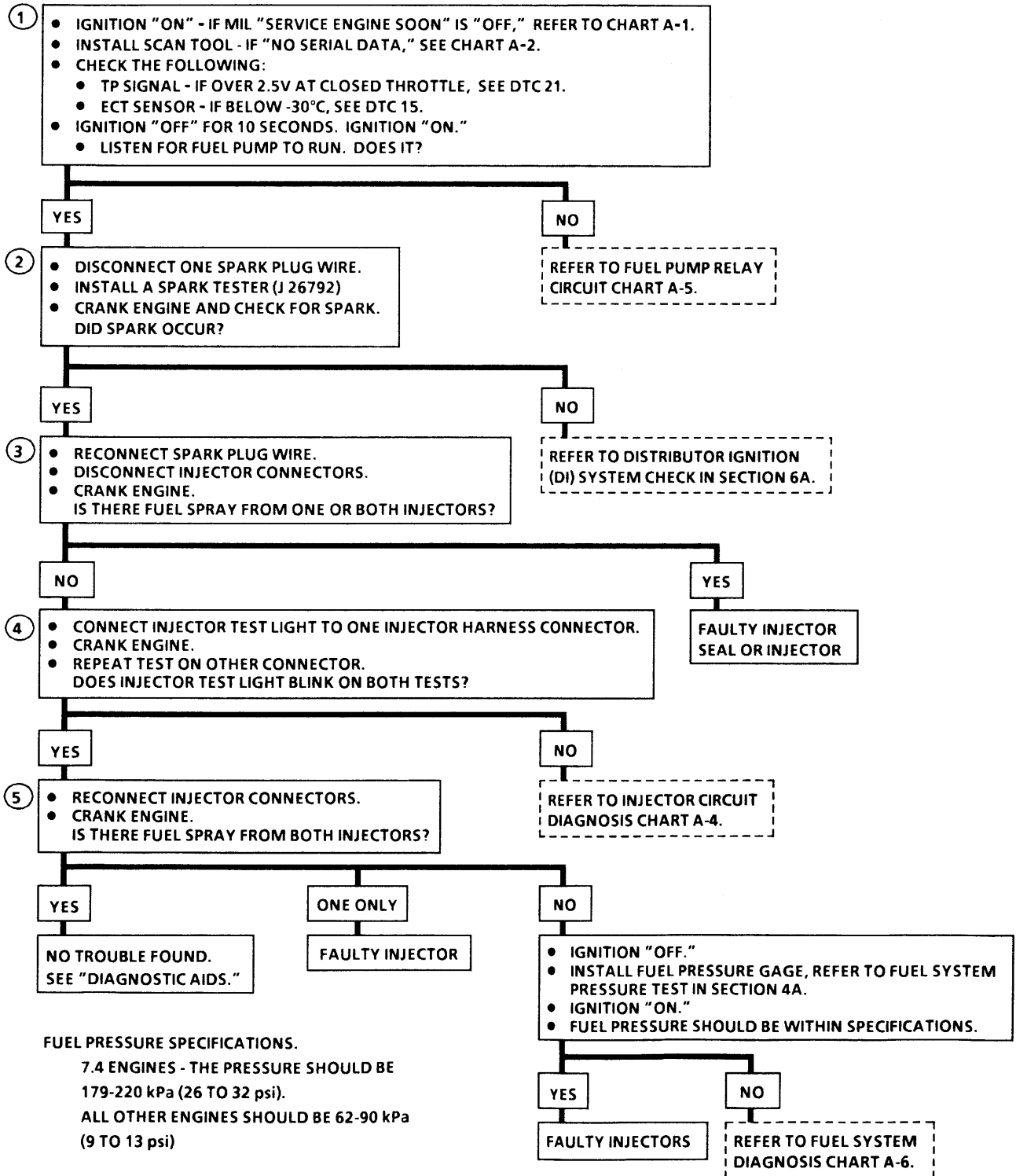
- Fouled spark plugs.
- EGR valve stuck open.
- Low fuel pressure. Refer to CHART A-6.
- Water or foreign material in the fuel system.
- A grounded CKT 423 Ignition Control (IC) may cause a "No Start" or a "Start then Stall" condition.
- Basic engine problem.

The PCM has integrated IC circuits that are fault protected, therefore, if a circuit has failed, the integrated IC may not be damaged and will keep the circuit open until the fault in the circuit has been corrected. When the fault has been corrected, reinstall PCM and check circuit. Replace PCM only if the circuit is still inoperative.

IF DTC 54 IS STORED, USE THAT CHART FIRST.

## CHART A-3

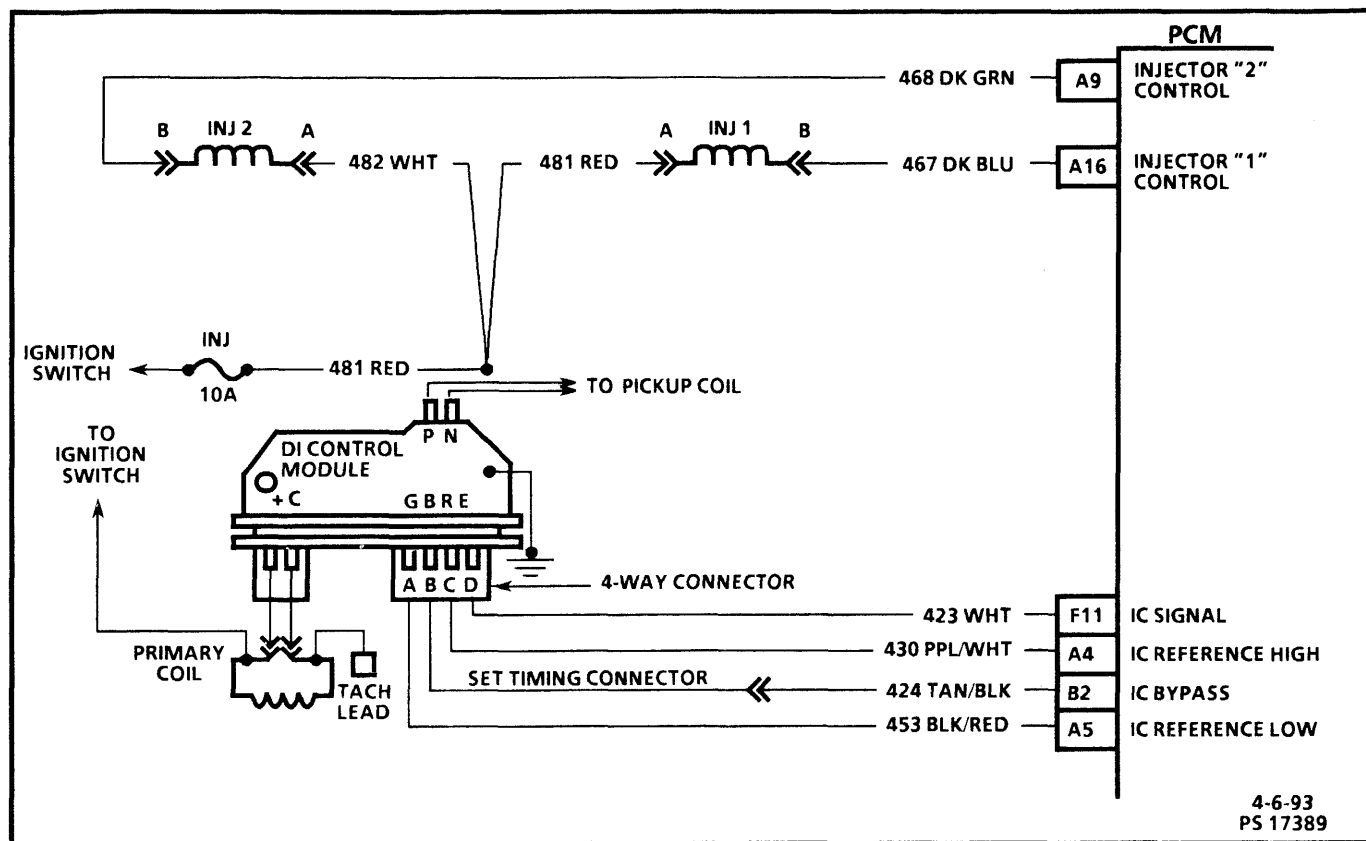
### ENGINE CRANKS BUT WILL NOT RUN TBI



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

5-11-93  
7S 3778-6E





**CHART A-4**  
**INJECTOR CIRCUIT DIAGNOSIS**  
**TBI**

### Circuit Description:

This chart should only be used if diagnosis in CHART A-3 indicated an injector circuit problem.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will determine if the ignition control module is generating a reference pulse or the wiring is at fault or if the PCM is at fault. By touching and removing a test light connected to 12 volts to CKT 430, a reference pulse should be generated. If injector test light blinks, the PCM and wiring are OK.
2. This step tests for 12 volts to the injector. It will also determine if there is a short to voltage on the PCM side of the circuit.
3. This test checks for continuity to the PCM.

**Diagnostic Aids:** The PCM has integrated IC circuits that are fault protected, therefore, if a circuit has failed, the integrated IC may not be damaged and will keep the circuit open until the fault in the circuit has been corrected. When the fault has been corrected, reinstall PCM and check circuit. Replace PCM only if the circuit is still operative.

## CHART A-4

### INJECTOR CIRCUIT DIAGNOSIS

#### TBI

FROM CHART A-3  
INJECTOR TEST LIGHT  
DOES NOT FLASH.

NO LIGHT, ONE OR BOTH

1

- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
- IGNITION "ON."
- MOMENTARILY TOUCH HARNESS CONNECTOR TERMINAL CKT 430 WITH TEST LIGHT TO 12 VOLTS.

**IMPORTANT:** INJECTOR TEST LIGHT SHOULD FLASH EACH TIME THE TEST LIGHT IS REMOVED FROM CKT 430.

INJECTOR TEST LIGHT DOES NOT FLASH.

INJECTOR TEST LIGHT FLASHES.

FAULTY DI MODULE OR CONNECTION.

STEADY LIGHT, ONE OR BOTH

CHECK FOR SHORT TO GROUND INJECTOR CKT 467 OR 468.

IF CIRCUIT IS NOT SHORTED TO GROUND, CHECK RESISTANCE ACROSS INJECTOR TERMINALS. SHOULD BE OVER 1.3 OHMS.

OK

FAULTY PCM.

NOT OK

FAULTY INJECTOR AND PCM.

2

- CHECK FOR:
- OPEN OR GROUNDED CKT 430.
  - FAULTY CONNECTION AT PCM CONNECTOR TERMINAL "A4".
- IF "OK":
- REMOVE INJECTOR TEST LIGHT.
  - IGNITION "ON."
  - PROBE EACH INJECTOR HARNESS CONNECTOR TERMINAL WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON" ONE TERMINAL

3

- IGNITION "OFF."
- RECONNECT INJECTOR CONNECTOR.
- DISCONNECT A-B (RED 32 PIN) PCM CONNECTOR.
- IGNITION "ON."
- PROBE CONNECTOR TERMINALS "A9" AND "A16" WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON"

FAULTY PCM CONNECTION "A9" OR "A16" OR FAULTY PCM.

TEST LIGHT "OFF" BOTH TERMINALS ON EACH CONNECTOR.

REPAIR OPEN IGNITION CKT 481 OR 482.

TEST LIGHT "ON" BOTH TERMINALS ON EACH CONNECTOR.

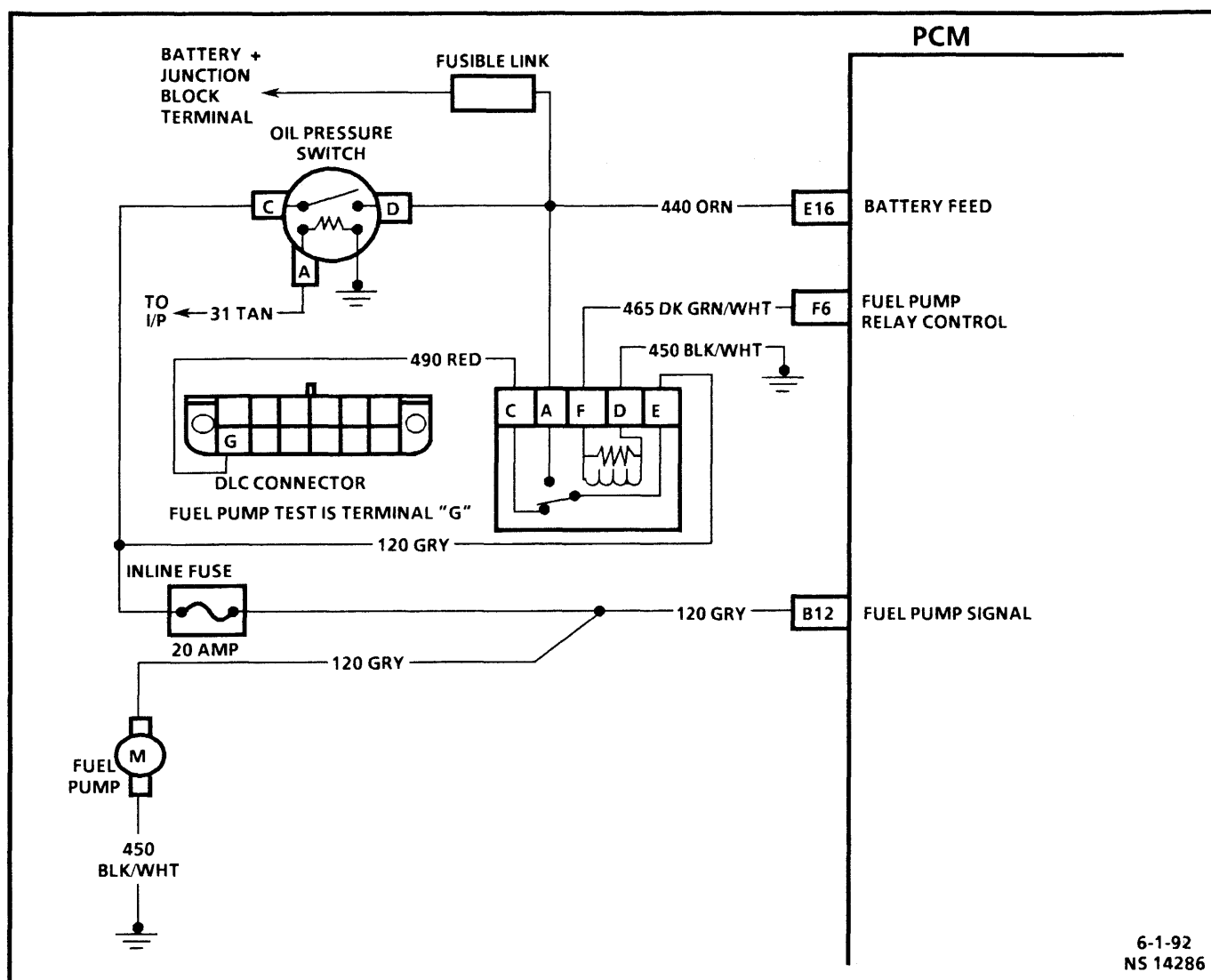
- REPAIR SHORT TO VOLTAGE IN CKT 467 OR 468 AND RETEST.
- REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

TEST LIGHT "OFF"

FAULTY CONNECTION OR OPEN CKT 467 OR 468.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

4-8-93  
NS 14603-6E

6-1-92  
NS 14286

## CHART A-5

### FUEL PUMP RELAY CIRCUIT DIAGNOSIS

#### Circuit Description:

When the ignition switch is turned "ON," the control module will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the PCM is receiving distributor reference pulses. If there are no reference pulses, the PCM will shut "OFF" the fuel pump within 2 seconds after ignition "ON" or engine stops.

On 4.3L, 5.0L and 5.7L applications the pump will deliver fuel to the TBI unit where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

On 7.4L applications the pump will deliver system pressure that is controlled to about 179-220 kPa (26 to 32 psi). Excess fuel is then returned to the fuel tank.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

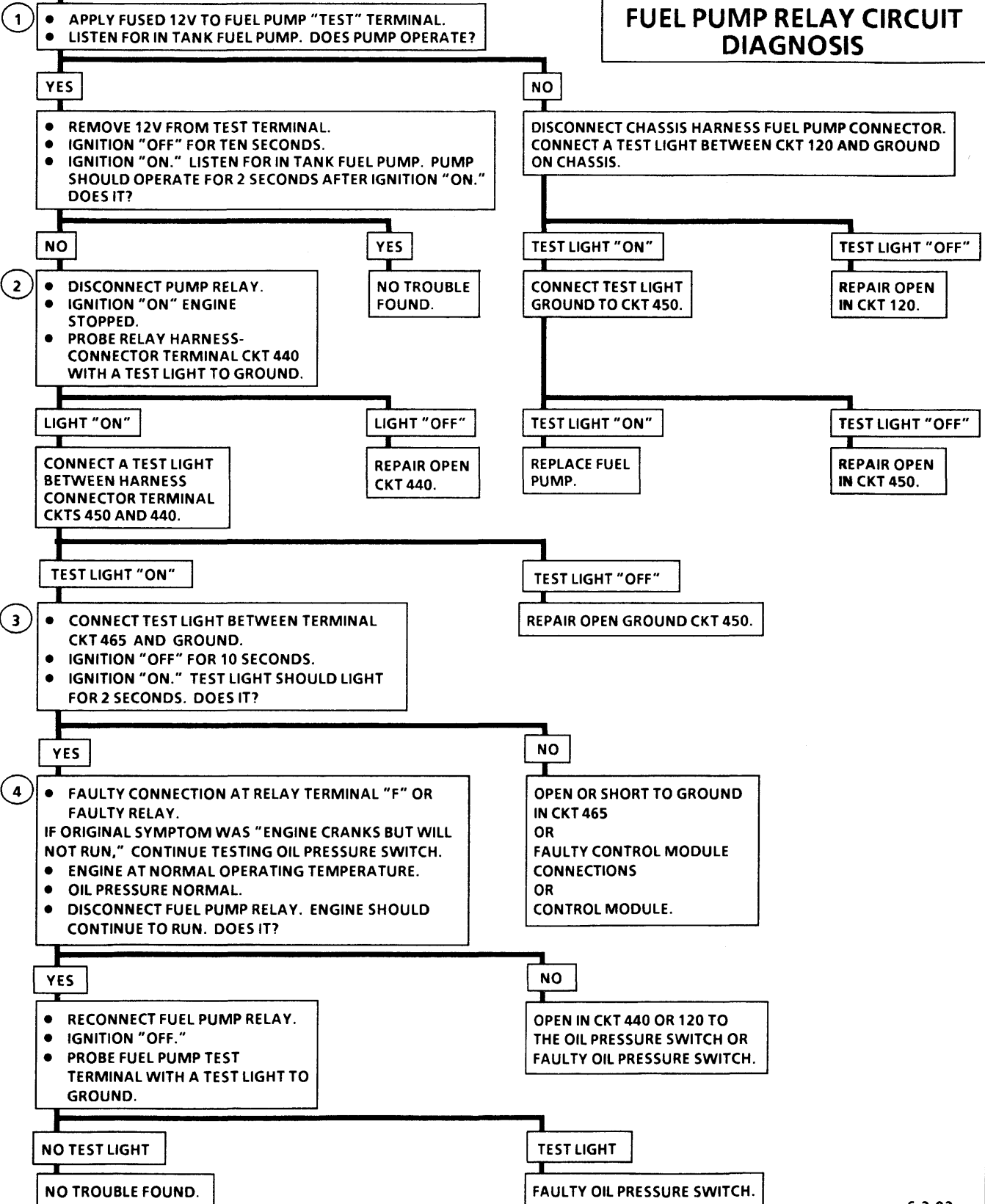
1. This procedure applies direct voltage to run the fuel pump. If the pump runs, it may be a fuel pump relay circuit problem which the following step will locate.
2. This step checks voltage from the battery and the ground circuit to the relay.
3. This test determines if there is voltage from the PCM terminal, "F6" to the relay connector.

4. This step completes the fuel pump relay circuit but if this diagnosis was used because the engine would not run then the oil pressure switch should also be diagnosed.

**Diagnostic Aids:** The PCM has integrated circuits that are fault protected, therefore, if a circuit has failed, the integrated circuits may not be damaged and will keep the circuit open until the fault has been corrected. When the fault has been corrected, reinstall PCM and check circuit. Replace PCM only if the circuit is still operative.

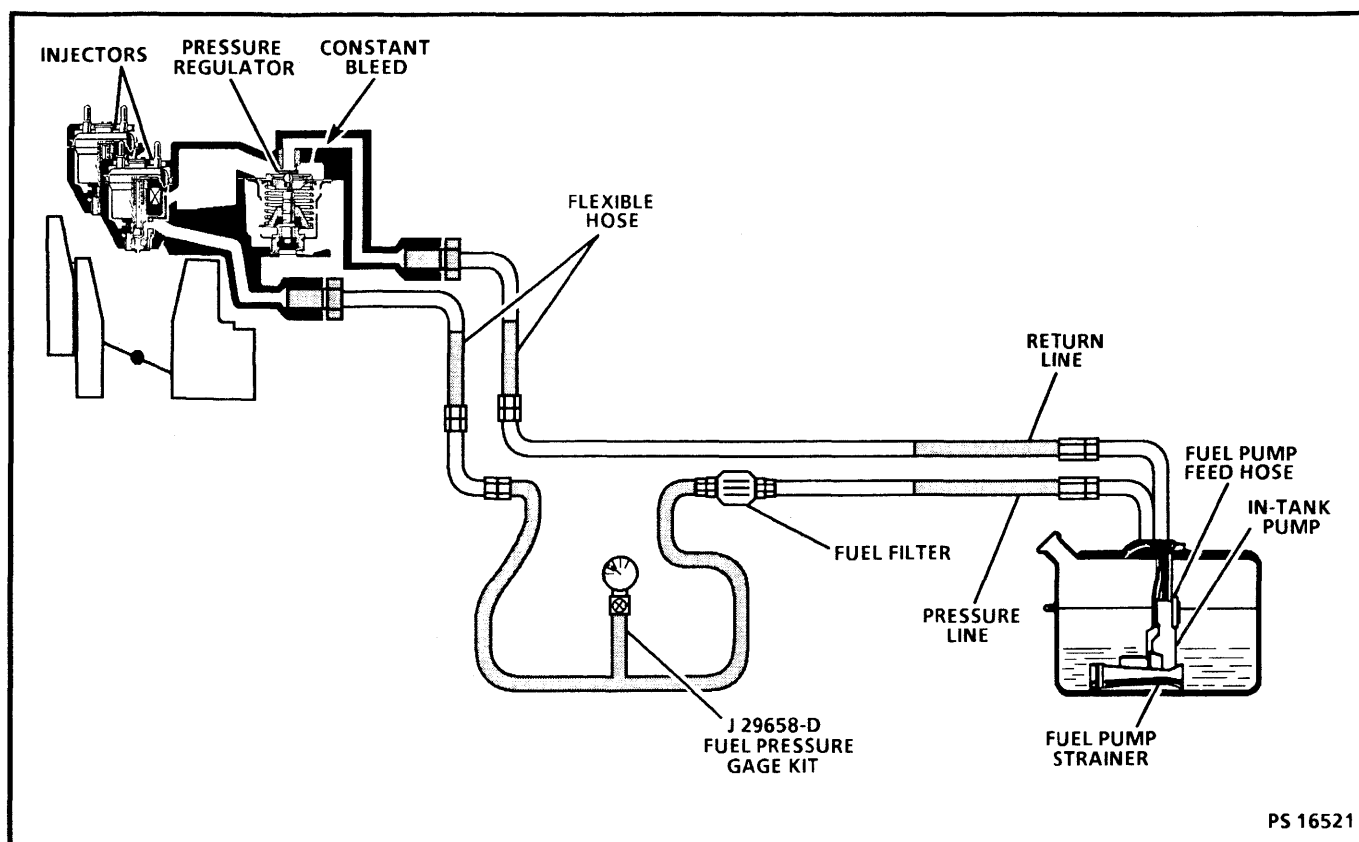
## CHART A-5 FUEL PUMP RELAY CIRCUIT DIAGNOSIS

FROM CHART A-3  
FUEL PUMP DOES NOT OPERATE



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-2-92  
NS 14287



PS 16521

## CHART A-6

### FUEL SYSTEM DIAGNOSIS TBI

#### Circuit Description:

When the fuel pump is running, fuel is delivered to the injector(s) and then to the regulator where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi) on 4.3L, 5.0L and 5.7L applications.

On 7.4L applications the pump will deliver system pressure that is controlled to about 179-220 kPa (26 to 32 psi). Excess fuel is then returned to the fuel tank.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Pressure, but less than minimum specifications falls into two areas:

- Regulated pressure but less than minimum specifications - Amount of fuel to injector OK but pressure is too low. System will run lean and may set DTC 44. Also, hard starting cold and poor overall performance.
- Restricted flow causing pressure drop - Normally, a vehicle with a fuel pressure of less than minimum specification at idle will not be driveable. However, if the pressure drop occurs only while driving, the engine could surge and stop when pressure is too low.
- If pressure builds slowly or vehicle is hard starting when cold, the fuel could be draining back into fuel tank. The check valve is diagnosed in this step.

2. Restricting the outlet side of the gage allows the pump to develop its maximum pressure (dead head pressure). With battery voltage applied to the pump "test" terminal, fuel pressure should rise above maximum specification as the pressure gage outlet hose is gradually pinched.
3. This test determines if the high fuel pressure is due to a restricted fuel return line or a throttle body pressure regulator problem.

**Diagnostic Aids:** Fuel system is under pressure. To avoid fuel spillage, refer to procedures in SECTION 4 for testing or making repairs requiring disassembly of fuel lines or fittings.

## CHART A-6

### FUEL SYSTEM DIAGNOSIS

#### TBI

FUEL PRESSURE SPECIFICATION ON 7.4 ENGINES FUEL PRESSURE SHOULD BE 179 TO 220 kPa (26 TO 32 PSI) ALL OTHERS ARE 62 TO 90 kPa (9 to 13 PSI).

- IGNITION "OFF" FOR TEN SECONDS.
- IGNITION "ON." LISTEN FOR IN-TANK FUEL PUMP. WITH IGNITION "ON," PUMP SHOULD RUN FOR 2 SECONDS.

YES

NO

- IGNITION "OFF."
- CHECK FOR ADEQUATE FUEL LEVEL IN-TANK.
- RELIEVE FUEL PRESSURE.
- INSTALL PRESSURE GAGE AS OUTLINED IN SECTION 4 (AN OUTLET OF FUEL FILTER).
- INSTALL FUSED 12 VOLTS TO FUEL PUMP "TEST" TERMINAL, NOTE PRESSURE WITHIN 2 SECONDS.

SEE FUEL PUMP RELAY CIRCUIT CHART A-5.

FUEL PRESSURE IS BELOW OR ABOVE PRESSURE SPECIFICATION WITHIN 2 SECONDS.

FUEL PRESSURE IS WITHIN PRESSURE SPECIFICATION

NO PROBLEM FOUND

LESS THAN PRESSURE SPECIFICATION

FUEL PRESSURE WITHIN SPEC. BUT, LONG CRANK TIMES BEFORE STARTING.

ABOVE PRESSURE SPECIFICATION

1

- INSTALL PRESSURE GAGE ON INLET SIDE OF FUEL FILTER AND REINSTALL FILTER OUTLET LINE.
- APPLY FUSED 12 VOLTS TO TEST TERMINAL. NOTE PRESSURE.

LESS THAN PRESSURE SPECIFICATION

ABOVE PRESSURE SPECIFICATION

2

- IGNITION "OFF."
- DISCONNECT INJECTOR.
- APPLY FUSED 12 VOLTS TO FUEL PUMP TEST CONNECTOR.
- GRADUALLY PINCH PRESSURE GAGE OUTLET HOSE AND NOTE PRESSURE.

REPLACE FILTER AND RECHECK.

ABOVE PRESSURE SPECIFICATION

REPLACE PRESSURE REGULATOR ASSY.

PRESSURE, BUT LESS THAN PRESSURE SPECIFICATION

CHECK FOR RESTRICTED FUEL LINE FROM FUEL TANK TO GAGE OR FAULTY IN-TANK

- FUEL PUMP.
- COUPLING HOSE.
- PUMP INLET FILTER.
- WRONG FUEL PUMP.

- IGNITION "OFF."
- APPLY FUSED 12 VOLTS TO TEST TERMINAL AND WAIT FOR PRESSURE TO BUILD.
- DISCONNECT JUMPER AND PINCH OFF FUEL RETURN LINE. SOME PRESSURE SHOULD HOLD FOR AT LEAST 30 SECONDS. DOES IT?

YES

NO

NO TROUBLE FOUND. REFER TO SECTION 2.

CHECK FOR LEAKING FUEL PUMP FEED HOSE.

IF OK

FUEL PUMP IS FAULTY. (LEAKING, CHECK VALVE INSIDE PUMP).

3

- DISCONNECT INJECTOR CONNECTOR.
- DISCONNECT FUEL RETURN LINE FLEXIBLE HOSE.
- ATTACH 5/16 I.D. FLEX HOSE TO THROTTLE BODY SIDE OF RETURN LINE. INSERT THE OTHER END IN AN APPROVED GASOLINE CONTAINER.
- NOTE FUEL PRESSURE WITHIN 2 SECONDS AFTER IGNITION "ON."

ABOVE PRESSURE SPECIFICATION

WITHIN SPECIFICATION

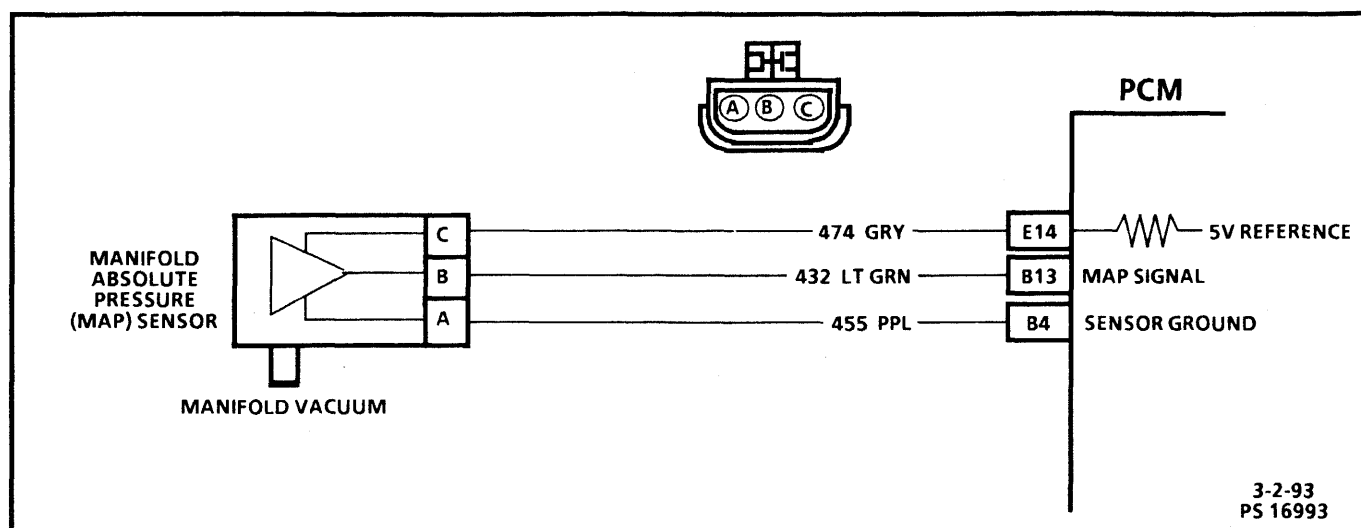
CHECK FOR RESTRICTED FUEL LINE BETWEEN GAGE AND RETURN LINE FLEXIBLE HOSE.

LOCATE AND CORRECT RESTRICTED FUEL RETURN LINE TO TANK.

IF LINE OK, REPLACE PRESSURE REGULATOR ASSY.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

5-10-93  
PS 17896



## MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and RPM changes; and converts these into a voltage output. The PCM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the manifold pressure. At lower pressure output voltage will be about 1 to 2 volts at idle. While at higher pressure or at Wide Open Throttle (WOT) output voltage will be about 4 to 4.8 volts. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to control fuel delivery and ignition timing.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.



### Important

- Be sure to use the same diagnostic test equipment for all measurements.

1. Checks MAP sensor output voltage to the PCM. This voltage, without engine running, represents a barometer reading to the PCM.

- When comparing Tech 1 scan readings to a known good vehicle, it is important to compare vehicles that use a MAP sensor having the same color insert or having the same "Hot Stamped" number. Refer to figures on facing page.

2. Applying 34 kPa (10" Hg) vacuum to the MAP sensor should cause the voltage to change. Subtract second reading from the first. Voltage value should be greater than 1.5 volts. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.

3. Check vacuum hose to sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

**NOTICE:** Make sure electrical connector remains securely fastened.

4. Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connection. Output changes greater than .1 volt indicate a bad connector or connection. If OK, replace sensor.

# MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

**NOTICE:** THIS CHART ONLY APPLIES TO MAP SENSORS HAVING GREEN OR BLACK COLOR KEY INSERT (SEE BELOW).

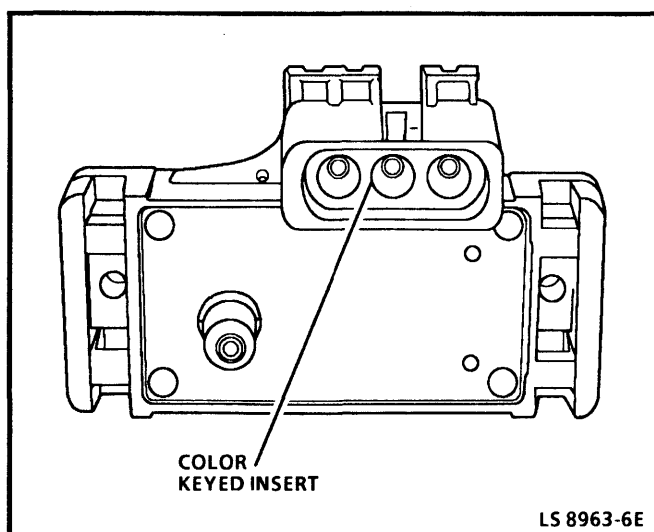
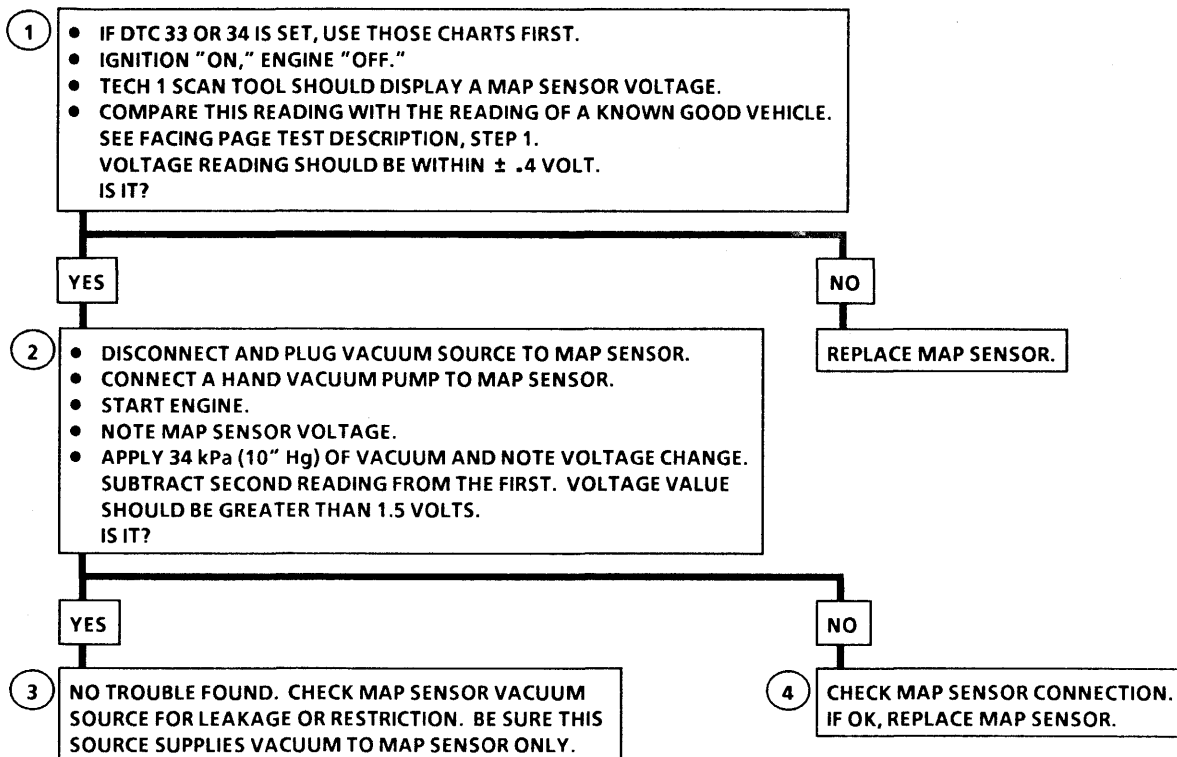


Figure 1 - Color Key Insert

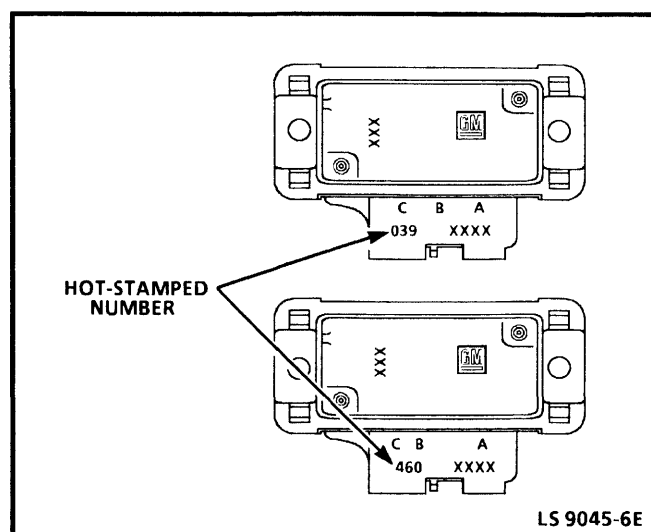
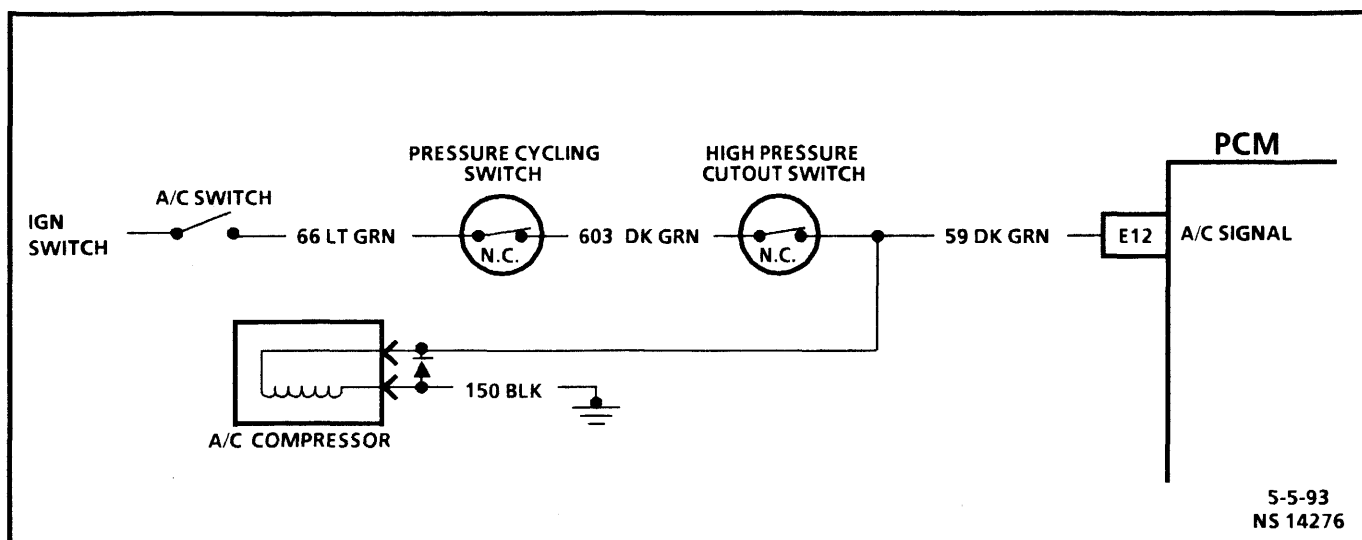


Figure 2 - Hot Stamped Number

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

5-1-92  
NS 13990





## A/C SIGNAL DIAGNOSIS

### Circuit and Test Description:

Turning "ON" the air conditioning supplies CKT 59 battery voltage to the A/C compressor clutch and to terminal "E12" of the PCM connector to increase and maintain idle speed.

The PCM does not control the A/C compressor clutch, therefore, if A/C does not function, refer to the A/C section of the service manual for diagnosis of the system.

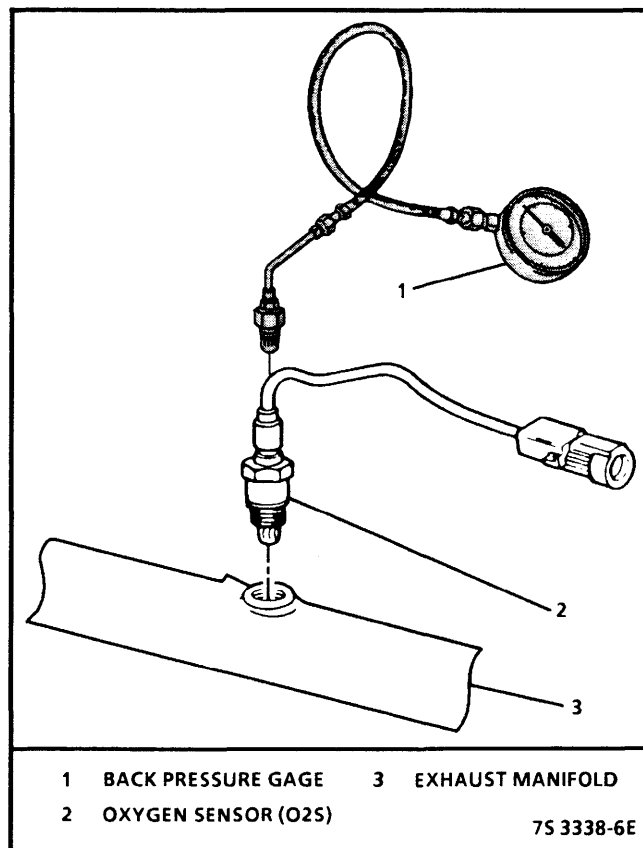
If A/C is operating properly and idle speed dips too low when the A/C compressor turns "ON" or flares too high when the A/C compressor turns "OFF," check for an open CKT 59 to the PCM. If circuits are OK, it is a faulty PCM connector terminal "E12" or PCM.

## RESTRICTED EXHAUST SYSTEM CHECK

Proper diagnosis for a restricted exhaust system is essential before any components are replaced.

### CHECK AT OXYGEN SENSOR (O2S):

1. Carefully remove O2S.
2. Install exhaust backpressure tester (J 35314-A) in place of O2S (see illustration).
3. After completing test described below, be sure to coat threads of O2S with anti-seize compound P/N 5613695 or equivalent prior to re-installation.



### DIAGNOSIS:

1. With the engine idling at normal operating temperature, observe the exhaust system backpressure reading on the gage. Reading should not exceed 8.6 kPa (1.25 psi).
2. Increase engine speed to 2000 RPM and observe gage. Reading should not exceed 20.7 kPa (3 psi).
3. If the backpressure at either speed exceeds specification, a restricted exhaust system is indicated.
4. Inspect the entire exhaust system for a collapsed pipe, heat distress, or possible internal muffler failure.
5. If there are no obvious reasons for the excessive backpressure, the catalytic converter is suspected to be restricted and should be replaced using current recommended procedures.

3-22-93  
NS 13992

Figure 3A-1 - Exhaust System Check

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION          | DTC NUMBER AND NAME                                                                            | SECTION |
|-------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------|---------|
| DTC 13 - Oxygen O2S Sensor Circuit (Open Circuit)                                         | 3A               | DTC 35 - IAC Error                                                                             | 3A      |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3A               | *DTC 37 - Brake Switch Stuck "ON"                                                              | 10A/10B |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3A               | *DTC 38 - Brake Switch Stuck "OFF"                                                             | 10A/10B |
| DTC 16 - VSS Buffer Fault                                                                 | 3A               | *DTC 39 - Torque Converter Clutch (TCC) Stuck OFF                                              | 10/B    |
| DTC 21 - Throttle Position (TP) Sensor Circuit High (Signal Voltage High)                 | 3A               | DTC 42 - Ignition Control (IC) Error                                                           | 3A      |
| DTC 22 - Throttle Position (TP) Sensor Circuit Low (Signal Voltage Low)                   | 3A               | DTC 43 - Knock Sensor (KS) Circuit                                                             | 3A      |
| *DTC 24 - Vehicle Speed Sensor (VSS) Circuit Low (Trans Output Speed Signal)              | 10A/10B<br>3A/3B | DTC 44 - Lean Exhaust                                                                          | 3A      |
| *DTC 28 - Transmission Range (TR) Pressure Switch Assembly                                | 10A/10B          | DTC 45 - Rich Exhaust                                                                          | 3A      |
| DTC 32 - Exhaust Gas Recirculation (EGR) Error                                            | 3A               | DTC 51 - PROM (MEM-CAL) Error                                                                  | 3A      |
| DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit High (Low Vacuum)                | 3A               | *DTC 52 - System Voltage High Long                                                             | 10A/10B |
| DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit Low (High Vacuum)                | 3A               | *DTC 53 - System Voltage High                                                                  | 10A/10B |
|                                                                                           |                  | DTC 54 - Fuel Pump Relay Circuit (Low Voltage)                                                 | 3A      |
|                                                                                           |                  | DTC 55 - Faulty PCM                                                                            | 3A      |
|                                                                                           |                  | *DTC 58 - Transmission Fluid Temperature (TFT) Sensor Circuit Low (High Temperature Indicated) | 10A/10B |
|                                                                                           |                  | *DTC 59 - Transmission Fluid Temperature (TFT) Sensor Circuit High (Low Temperature Indicated) | 10A/10B |

Figure 3A-2 - Diagnostic Trouble Code Identification (1 of 2)

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go out and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

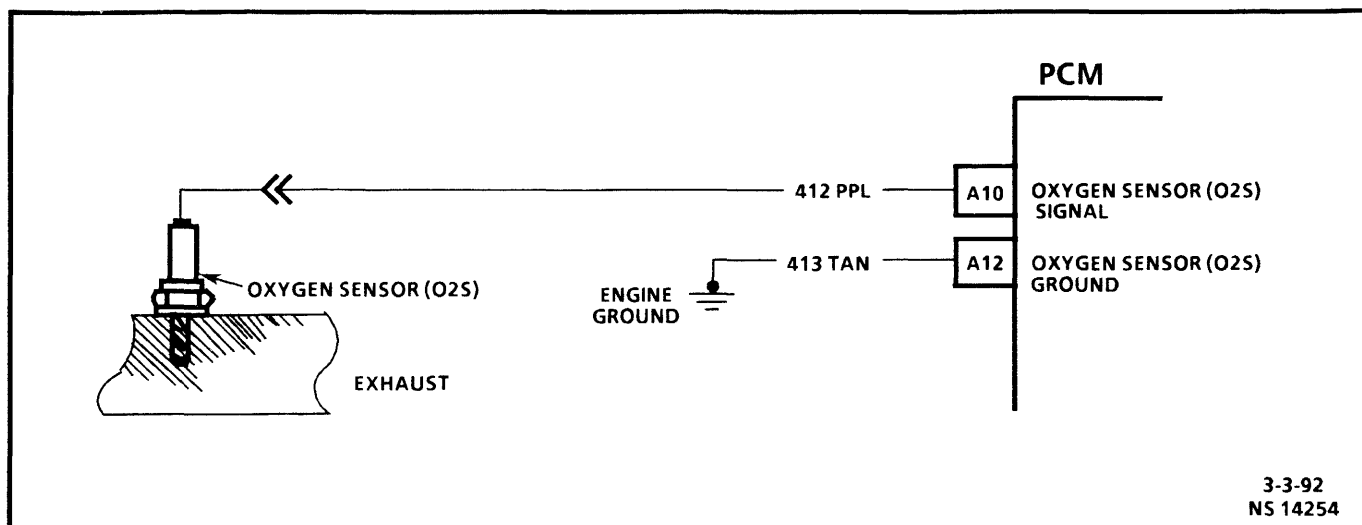
### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical DTC first, when diagnosing some engine DTCs other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                  | SECTION | DTC NUMBER AND NAME             | SECTION |
|--------------------------------------------------------------------------------------|---------|---------------------------------|---------|
| *DTC 66 - 3-2 Control Solenoid Circuit Fault                                         | 10A     | *DTC 85 - Undefined Ratio Error | 10B     |
| *DTC 67 Torque Converter Clutch (TCC) Solenoid Circuit Fault                         | 10A     | *DTC 86 - Low Ratio Error       | 10B     |
| *DTC 68 - Trans Component Slipping                                                   | 10B     | *DTC 87 - High Ratio Error      | 10B     |
| *DTC 69 - Torque Converter Clutch (TCC) Stuck "ON"                                   | 10A/10B |                                 |         |
| *DTC 72 - Vehicle Speed Sensor (VSS) Circuit Loss (Trans Output Speed Signal)        | 10A/10B |                                 |         |
| *DTC 73 - Pressure Control Solenoid (PCS) Fault (Current Error)                      | 10A/10B |                                 |         |
| *DTC 74 - Transmission Input Speed (TIS) Sensor Circuit                              | 10B     |                                 |         |
| *DTC 75 - System Voltage Low                                                         | 10A/10B |                                 |         |
| *DTC 79 - Transmission Fluid Over temp                                               | 10A/10B |                                 |         |
| *DTC 81 - 2-3 Shift Solenoid Circuit Fault                                           | 10A/10B |                                 |         |
| *DTC 82 - 1-2 Shift Solenoid Circuit Fault                                           | 10A/10B |                                 |         |
| *DTC 83 - Torque Converter Clutch (TCC) Pulse Width Modulated (PWM) Solenoid Circuit | 10B     |                                 |         |

5-10-93  
PS 17022

Figure 3A-3 - Diagnostic Trouble Code Identification (2 of 2)



## DTC 13

### OXYGEN SENSOR (O2S) CIRCUIT (OPEN CIRCUIT)

#### Circuit Description:

The PCM applies a bias voltage of approximately 450 millivolts (350-550 mV is normal bias voltage) between terminals "A10" and "A12". The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, and down to about .010 volt if exhaust is lean. DTC 13 is set when the voltage does not vary on CKT 412 within a predetermined amount of time.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit, or a cold sensor causes "Open Loop" operation.

#### DTC 13 Will Set When:

- Engine has been running longer than 2 minutes.
- Engine Coolant Temperature (ECT) greater than 70°C (158°F).
- Throttle Position (TP) signal has been above 5%.
- O2S signal voltage steady between .35 and .55 volt.
- All conditions must be met for about 60 seconds.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate and system will go into "Open Loop."

**DTC 13 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

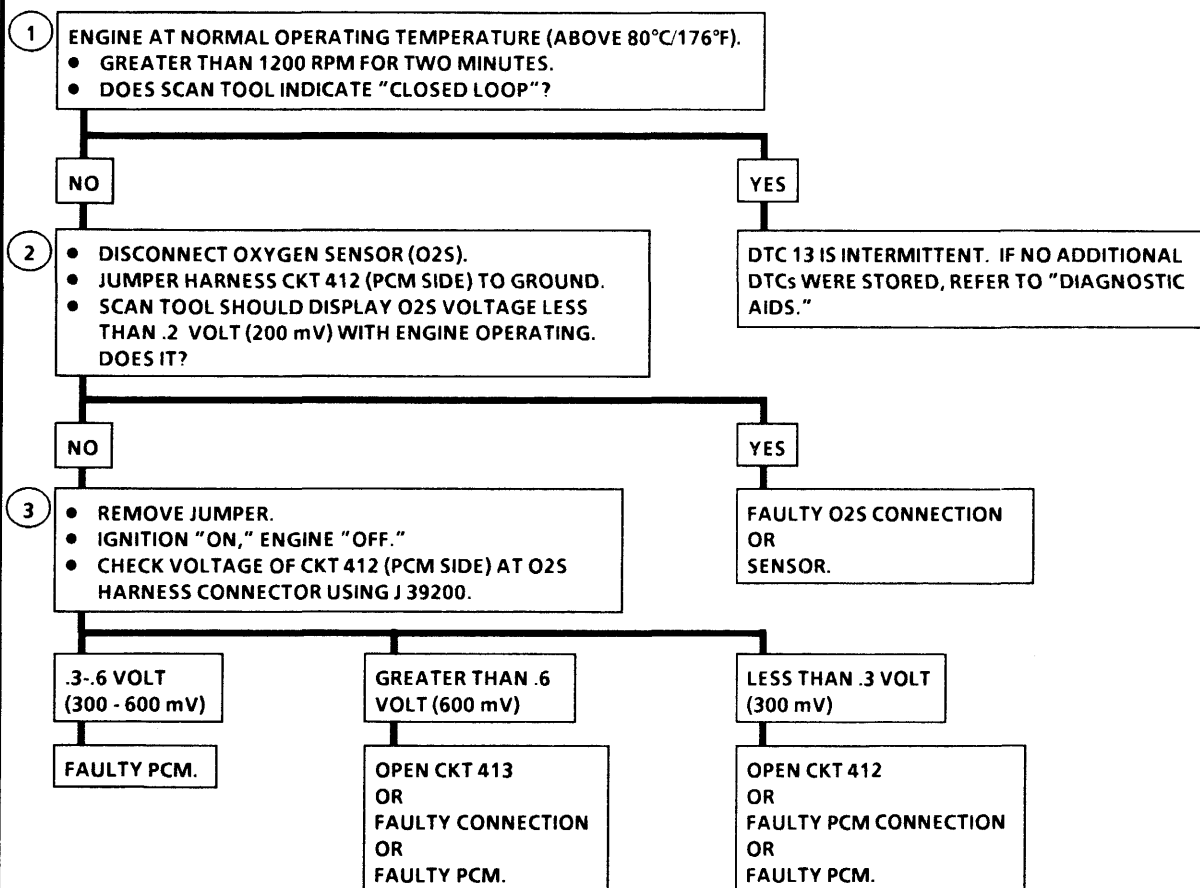
1. This test verifies operating temperature and "Closed Loop" conditions.
2. This will determine if the sensor is at fault.
3. For this test use J 39200. This test checks the continuity of CKT 412 and CKT 413. If CKT 413 is open, the voltage on CKT 412 will be over .6 volt (600 mV).

**Diagnostic Aids:** Normal Tech 1 scan tool voltage varies between 100 mV to 1000 mV (.1 and 1.0 volt), while in "Closed Loop." DTC 13 sets in one minute if voltage remains between .35 and .55 volt, however the system will go "Open Loop" in about 15 seconds.

Refer to "Intermittents" in SECTION 2.

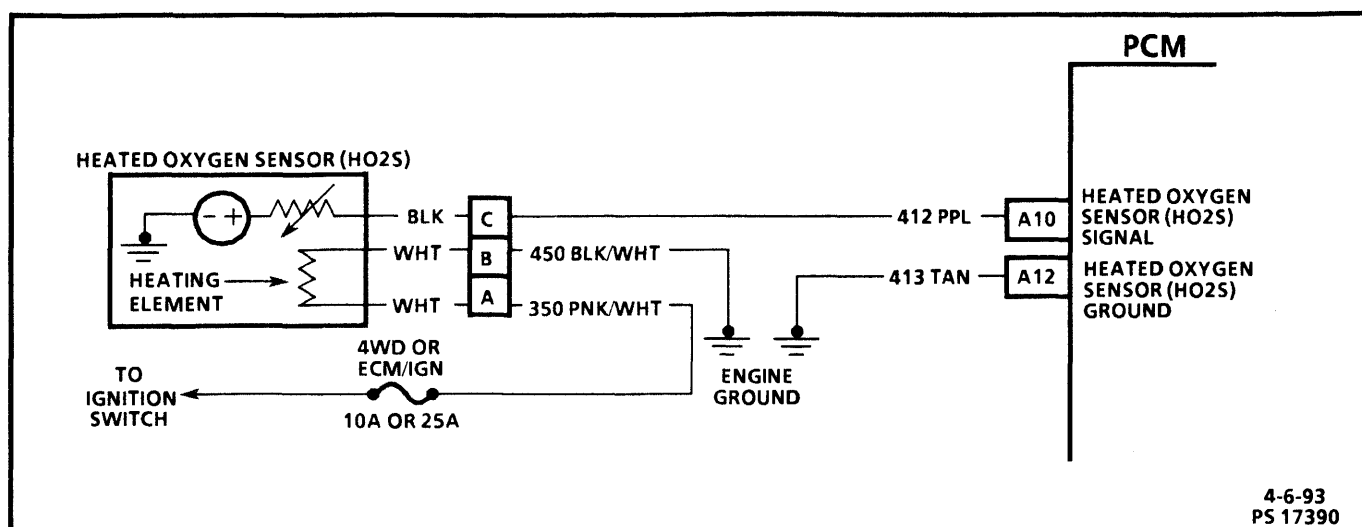
## DTC 13

### OXYGEN SENSOR (O2S) CIRCUIT (OPEN CIRCUIT)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-30-92  
MS 9966-6E



## DTC 13

### HEATED OXYGEN SENSOR (HO2S) CIRCUIT (OPEN CIRCUIT)

#### Circuit Description:

The PCM applies a bias voltage of approximately 450 millivolts (350-550 mV is normal bias voltage) between terminals "A10" and "A12". The Heated Oxygen Sensor (HO2S) varies the voltage within a range of about 1 volt if the exhaust is rich, and down to about .010 volt if exhaust is lean. DTC 13 is set when the voltage does not vary on CKT 412 within a predetermined amount of time.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit, or a cold sensor causes "Open Loop" operation.

#### DTC 13 Will Set When:

- Engine has been running longer than 2 minutes.
- Engine Coolant Temperature (ECT) greater than 70°C (158°F).
- Throttle Position (TP) signal has been above 5%.
- HO2S signal voltage steady between .35 and .55 volt.
- All conditions must be met for about 60 seconds.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate and system will go into "Open Loop."

**DTC 13 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test verifies operating temperature and "Closed Loop" conditions.
2. This test checks the oxygen sensor's heating element. The heating element resistance should be 3.5 ohms at 20°C (68°F) or 14 ohms at 350°C (662°F).
3. This will determine if the sensor is at fault.
4. For this test use J 39300. This test checks the continuity of CKT 412 and CKT 413. If CKT 413 is open, the voltage on CKT 412 will be over .6 volt (600 mV).
5. If the fuse was open, check the wiring diagram for complete wiring circuit.

**Diagnostic Aids:** If the oxygen sensor heaters are not operating properly, system may go into "Open Loop" after extended idle.

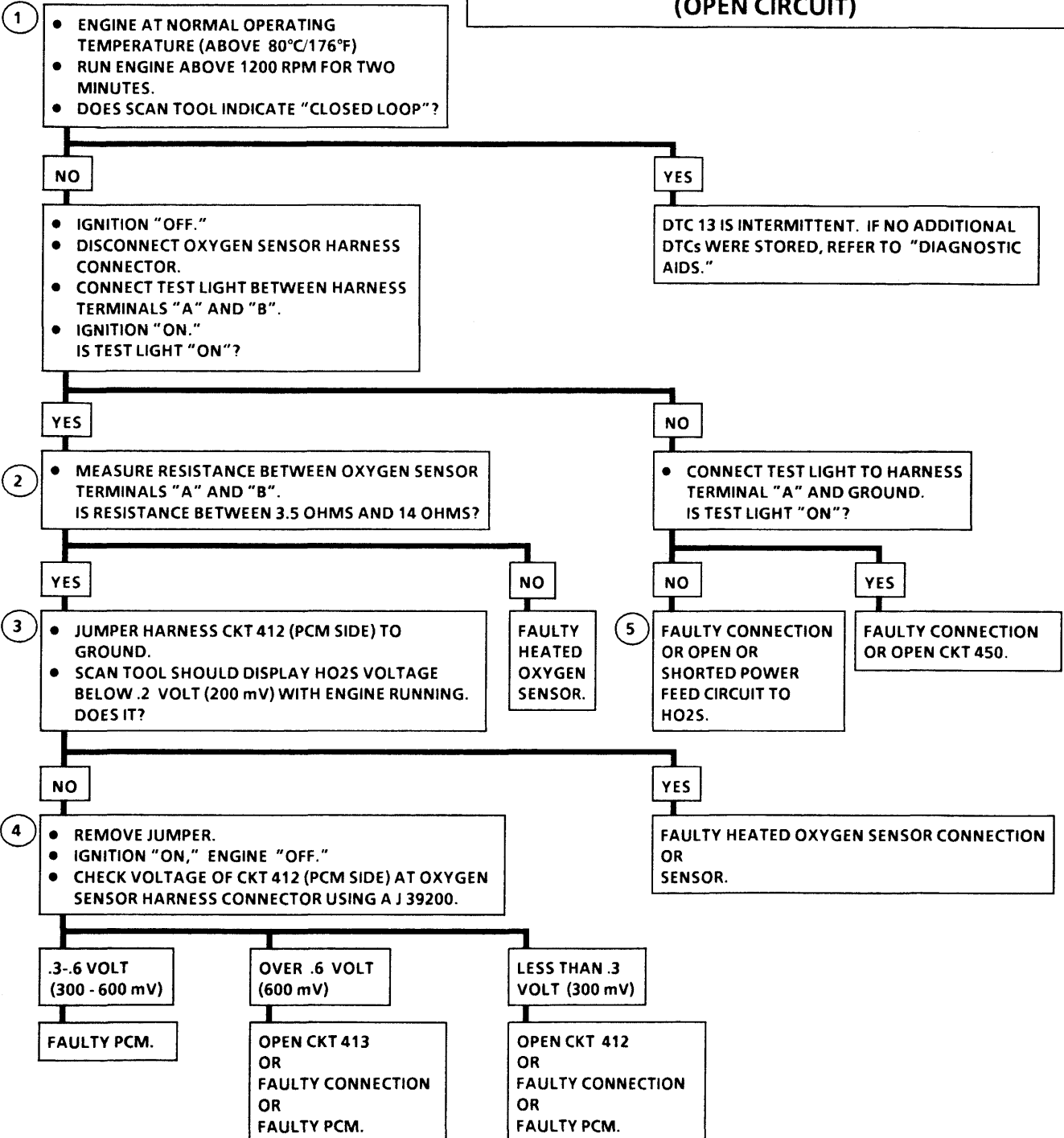
Normal Tech 1 scan tool voltage varies between 100 mV to 1000 mV (.1 and 1.0 volt), while in "Closed Loop." DTC 13 sets in one minute if voltage remains between .35 and .55 volt, however the system will go "Open Loop" in about 15 seconds.

Refer to "Intermittents" in SECTION 2.

An oxygen supply inside the HO2S is necessary for proper HO2S operation. This supply of oxygen is supplied through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination that could prevent reference signal from reaching the HO2S.

## DTC 13

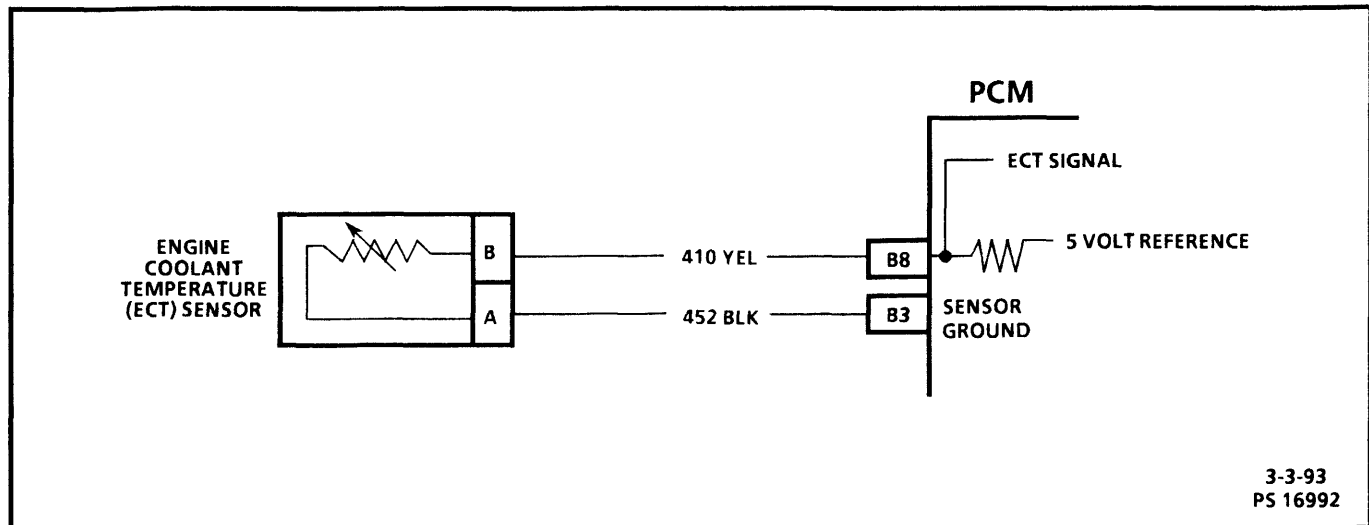
### HEATED OXYGEN SENSOR (HO2S) CIRCUIT (OPEN CIRCUIT)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-1-93  
MS 11849





## DTC 14

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the PCM will see a high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

**DTC 14 Will Set When:** Signal voltage indicates an engine coolant temperature above 135°C (270°F) for 1 second.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate, and transmission TCC will apply early.

**DTC 14 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

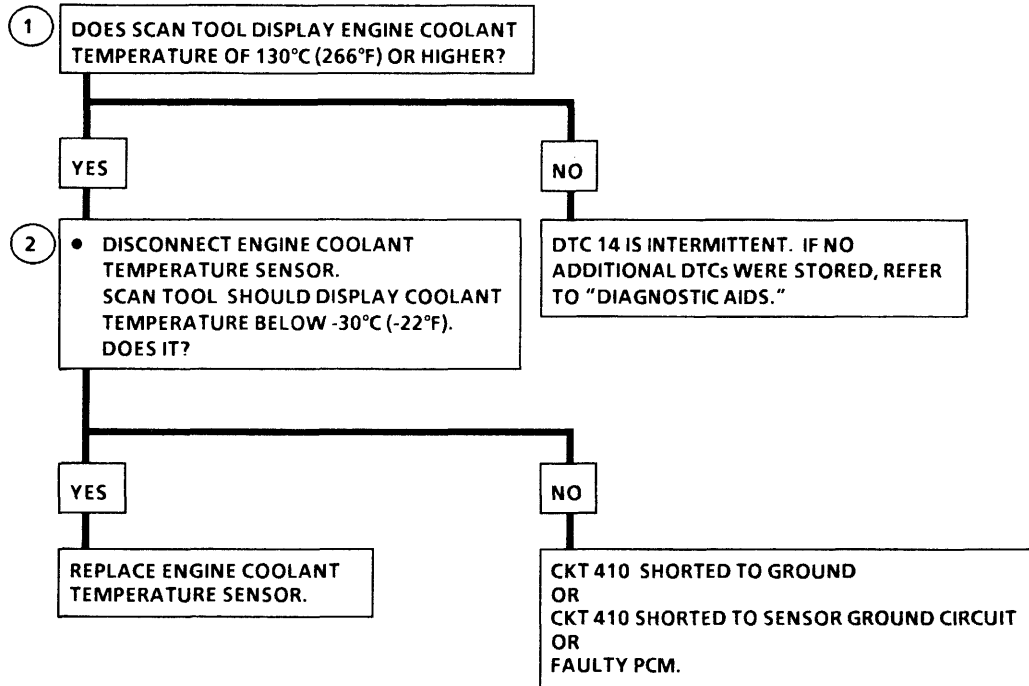
1. This test verifies coolant temperature display.
2. This test will determine if CKT 410 is shorted to ground which will cause the condition for DTC 14.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 410.

Tech 1 scan tool displays engine temperature in degrees centigrade and fahrenheit. After engine is started, the temperature should rise steadily to about 90°C (194°F) then stabilize when thermostat opens.

Refer to "Intermittents" in SECTION 2.

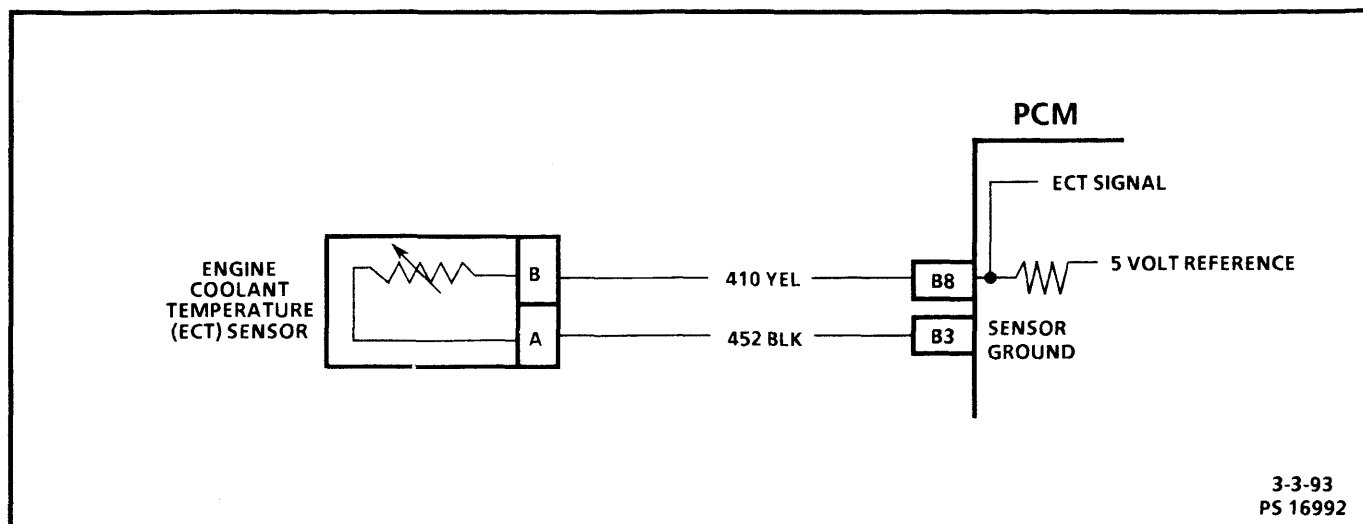
The "Temperature to Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

**DTC 14****ENGINE COOLANT TEMPERATURE  
(ECT) SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| ENGINE COOLANT SENSOR                              |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-30-92  
MS 9972-6E



## DTC 15

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the PCM will see a high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

**DTC 15 Will Set When:** Signal voltage indicates an engine coolant temperature less than -33°C (-27°F) for 2 seconds.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate, and transmission TCC will apply early.

**DTC 15 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

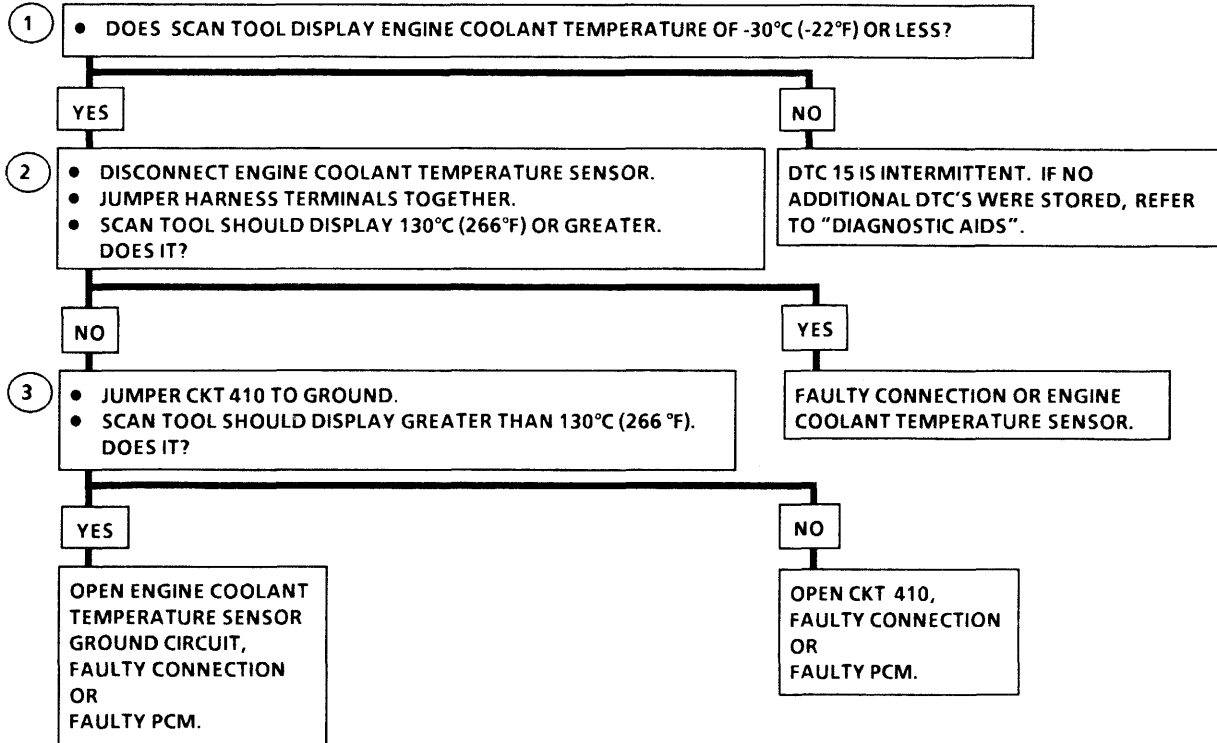
1. This test verifies coolant temperature display.
2. This test simulates a DTC 14. If the PCM recognizes the low signal voltage (high temperature), and the Tech 1 scan tool reads 130°C or above, the PCM and wiring are OK.
3. This test will determine if CKT 410 is open. There should be 5 volts present at sensor connector when measured with a J 39200.

**Diagnostic Aids:** A Tech 1 scan tool reads engine temperature in degrees centigrade and fahrenheit. After engine is started, the temperature should rise steadily to about 90°C (194°F) then stabilize when thermostat opens.

A faulty connection, or an open in CKT 410 or 452 will result in a DTC 15.

Refer to "Intermittents" in SECTION 2.

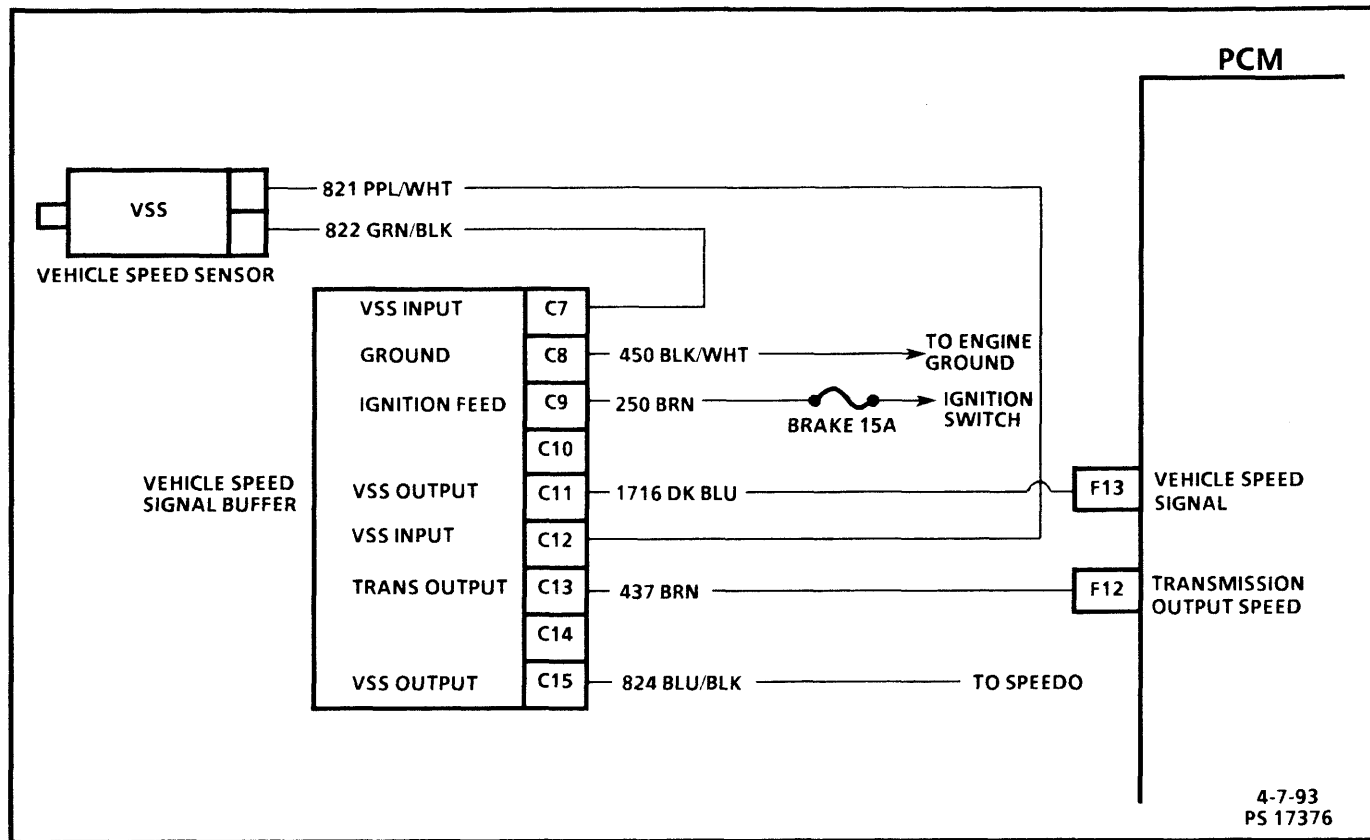
The "Temperature To Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

**DTC 15****ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| ENGINE COOLANT SENSOR                              |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

5-1-92  
MS 9965-6E



## DTC 16

### VSS BUFFER FAULT (4L60E TRANSMISSION ONLY)

#### Circuit Description:

This DTC concerns a loss of 2002 pulses per mile to the PCM terminal "F13". This may be caused by loss of power to the VSS buffer or an open or grounded signal line.

#### DTC 16 Will Set When:

- Less than 2 mph.
- 1000 to 4400 RPM.
- Throttle angle less than 2%.
- ECT greater than 60°C.
- MAP less than or equal to 28 kPa.
- CKT 1716 open or grounded.
- All conditions must be met for 3 seconds.

**Action Taken (PCM will default to):** None.

**DTC 16 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

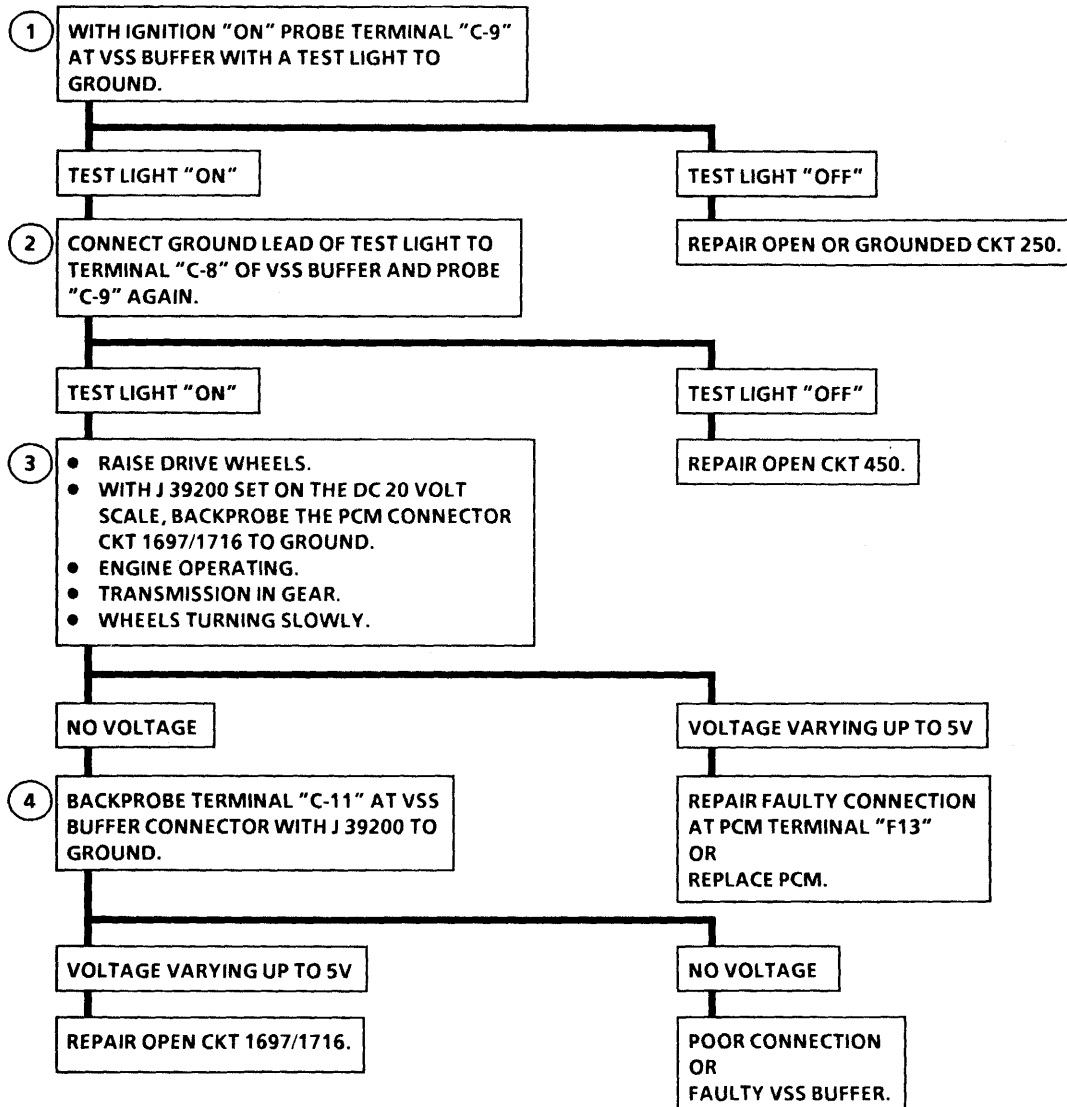
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This tests for B+ at VSS buffer.
2. This tests for proper ground path for vehicle speed sensor signal buffer.
3. This tests for vehicle speed sensor signal buffer signal to PCM.
4. This test checks for faulty connections and a faulty VSS buffer.

**Diagnostic Aids:** Check connections at VSS buffer and PCM. Refer to SECTION 10 if DTC 24 or DTC 72 is also set.

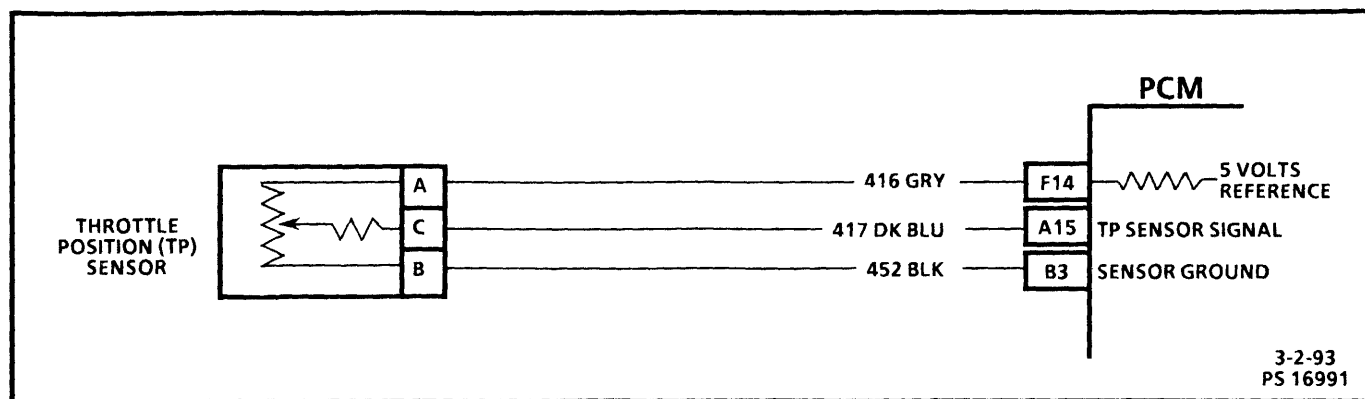
**DTC 16****VSS BUFFER FAULT  
(4L60E TRANSMISSION ONLY)**

**NOTE:** VERIFY OPERATION OF SPEEDOMETER.  
REPAIR SPEEDO IF INOP. IF OK CONTINUE WITH  
DIAGNOSIS.



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-5-93  
PS 17375



## DTC 21

### THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH)

#### Circuit Description:

The Throttle Position (TP) sensor provides a voltage signal that changes relative to the throttle blade angle. Signal voltage will vary from about .5 volt at idle to about 4.0 volts at Wide Open Throttle (WOT).

The TP signal is one of the most important inputs used by the PCM for fuel control and for most of the PCM control outputs.

#### DTC 21 Will Set When:

- Engine running.
- TP sensor signal voltage is greater than or equal to 4.9 volts at Wide Open Throttle (WOT).
- All conditions met for 4 seconds.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate, transmission TCC will not apply, high transmission line pressure, fixed shift points, hard shifts and no fourth gear in hot mode.

**DTC 21 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

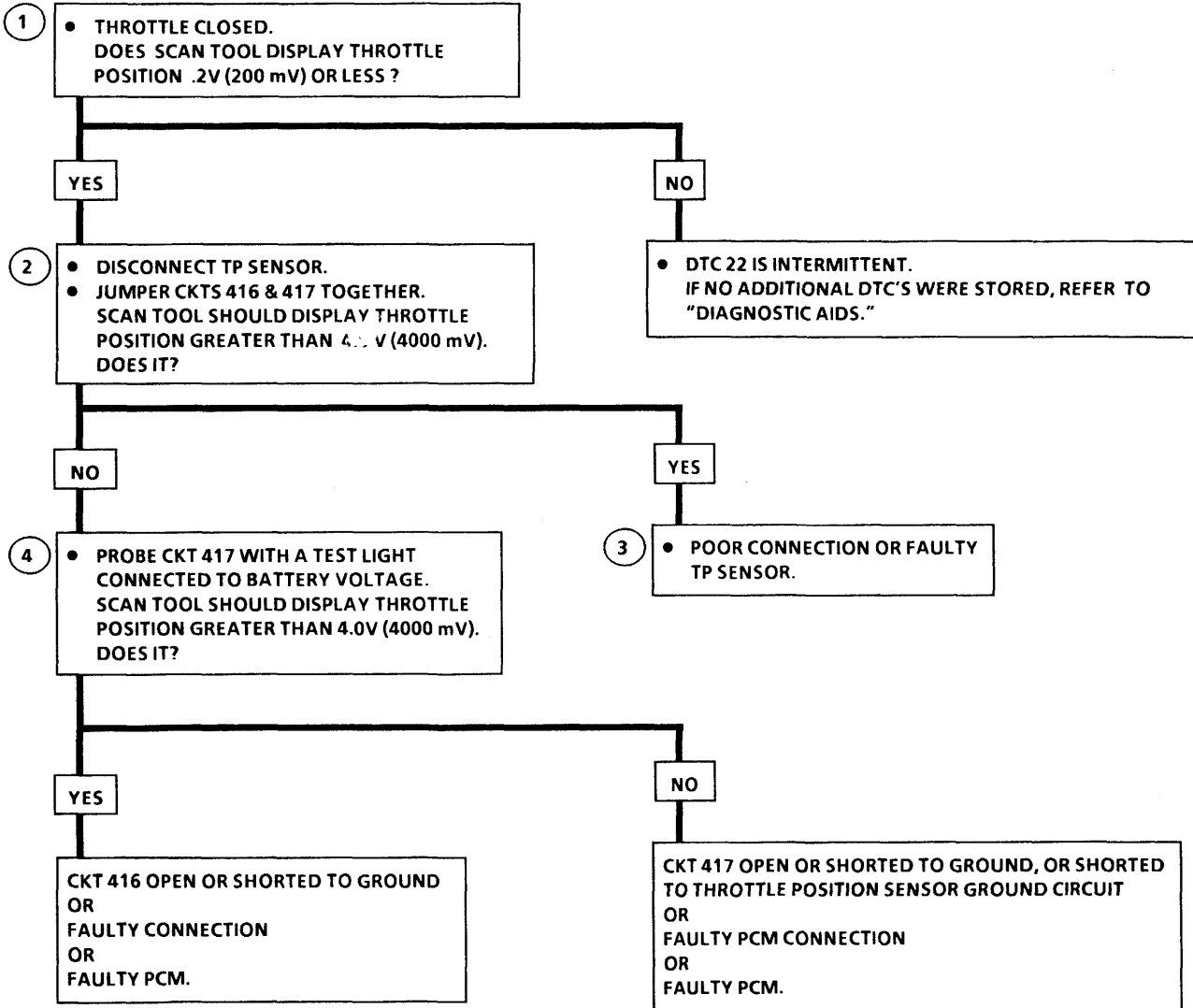
1. Verifies TP signal display.
2. With the TP sensor disconnected, the TP signal voltage should go low if the PCM and wiring are OK.
3. Probing CKT 452 with a test light checks the 5 volt return circuit.

**Diagnostic Aids:** A Tech 1 scan tool reads throttle position in volts and should read about .5 to 1.25 volts with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT.

Also some Tech 1 scan tools will read throttle angle .0% = closed throttle 100% = WOT.

Refer to SECTION 2 for "Intermittents."

Scan TP signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.0 volts (4000 mV) when throttle is held at Wide Open Throttle (WOT) position.

**DTC 22****THROTTLE POSITION (TP) SENSOR CIRCUIT LOW  
(SIGNAL VOLTAGE LOW)**

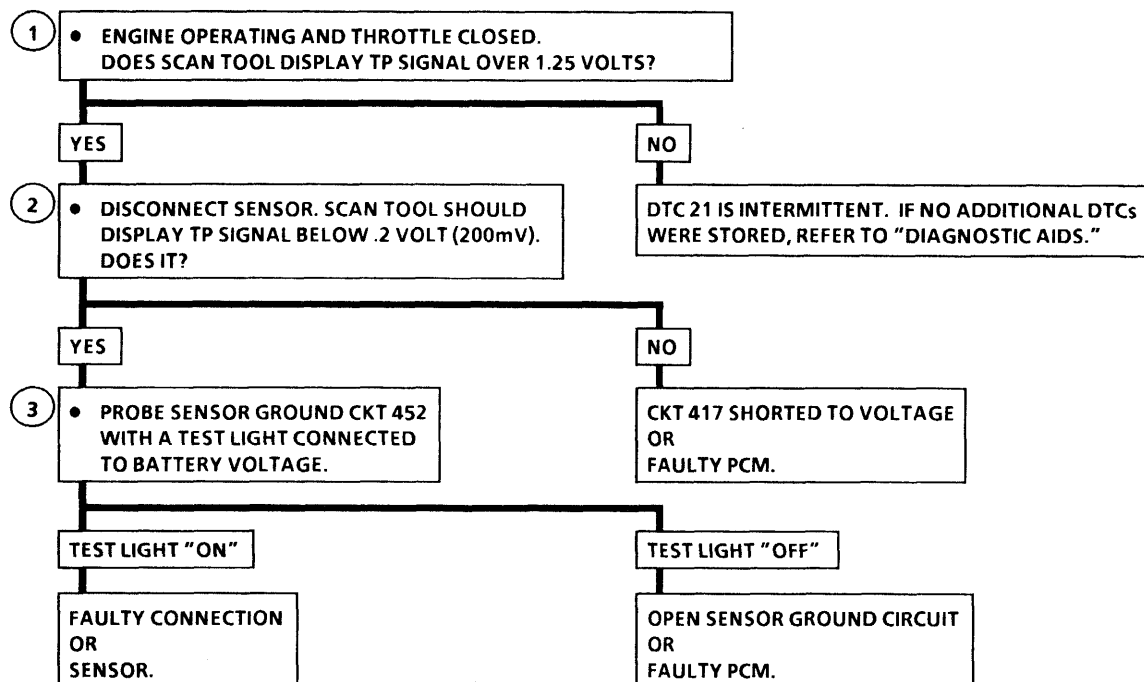
"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-30-92  
MS 9963-06E



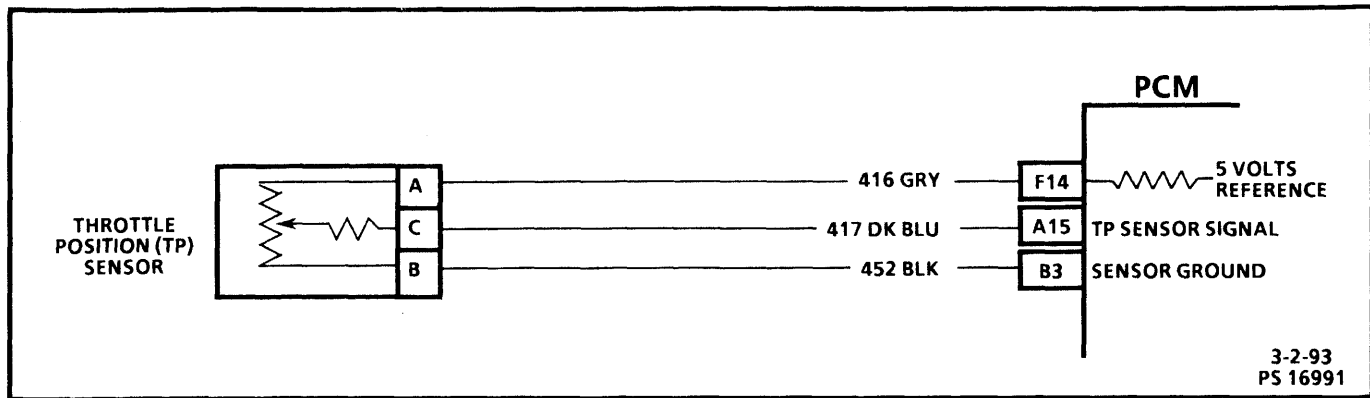
## DTC 21

### THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-2-93  
MS 9964-6E



## DTC 22

### THROTTLE POSITION (TP) SENSOR CIRCUIT LOW (SIGNAL VOLTAGE LOW)

#### Circuit Description:

The Throttle Position (TP) sensor provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to about 4.0 volts at Wide Open Throttle (WOT).

The TP signal is one of the most important inputs used by the PCM for fuel control and for most of the PCM control outputs.

#### DTC 22 Will Set When:

- Engine running.
- TP signal voltage is less than 2 volts for 4 seconds.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate, transmission TCC will not apply, high transmission line pressure, harsh shifts, fixed shift points and no fourth gear in hot mode.

**DTC 22 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

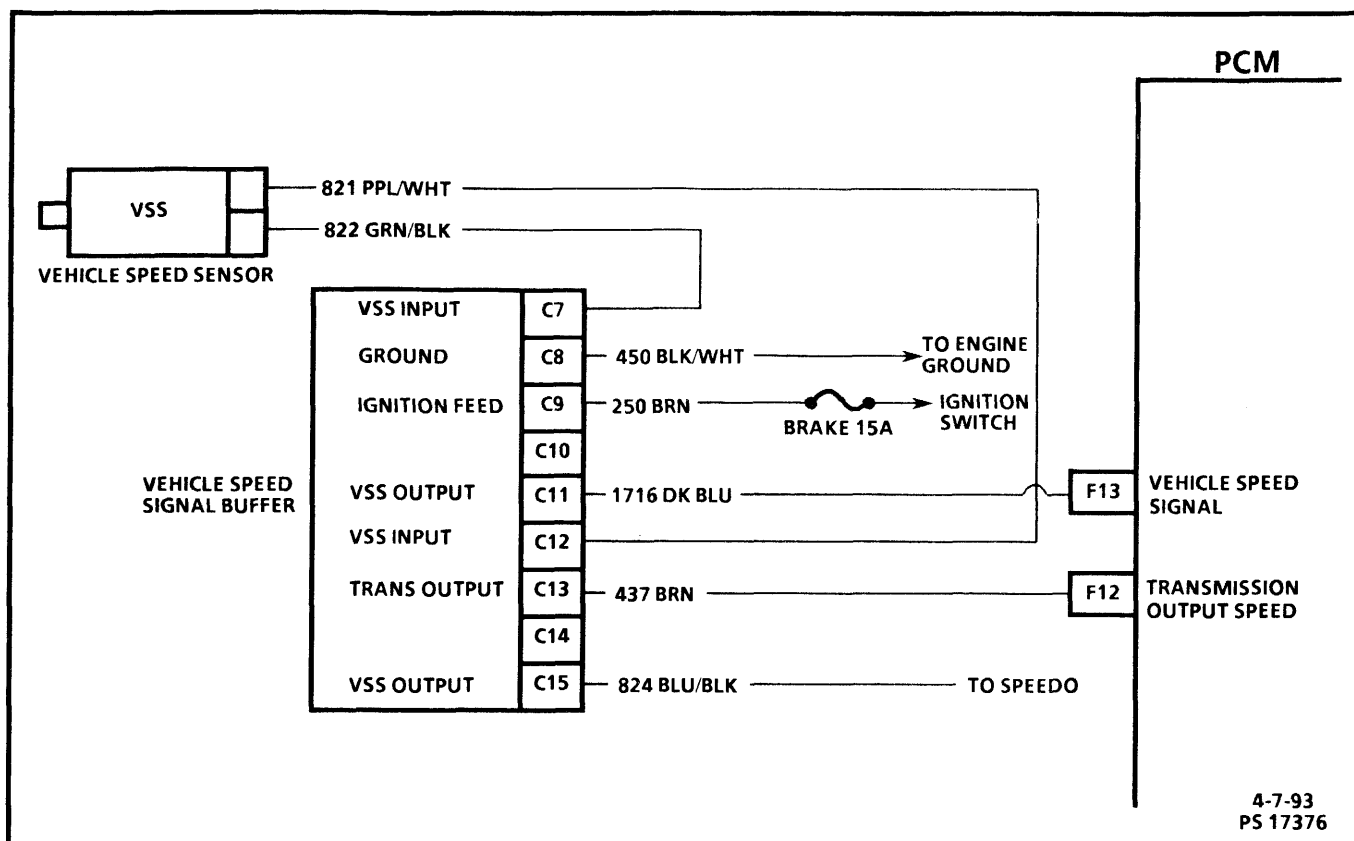
1. Verifies TP signal display.
2. Simulates DTC 21: (high voltage) If the PCM recognizes the high signal voltage the PCM and wiring are OK.
3. This step determines a poor connection or faulty TP sensor.
4. This simulates a high signal voltage to check for an open in CKT 417.

**Diagnostic Aids:** A Tech 1 scan tool reads throttle position in volts and should read about .5 to 1.25 volts with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT.

An open or short to ground in CKT 416 or 417 will result in a DTC 22.

Refer to SECTION 2 for "Intermittents."

Scan TP sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.0 volts (4000 mV) when throttle is held at Wide Open Throttle (WOT) position.

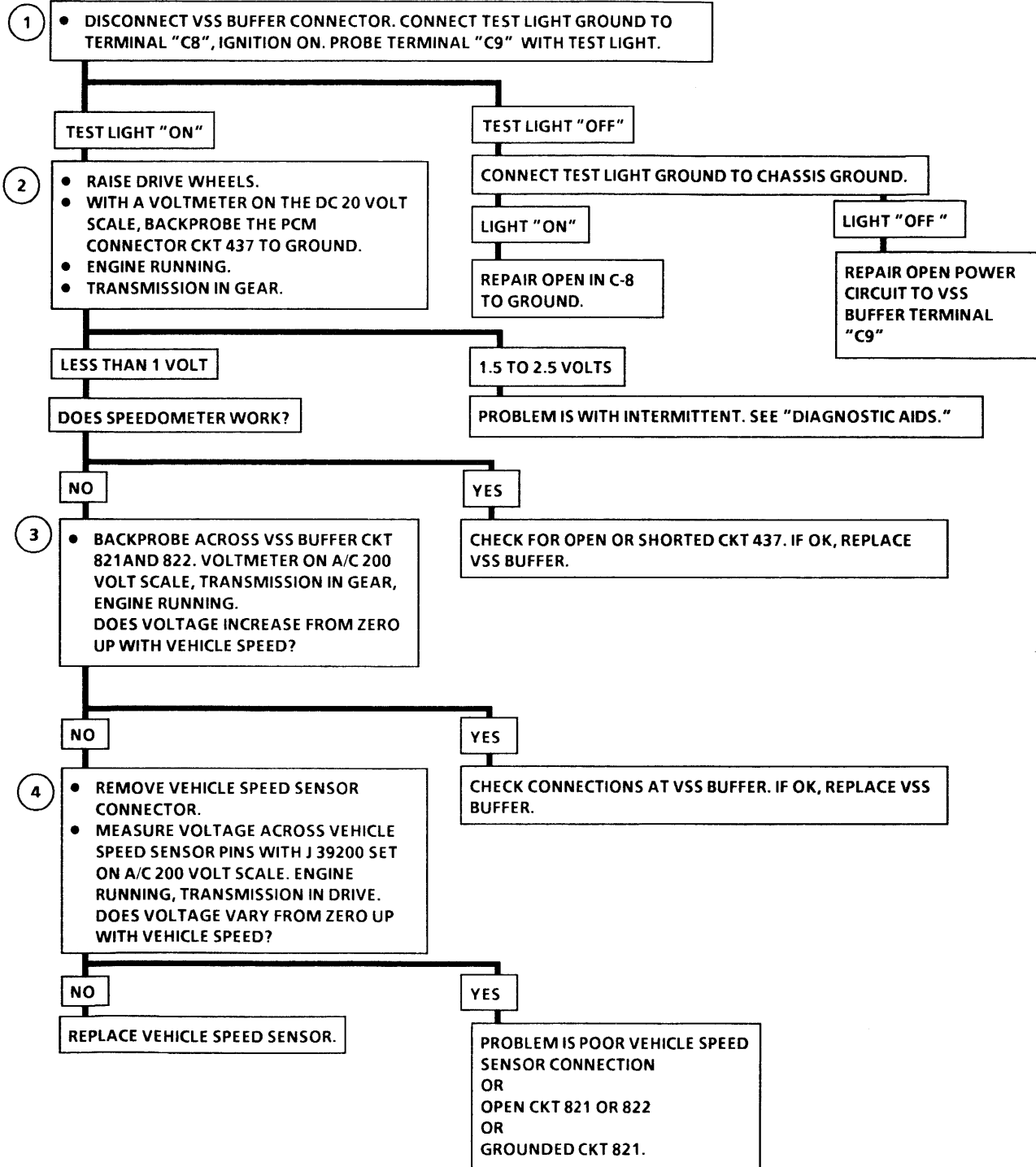
**DTC 24****VEHICLE SPEED SENSOR (VSS)  
(MANUAL TRANSMISSION ONLY)****Circuit Description:**

The Vehicle Speed Sensor (VSS) circuit consists of a magnetic induction type sensor, Vehicle Speed Sensor (VSS) buffer and wiring. Gear teeth pressed on the outside diameter of the output carrier assembly induce an alternating current in the sensor. On two wheel drive vehicles, this current is transmitted to the vehicle speed signal buffer where it is passed on to the PCM. The VSS buffer compensates for various axle ratios and converts the signal to a square wave for use by the speedometer, cruise control and antilock brake system. Since vehicle speed is taken from the transfer case on four wheel drive vehicles, the transmission vehicle speed sensor signal on these units goes directly to the PCM. DTC 24 will set when vehicle speed is less than 250 RPM for 3 seconds while engine speed is greater than 3000 RPM.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

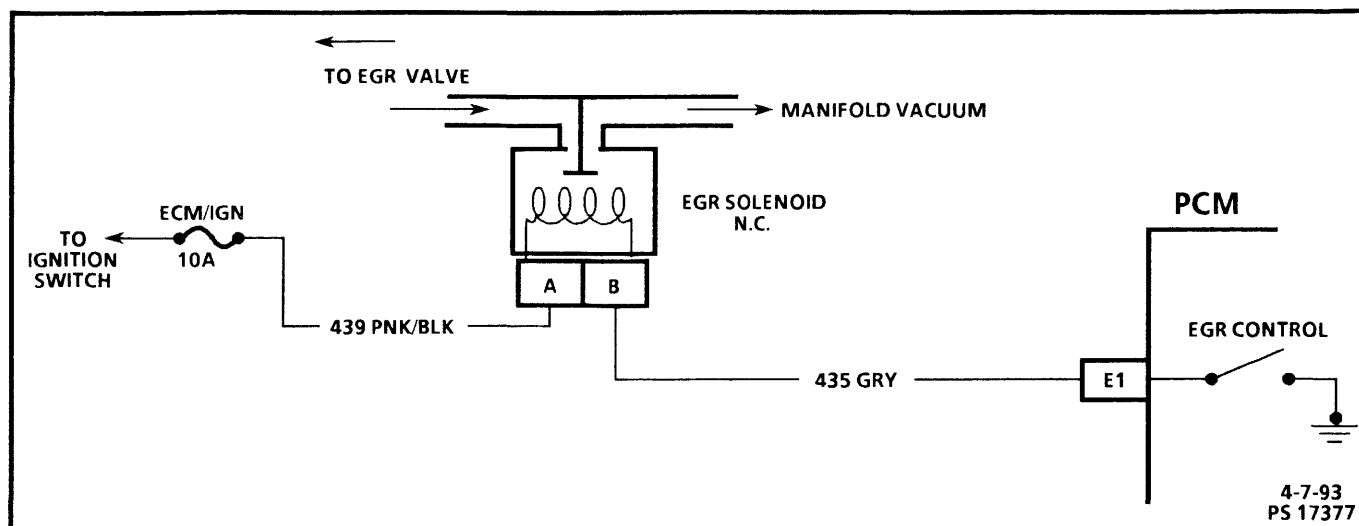
1. Verifys power and ground to VSS buffer module.
2. The first test checks the vehicle speed sensor signal to the PCM.
3. Test two checks the vehicle speed sensor signal to the digital ratio adapter.
4. Test three directly verifies the vehicle speed sensor signal.

**Diagnostic Aids:** Check all connections especially at the transmission pass-thru connector. Refer to "Intermittents" in SECTION 2.

**DTC 24****VEHICLE SPEED SENSOR (VSS)  
(MANUAL TRANSMISSION ONLY)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

5-5-92  
NS 14613



## DTC 32

### EXHAUST GAS RECIRCULATION (EGR) ERROR 4.3L, 5.0L, 5.7L (BACKPRESSURE)

#### Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the PCM energizes the solenoid which then allows vacuum to pass to the EGR valve.

**DTC 32 Will Set When:** The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid, thereby, shutting "OFF" vacuum to the EGR valve diaphragm. With the EGR valve closed, and O2S fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, after failing the test twice a DTC 32 will be set.

The PCM will check EGR operation when:

- Throttle position between 10% and 25% angle.
- Steady throttle with no more than 2% change in throttle.
- Above 32 mph "Closed Loop" operation.
- Max short term fuel trim less than 6 counts for 3.2 seconds.
- Desired EGR command greater than 93%.
- MAP above 47.5 kPa or less than 15 kPa.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 32 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. By commanding the EGR solenoid "ON," vacuum is applied to the EGR valve and the vacuum should hold.
2. When the diagnostic terminal is ungrounded, the vacuum to the EGR valve should bleed off through a vent in the solenoid and the valve should close. The gage may or may not bleed off but this does not indicate a problem.
3. This test will determine if the electrical control part of the system is at fault, or if the connector or solenoid is at fault.

4. This system uses a negative backpressure valve which should hold vacuum with engine "OFF."
5. When engine is started, exhaust backpressure should cause vacuum to bleed off and valve should fully close.

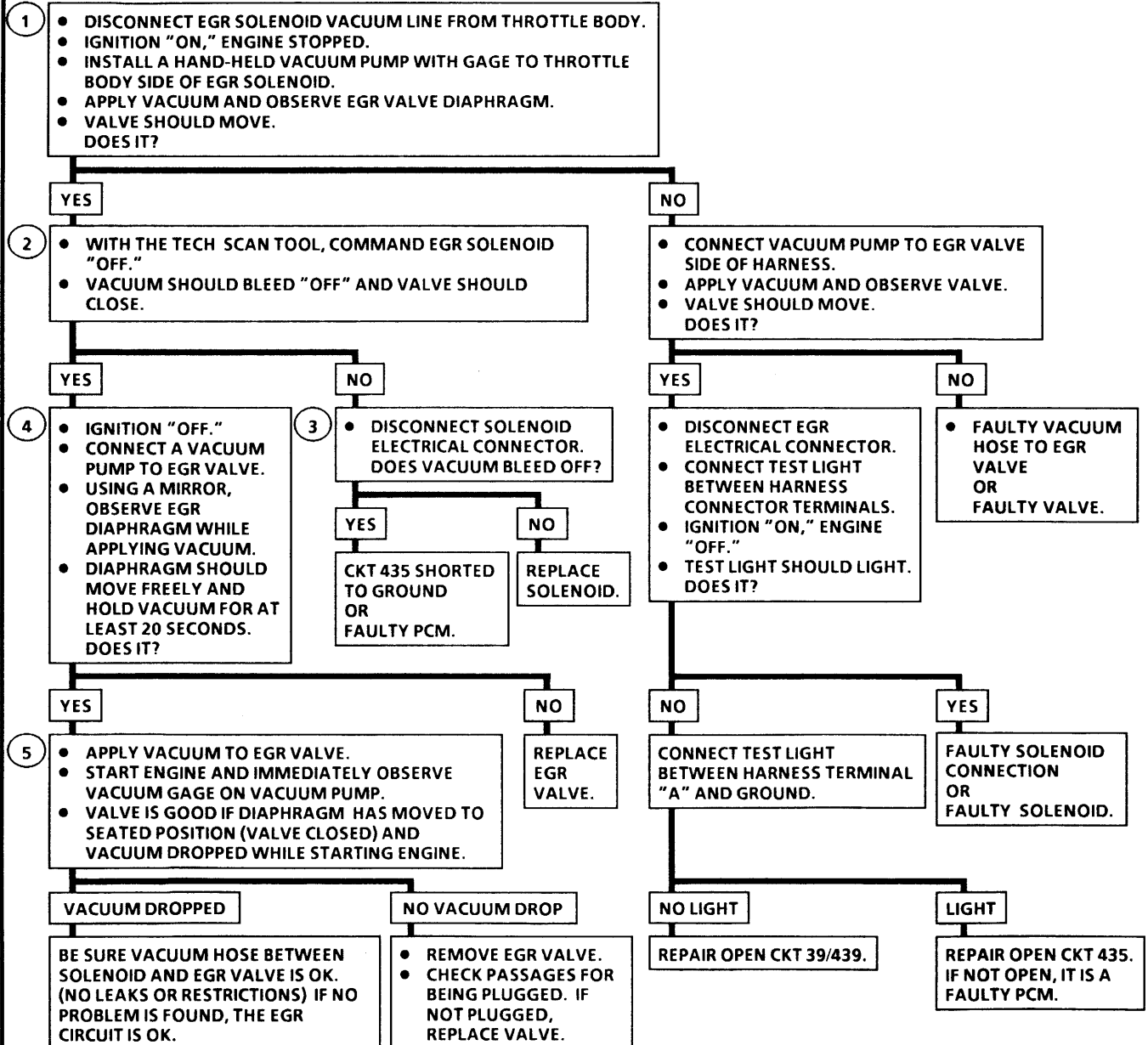
**Diagnostic Aids:** Before replacing PCM, use an ohmmeter and check the resistance of each PCM controlled relay and solenoid coil.

Refer to "PCM Wiring Diagram" for coil terminal ID of solenoid(s) and relay(s) to be checked.

Replace any solenoid where resistance measures less than 20 ohms.

**DTC 32****EXHAUST GAS RECIRCULATION (EGR) ERROR  
4.3L, 5.0L, 5.7L (BACKPRESSURE)**

BEFORE USING THIS CHART, CHECK VACUUM SOURCE TO EGR SOLENOID, ALSO CHECK HOSES FOR LEAKS OR RESTRICTIONS. SHOULD BE AT LEAST 24 kPa (7" Hg) VACUUM AT 2000 RPM.



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

6-2-92  
NS 14262

## DTC 32

## EXHAUST GAS RECIRCULATION (EGR) ERROR (PORT)

### Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the PCM energizes the solenoid which then allows vacuum to pass to the EGR valve.

**DTC 32 Will Set When:** The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid, thereby, shutting "OFF" vacuum to the EGR valve diaphragm. With the EGR valve closed, and O2S fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, after failing the test twice a DTC 32 will be set.

The PCM will check EGR operating when:

- Throttle position between 10% and 25% angle.
- Steady throttle with no more than 2% change in throttle.
- Above 32 mph "Closed Loop" operation.
- Max short term fuel trim less than 6 counts for 3.2 seconds.
- Desired EGR command greater than 40%.
- MAP above 47.5 kPa or less than 15 kPa.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 32 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON," engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve. Energizing the solenoid will allow vacuum to pass to the valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the PCM is commanding the system "ON."

**Diagnostic Aids:** Before replacing the PCM, use an ohmmeter and check the resistance of each PCM controlled relay and solenoid coil.

Refer to "PCM Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked.

Replace any solenoid where resistance measures less than 20 ohms.

The EVRV solenoid cannot be diagnosed by an electrical check, because of the solid state circuitry involved.

**DTC 32****EXHAUST GAS RECIRCULATION  
(EGR) ERROR  
(PORT)**

IF ANY OTHER DTCs ARE STORED, DIAGNOSE THEM FIRST.  
IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR IDLE COMPLAINT FIRST. REFER TO "DRIVEABILITY SYMPTOMS" IN SECTION 2.

**1**

- DISCONNECT EVRV SOLENOID VACUUM HOSE (MANIFOLD SIDE).
- CHECK VACUUM SOURCE TO EVRV SOLENOID (IF NOT OK, REPAIR).
- CHECK VACUUM HOSE BETWEEN EVRV SOLENOID AND VALVE FOR RESTRICTIONS.
- INSTALL A HAND-HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EVRV SOLENOID.
- IGNITION "ON," ENGINE STOPPED.
- WITH TECH 1 SCAN TOOL COMMAND EVRV SOLENOID "ON."
- APPLY VACUUM.
- OBSERVE EGR VALVE.
- VALVE SHOULD MOVE. DOES IT?

NO

- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM?

NO

- DISCONNECT SOLENOID CONNECTOR.
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

- CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "D".

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "B".
- WITH TECH 1 SCAN TOOL COMMAND EVRV SOLENOID ON.

LIGHT "ON"

REPLACE EVRV SOLENOID.

YES

REPLACE EGR VALVE.

LIGHT "OFF"

REPAIR OPEN IN CKT 439.

LIGHT "OFF"

REPAIR OPEN IN GROUND CIRCUIT.

LIGHT "OFF"

OPEN CKT 435 OR FAULTY PCM. REFER TO "DIAGNOSTIC AIDS."

YES

**2**

- PLUG VACUUM HOSE FROM THROTTLE BODY.
- EGR SOLENOID IN NORMALLY CLOSED POSITION.
- START AND IDLE ENGINE.
- LIFT UP ON EGR VALVE AND OBSERVE IDLE.

IDLE ROUGHENS

**3**

- RECONNECT EVRV SOLENOID.
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE, ENGINE AT NORMAL OPERATING TEMPERATURE.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 34 kPa (10" Hg) VACUUM.

OK

NO TROUBLE FOUND. REFER TO "INTERMITTENTS" IN SECTION 2.

NO CHANGE

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.

NOT OK

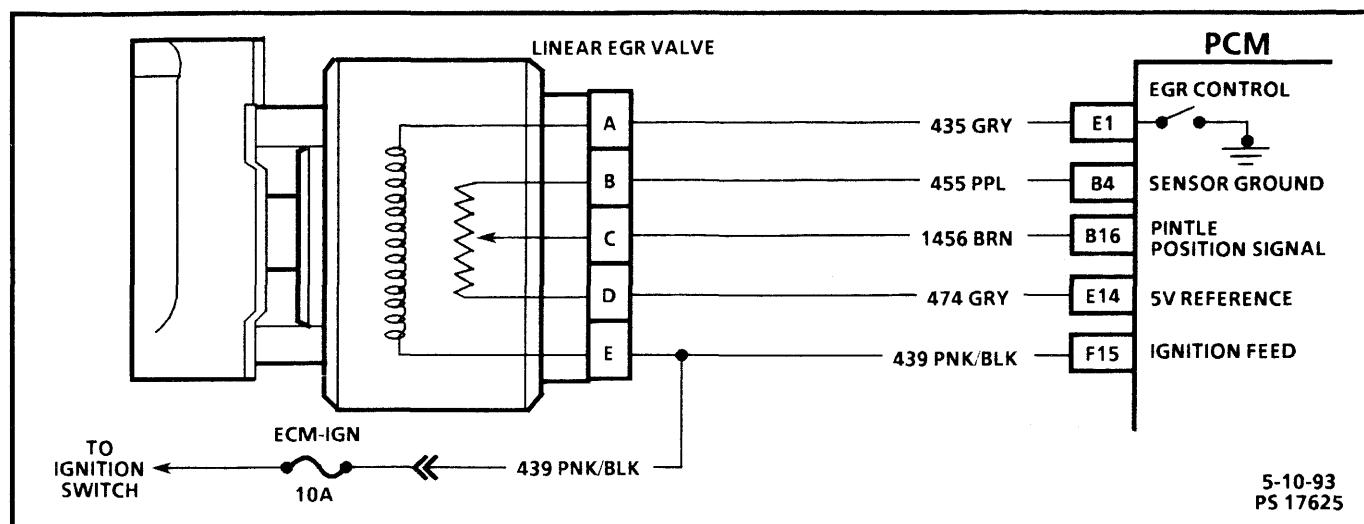
OVER 34 kPa (10" Hg) VACUUM

REPLACE EGR FILTER.

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-5-92  
NS 14253





## DTC 32

### EGR ERROR

#### (LINEAR EXHAUST GAS RECIRCULATION (EGR) SYSTEM)

##### Circuit Description:

The PCM operates the linear EGR valve to control exhaust gas recirculation, by providing a ground control that commands the pintle valve away from its seat allowing exhaust gas through the valve.

**DTC 32 Will Set When:** The PCM monitors EGR effectiveness by de-energizing the EGR control, thereby, shutting "OFF" the EGR valve. With the EGR valve closed, and HO2S fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, after failing the test twice a DTC 32 will be set.

The PCM will check EGR operation when:

- Throttle position between 10% and 25% angle.
- Steady throttle with no more than 2% change in throttle.
- Above 32 mph "Closed Loop" operation.
- Max short term fuel trim less than 6 counts for 3.2 seconds.
- Desired EGR command greater than 40%.
- MAP above 60 kPa or less than 15 kPa.

**Action Taken (PCM will default to):** The PCM will turn "ON" the Malfunction Indicator Lamp (MIL).

**DTC 32 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step checks the pintle's ability to be commanded to the desired position.
2. This step checks for voltage to the linear EGR valve to verify if the problem is in the ignition feed circuit.
3. This checks the PCM control circuit by jumpering across the CKT 435 and CKT 439 with a test light and grounding the diagnostic connector to command the EGR "ON."

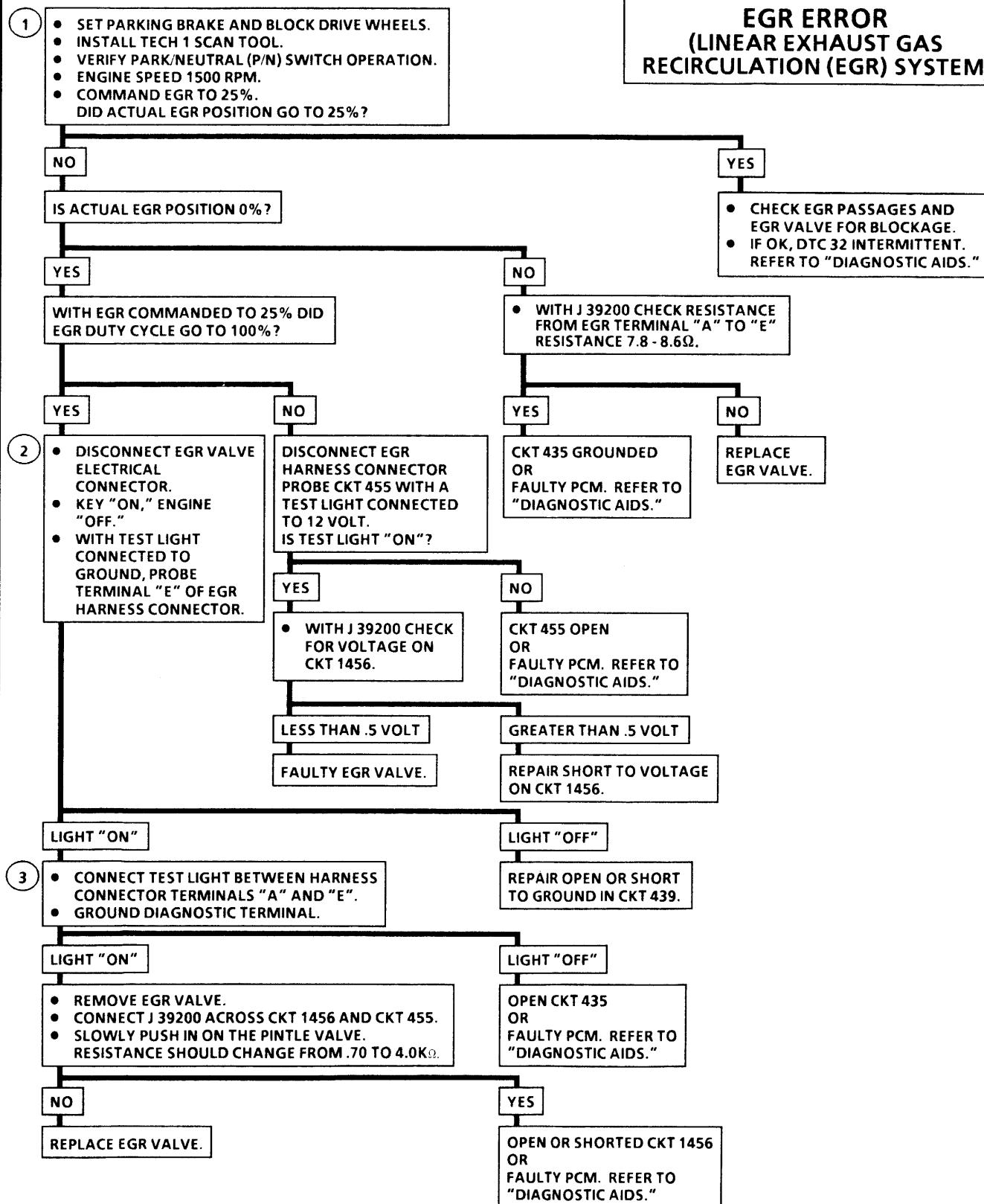
**Diagnostic Aids:** Before replacing PCM, use an ohmmeter and check the resistance of each PCM controlled relay and solenoid coil.

With J 39200, check resistance of EGR pins.

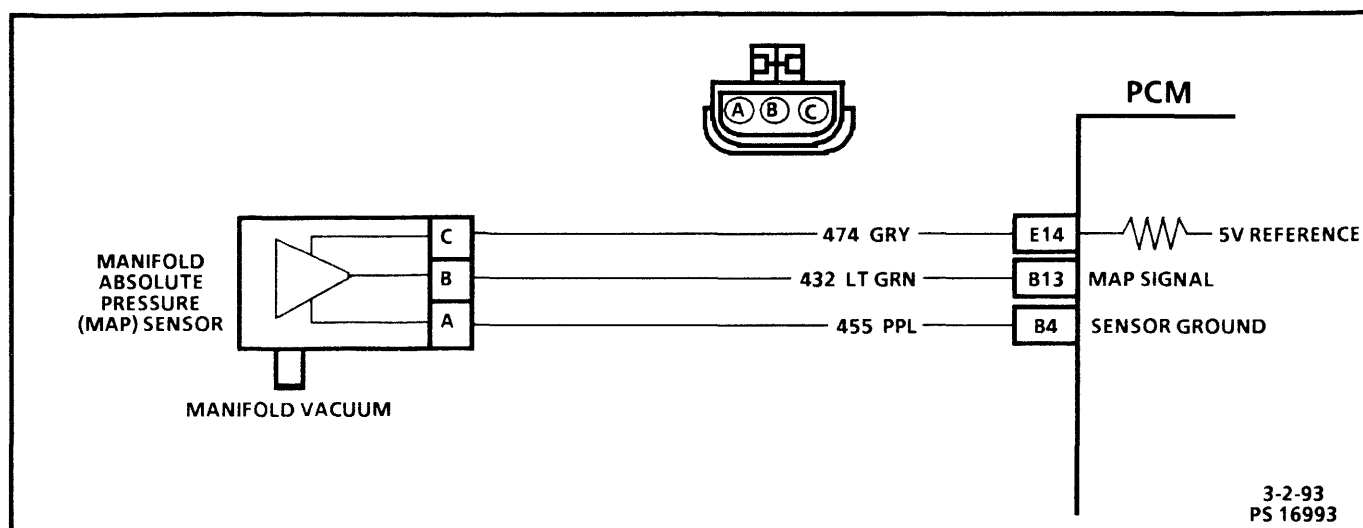
|        |                                                        |
|--------|--------------------------------------------------------|
| A to E | 7.8 - 8.6Ω                                             |
| B to D | Above 3k                                               |
| D to C | From .7 to 4.0k when slowly moving pintle valve inward |

## DTC 32

### EGR ERROR (LINEAR EXHAUST GAS RECIRCULATION (EGR) SYSTEM)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.



## DTC 33

### MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH - LOW VACUUM)

#### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The PCM receives this information as a signal voltage that will vary from about 1-1.5 volts at closed throttle (idle) to 4-4.6 volts at Wide Open Throttle (WOT) (low vacuum).

#### DTC 33 Will Set When:

- RPM greater than 600.
- MAP signal voltage is too high (vacuum less than 96.7 kPa).
- Throttle closed.
- These conditions exist longer than 2 seconds.
- Engine misfire or a low unstable idle may set DTC 33.

**Action Taken (PCM will default to):** If the MAP sensor fails, the PCM will substitute a MAP value and use the Throttle Position (TP) sensor and RPM to control fuel delivery and the malfunction indicator lamp will illuminate.

**DTC 33 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 33 is the result of a hard failure or an intermittent condition.
2. This step simulates conditions for a DTC 34. If the PCM recognizes the change, the PCM and CKT 474 and CKT 432 are OK. If CKT 455 is open, there may also be a stored DTC 23 with CMFI.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the PCM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

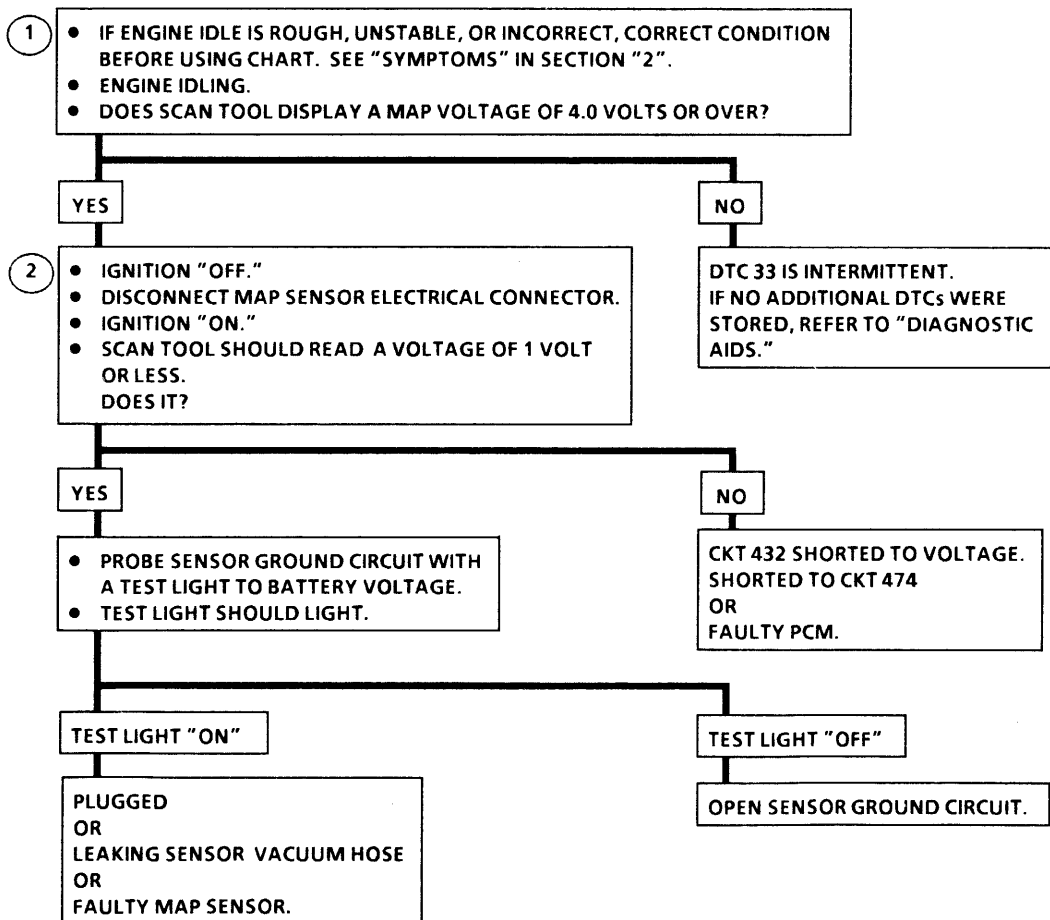
A DTC 33 will result if CKT 455 is open or if CKT 432 is shorted to voltage or to CKT 474.

If DTC 33 is intermittent, refer to SECTION 2.

- Check all connections.
- Disconnect sensor from bracket and twist sensor connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

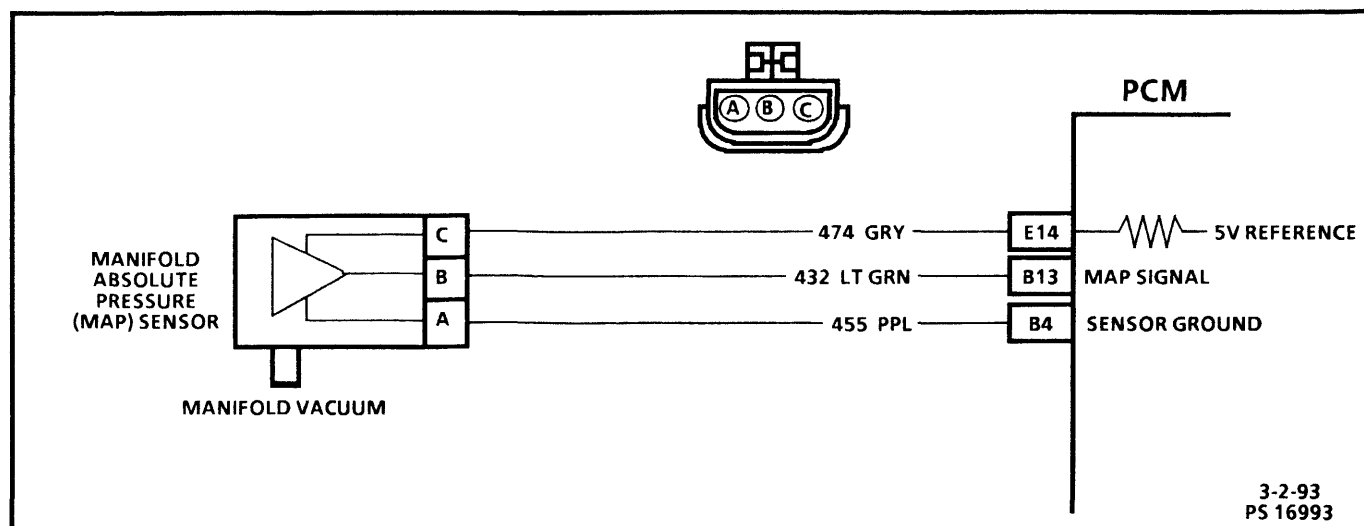
**NOTICE:** Make sure electrical connector remains securely fastened.

- Refer to "MAP Output Check" in SECTION 3 for further diagnosis.

**DTC 33****MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH  
(SIGNAL VOLTAGE HIGH - LOW VACUUM)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-30-92  
MS 9959-6E



## DTC 34

### MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW (SIGNAL VOLTAGE LOW - HIGH VACUUM)

#### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The PCM receives this information as a signal voltage that will vary from about 1-1.5 volts at idle to 4-4.6 volts at Wide Open Throttle (WOT).

A Tech 1 scan tool displays manifold pressure in volts. Low pressure (high vacuum) reads a low voltage while a high pressure (low vacuum) reads a high voltage.

#### DTC 34 Will Set When:

- When engine is less than 1000 RPM.
- Manifold pressure reading less than 17 kPa.
- Conditions met for 2.5 seconds.
- OR
- Engine speed is greater than 1000 RPM.
- Throttle angle over 10%.
- Manifold pressure less than 17 kPa, conditions met for 1 second.

**Action Taken (PCM will default to):** If the MAP sensor fails, the PCM will substitute a fixed MAP value, use the Throttle Position (TP) sensor and RPM to control fuel delivery and the Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 34 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 34 is the result of a hard failure or an intermittent condition.
2. Jumpering harness terminals "B" to "C" (5 volts to signal circuit) will determine if the sensor is at fault, or if there is a problem with the PCM or wiring.
3. The Tech 1 scan tool may not display 5 volts. The important thing is that the PCM recognized the voltage as more than 4 volts, indicating that the PCM and CKT 432 are OK.

**Diagnostic Aids:** An intermittent open in CKT 432 or CKT 474 will result in a DTC 34.

With the ignition "ON" and the engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the PCM as an indication of vehicle altitude.

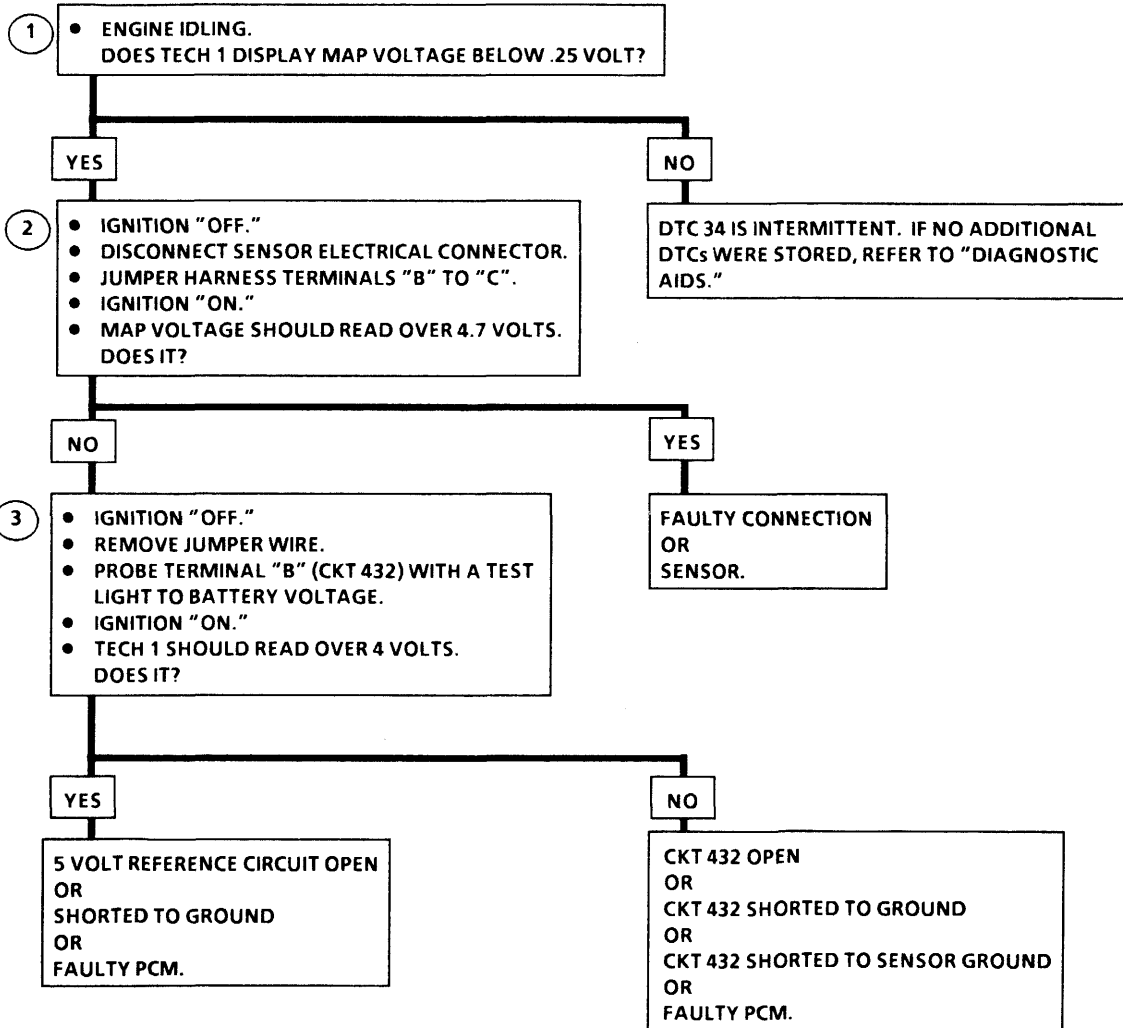
Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Reading should be the same  $\pm .4$  volt. Also, MAP output check in SECTION 3 can be used to test the MAP sensor.

Refer to "Intermittents," in SECTION 2.

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

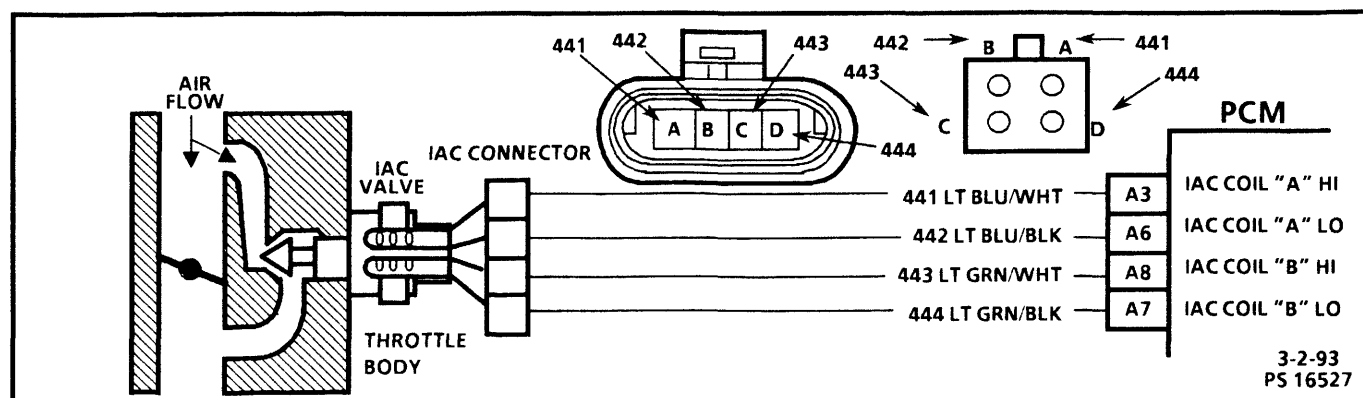
**NOTICE:** Make sure electrical connector remains securely fastened.

Refer to "MAP Output Check" in SECTION 3 for further diagnosis.

**DTC 34****MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW  
(SIGNAL VOLTAGE LOW - HIGH VACUUM)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-10-92  
NS 14250



## DTC 35

### IDLE AIR CONTROL (IAC) ERROR

#### Circuit Description:

The control module controls engine idle speed with the IAC valve. To increase idle speed, the control module retracts the IAC valve pintle away from its seat, allowing more air to pass by the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing bypass air flow. A Tech 1 scan tool will read the control module commands to the IAC valve in counts. Higher the counts indicate more air bypass (higher idle). The lower the counts indicate less air is allowed to bypass (lower idle).

**DTC 35 Will Set When:** The PCM sees a different reading in desired IAC and actual IAC.

**Action Taken (PCM will default to):** None. The PCM turns "ON" the Malfunction Indicator Lamp (MIL).

**DTC 35 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in Step 1. Between 700 RPM and about 1500 RPM, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 RPM), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. Each lamp on the node light should flash red and green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash red and green, check the circuits for faults beginning with poor terminal contacts.

#### IAC VALVE RESET PROCEDURE

- Disconnect negative battery cable for 10 seconds then reconnect cable battery.
- Key "ON," engine "OFF."
- Ignition "OFF" for 10 seconds.

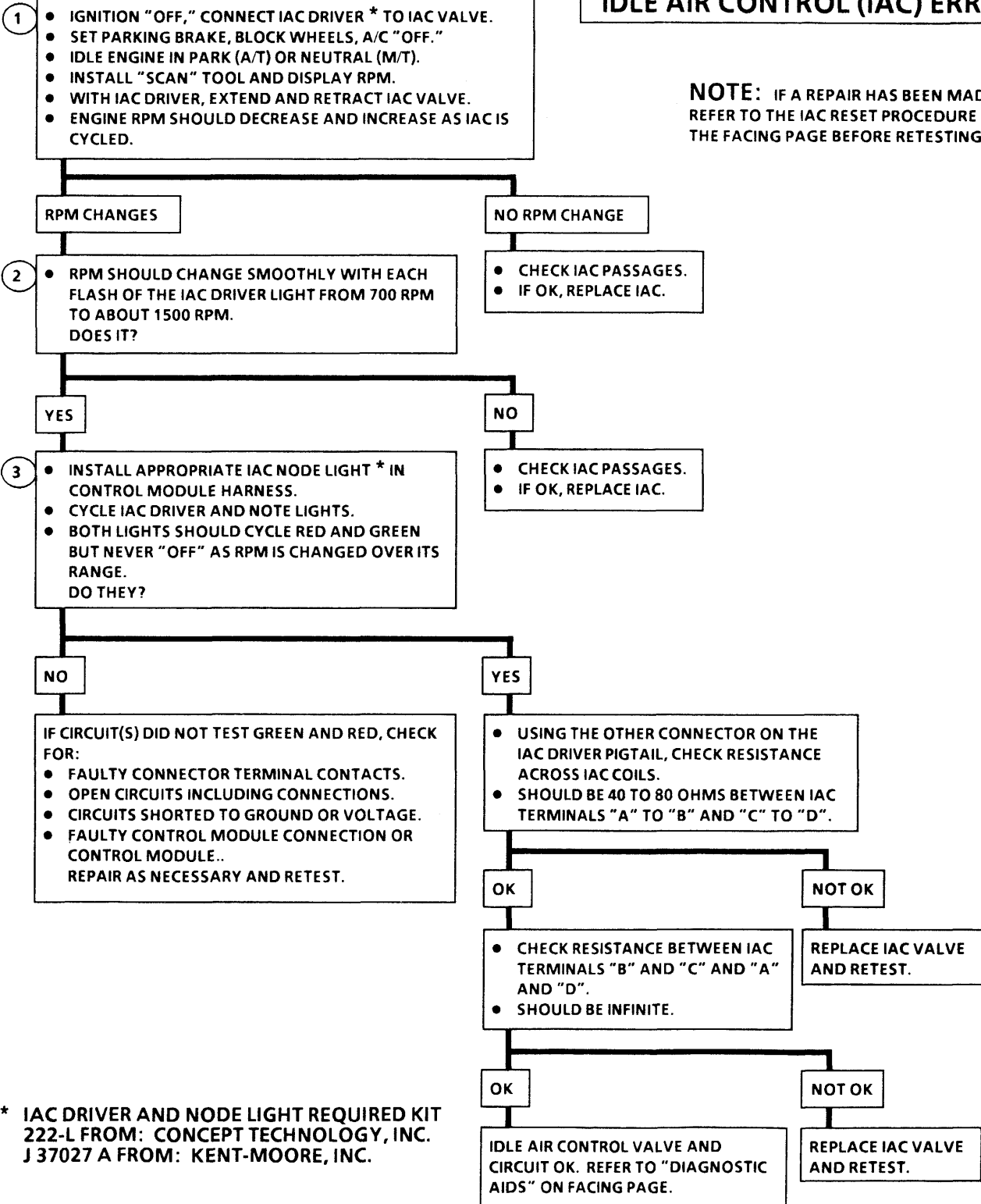
**Diagnostic Aids:** A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range, IAC Tech 1 scan tool counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non-IAC system problem.

- Vacuum leak (High Idle) - If idle is too high, stop the engine. Also, check for binding of throttle blade or linkage.
- System too rich (Low Air/Fuel Ratio) - The idle speed will be too low.
- Throttle body - Remove IAC valve and inspect bore for foreign material.
- IAC valve electrical connections - IAC valve connections should be carefully checked for proper contact.
- Crankcase ventilation valve - An incorrect or faulty crankcase ventilation valve may result in an incorrect idle speed.
- A/C compressor or relay failure - Refer to A/C diagnosis if circuit is shorted to ground.
- If intermittent poor driveability or idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance or replace IAC.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling" in SECTION 2.

# DTC 35

## IDLE AIR CONTROL (IAC) ERROR

**NOTE:** IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

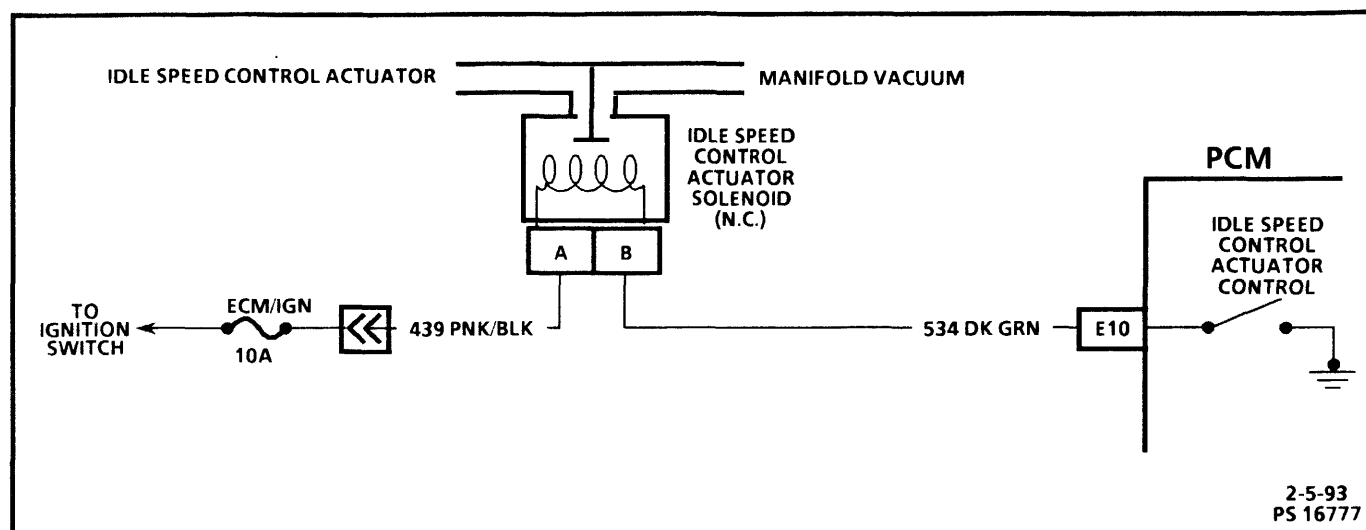


\* IAC DRIVER AND NODE LIGHT REQUIRED KIT 222-L FROM: CONCEPT TECHNOLOGY, INC. J 37027 A FROM: KENT-MOORE, INC.

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

5-30-92  
• 95 7497-6E





## DTC 36

### IDLE SPEED CONTROL ACTUATOR FAULT

#### Circuit Description:

The control module grounds CKT 534 when ECT is within range to enable the solenoid, allowing vacuum to retract the idle speed control actuator and lower the idle to controlled idle specification.

**DTC 36 Will Set When:** ECT is above 55°C (132°F), VSS is present, above 10 mph and TP angle is above 10%. The DTC will set on the keycycle after the fault has occurred.

**Action Taken (PCM will default to):** None. (Warm idle speed will be higher than normal when idle speed control actuator system is inop.)

**DTC 36 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if a vacuum source is present.
2. Checks to see if idle speed control actuator solenoid is commanded "ON."
3. Checks for power to the solenoid, the ground circuit, the connections at the idle speed control actuator solenoid and the solenoid itself.
4. Checks for open or grounded CKT 439.
5. Checks for open CKT 543 or faulty control module.

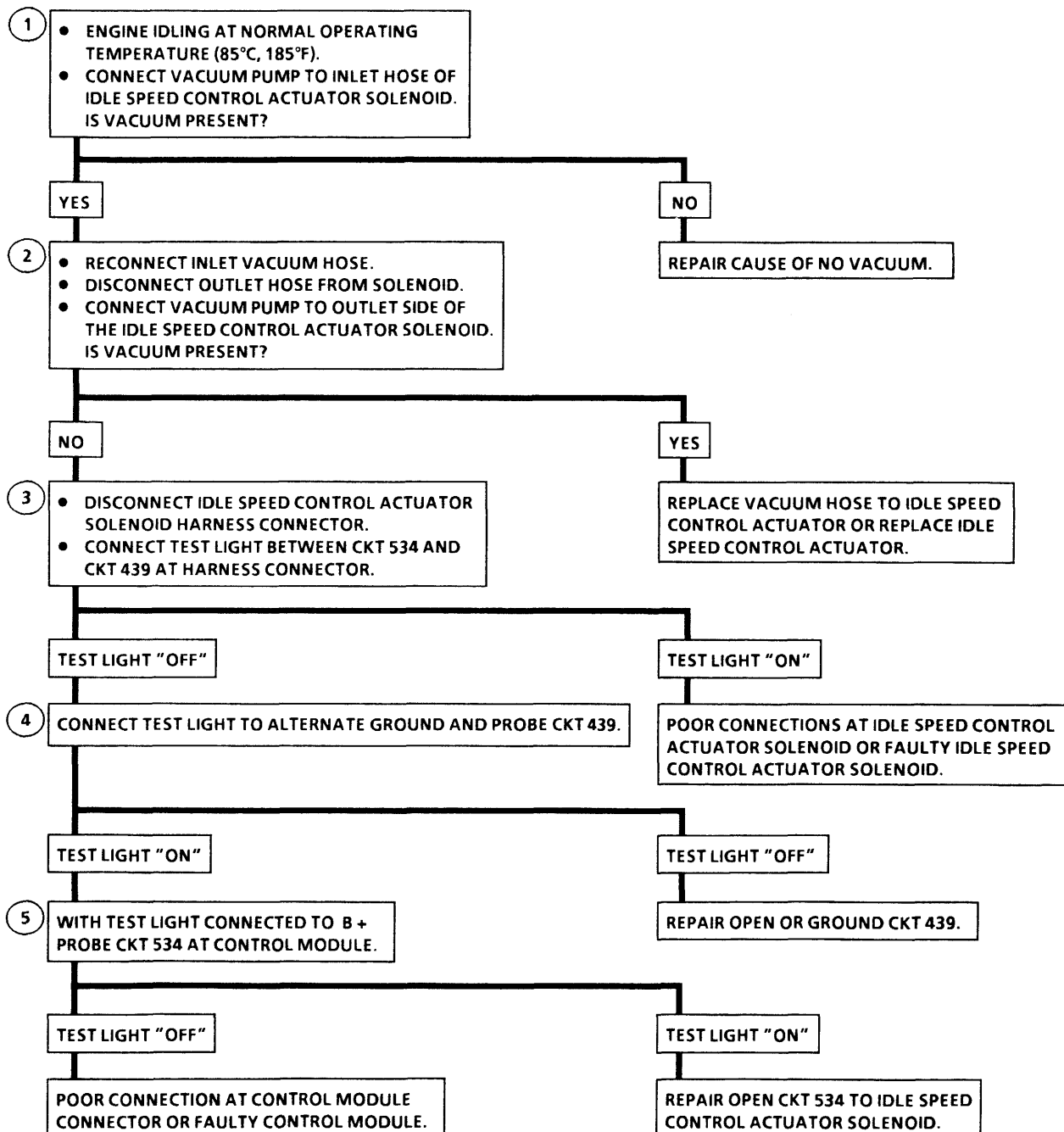
**Diagnostic Aids:** If BARO is below 68 kPa, a 96 second reset will result.

If DTC 36 sets, a DTC 35 will usually also set. Repair the DTC 36 first, clear DTCs and recheck for DTCs.

If IAC counts are at 0, the idle speed control actuator will disengage and raise idle speed.

## DTC 36

### IDLE SPEED CONTROL ACTUATOR FAULT



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

2-5-93  
PS 16779



## IGNITION CONTROL (IC) ERROR

When the system is running on the ignition module, that is, no voltage on the bypass line, the ignition module grounds the IC signal. The PCM expects to see no voltage on the IC line during this condition. If it sees a voltage, it sets DTC 42 and will not go into the IC mode.

**DTC 42 Will Set When:** If the bypass line is open or grounded, the ignition module will not switch to IC mode so the IC voltage will be low and DTC 42 will be set.

**Action Taken (PCM will default to):** The PCM turns "ON" the Malfunction Indicator Lamp (MIL). (Possible ignition bypass mode depending on fault.)

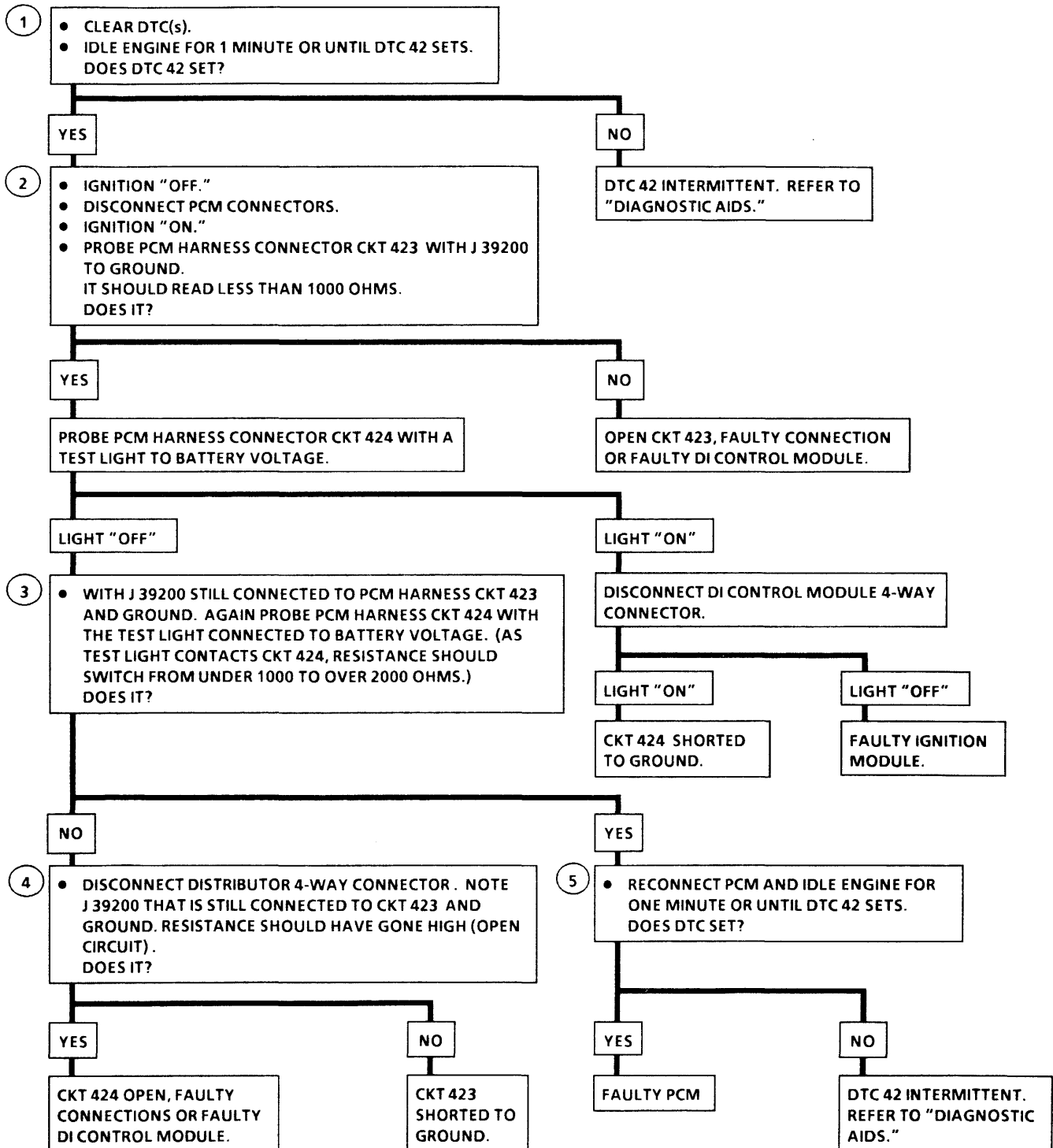
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- Selecting the 10-20,000 ohms position will indicate above 5000 ohms. The important thing is that the module "switched."
4. The module did not switch and this step checks for:
    - IC CKT 423 shorted to ground.
    - Bypass CKT 424 open.
    - Faulty ignition module connection or module.
  5. Confirms that DTC 42 is a faulty PCM and not an intermittent in CKT 423 or 424.

**Diagnostic Aids:** The Tech 1 does not have any ability to help diagnose a DTC 42 problem.  
Refer to SECTION 2 for "Intermittents."

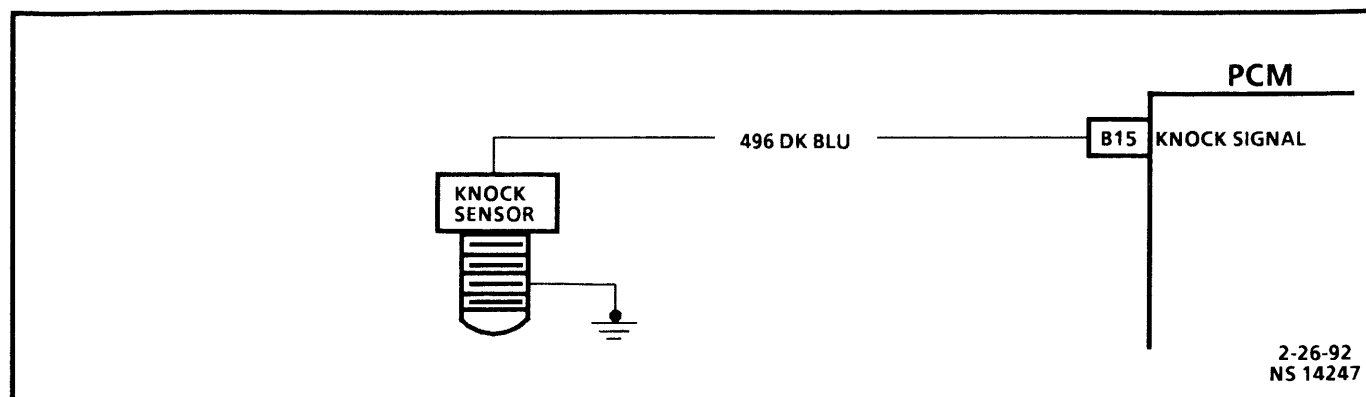
## DTC 42

### IGNITION CONTROL (IC) ERROR



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-1-93  
NS 14249



## DTC 43

### KNOCK SENSOR (KS) CIRCUIT (SINGLE KNOCK SENSOR SYSTEM)

#### Circuit Description:

The DTC 43 circuit consists of a knock sensor with one wire that goes directly to the PCM. There are two DTC 43 checks performed by the PCM. One check consists of monitoring CKT 496 for a voltage that is more than 4.3 volts and less than .64 volt.

**DTC 43 Will Set When:** If voltage is either too high or too low, for 10 or more seconds, DTC 43 will set.

**Action Taken (PCM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

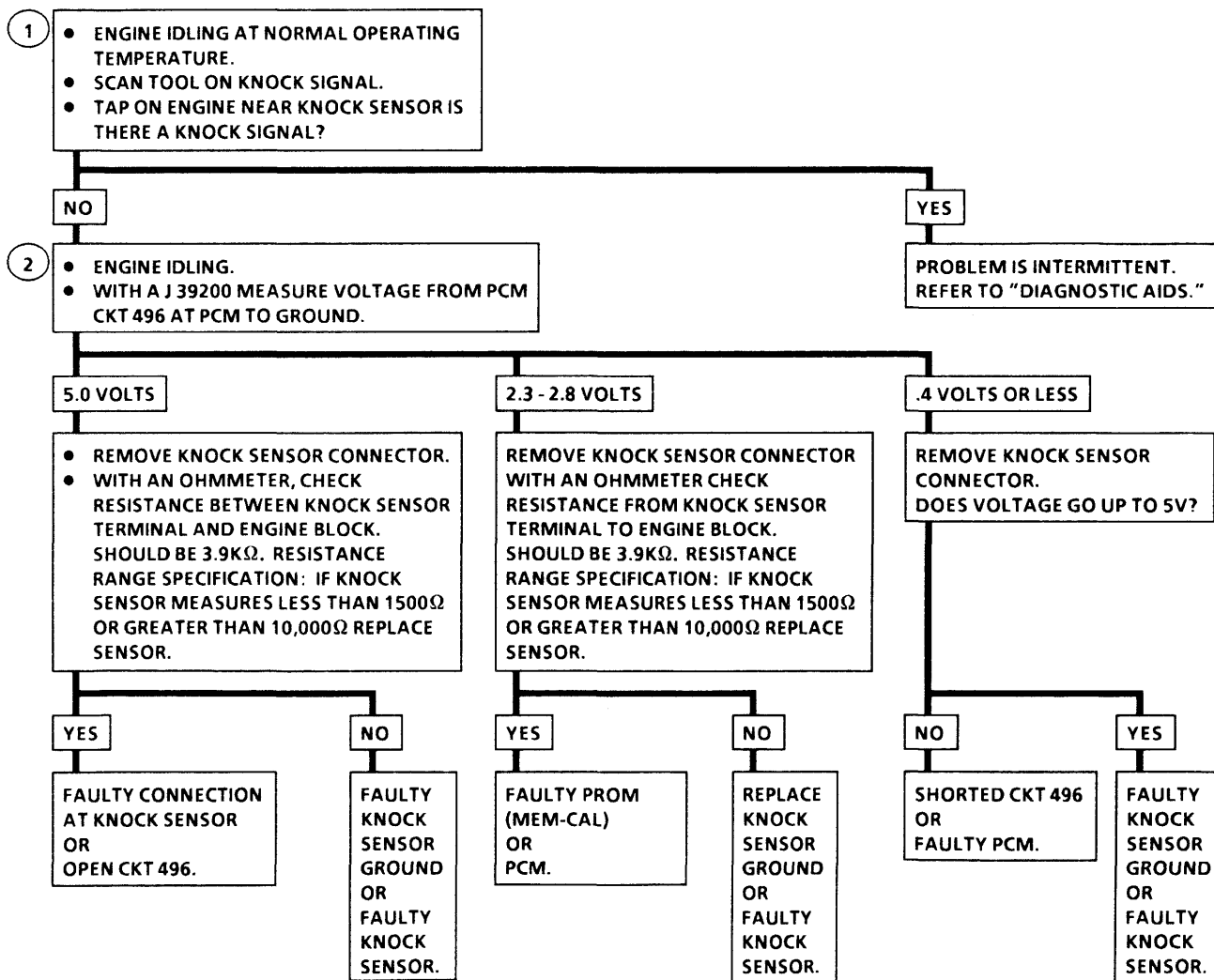
**DTC 43 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test is to determine if the system is functioning at the present time.
2. Test two determines the state of the 5 volt reference voltage applied to the knock sensor circuit.

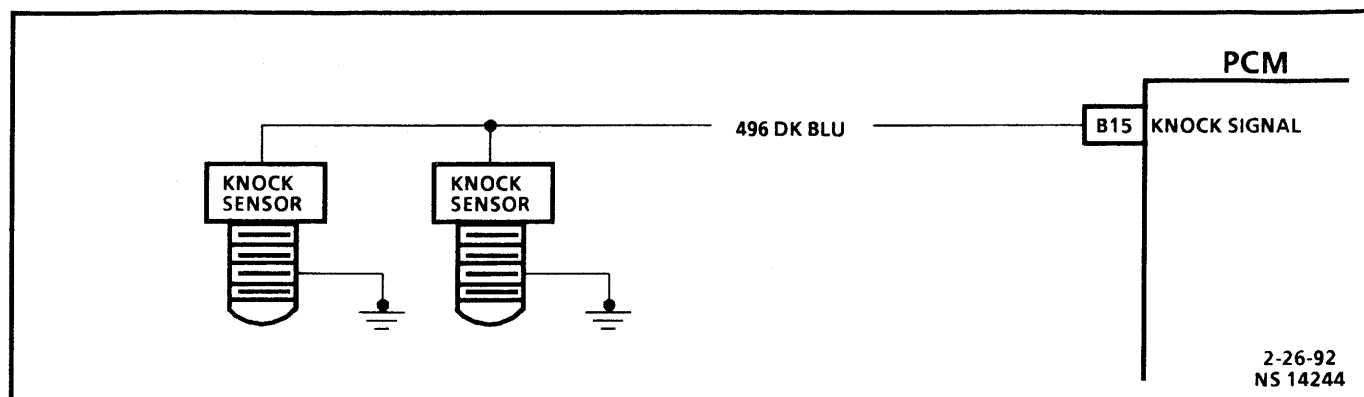
**Diagnostic Aids:** The PCM applies 5 volts to CKT 496. A 3.9k ohm resistor in the knock sensor reduces the voltage to about 2.5 volts. When knock occurs, the knock sensor produces a small AC voltage that rides on top of the 2.5 volts already applied. An AC voltage monitor in the PCM is able to read this signal as knock and incrementally retard spark.

For further information, refer to "Intermittents" in SECTION 2.

**DTC 43****KNOCK SENSOR (KS) CIRCUIT  
(SINGLE KNOCK SENSOR SYSTEM)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-7-93  
NS 14246



## DTC 43

### KNOCK SENSOR (KS) CIRCUIT (DUAL KNOCK SENSOR SYSTEM)

#### Circuit Description:

The DTC 43 circuit consists of two knock sensors with one wire that is spliced together and goes directly to the PCM. There is one DTC 43 check performed by the PCM. The check consists of monitoring CKT 496 for a voltage that is above .63 volt and below 3 volts.

**DTC 43 Will Set When:** If voltage is either too high or too low, for 10 seconds, DTC 43 will set.

**Action Taken (PCM will default to):** The PCM will turn "ON" the MIL (Malfunction Indicator Lamp).

**DTC 43 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. If an audible knock is heard from the engine, repair the internal engine problem as normally no knock should be detected at idle.  
The PCM applies 5 volts on CKT 496 which should be present at the knock sensor terminals when the sensors are disconnected.
2. This test determines if the wiring or if the KS portion of the PROM (MEM-CAL) is faulty.
3. An improperly installed knock sensor can prevent the knock sensor from grounding to the block.

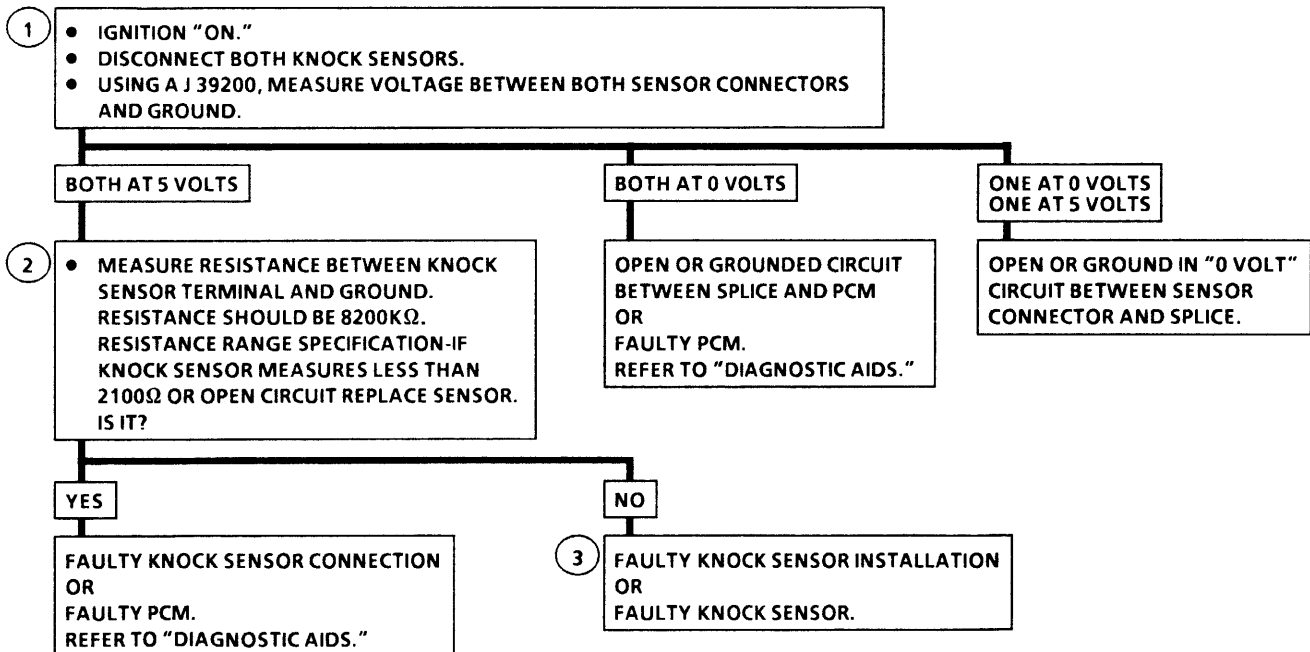
**Diagnostic Aids:** Check CKT 496 for a potential open or short to ground.

Also, check for proper installation of PROM (MEM-CAL).

Refer to "Intermittents" in SECTION 2.

**DTC 43****KNOCK SENSOR (KS) CIRCUIT  
(DUAL KNOCK SENSOR SYSTEM)**

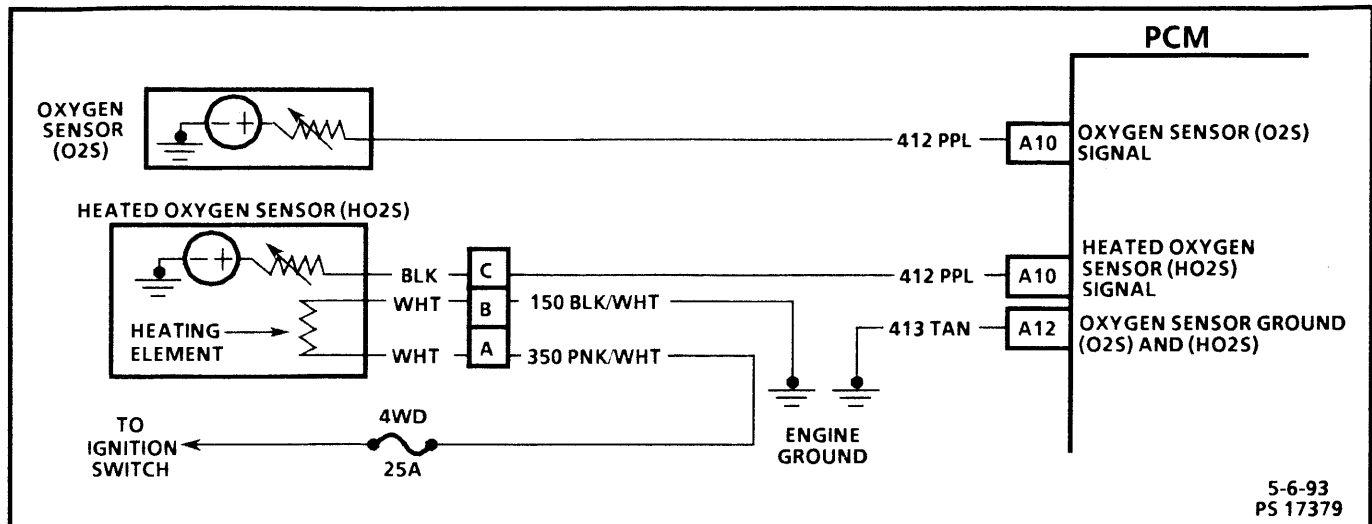
CHECK FOR A MECHANICAL KNOCK CONDITION BEFORE USING THIS CHART.



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-17-93  
NS 14245





## DTC 44

### LEAN EXHAUST

#### Circuit Description:

This DTC chart applies to heated and non-heated oxygen sensors. The PCM supplies a voltage of about 450 mV between terminals "A10" and "A12". (If measured with a 10 megohm digital voltmeter, this may read as low as 320 mV.) The Oxygen Sensor (O2S) varies the voltage within a range of near 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

#### DTC 44 Will Set When:

PART 1: The Oxygen Sensor (O2S) signal voltage on CKT 412:

- Remains below 100 mV for 70 seconds.
- And the system is operating in "Closed Loop."

PART 2:

- "Open Loop" for 10 seconds.
- Maximum air fuel ratio is 14.6.

**Action Taken (PCM will default to):** The PCM will enable the MIL. The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

**DTC 44 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

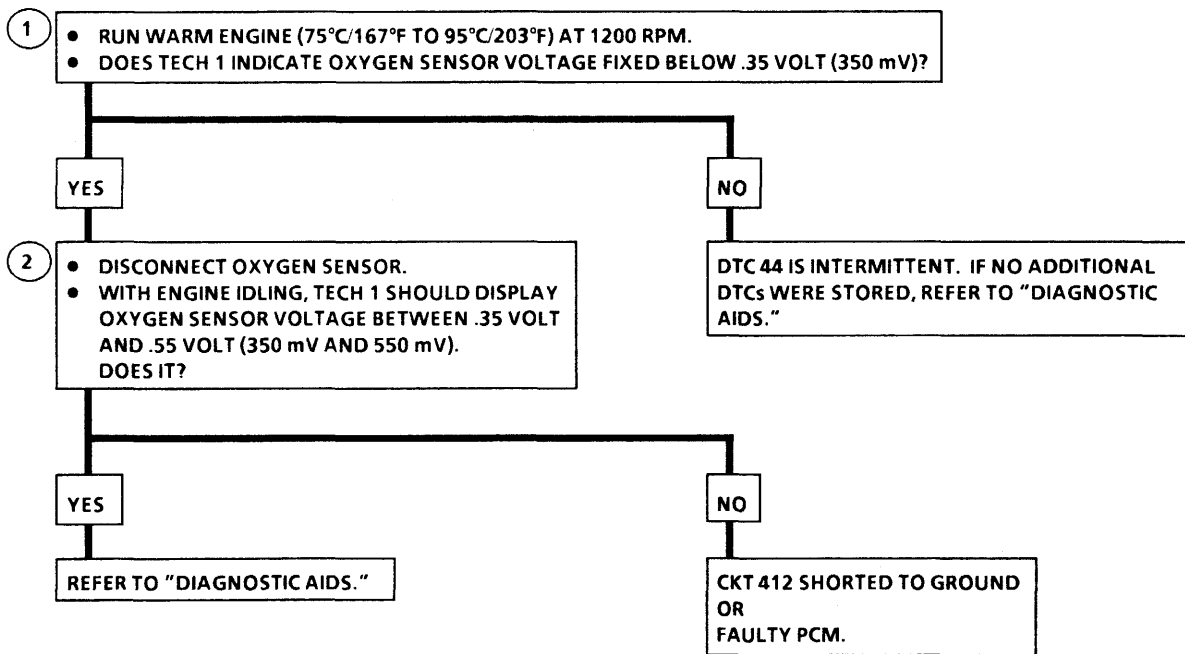
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks engine operating temperature and O2S voltage having a low reading.
2. Checks the wiring and PCM first and then to the "Diagnostic Aids" to check other variables and finally the sensor.

**Diagnostic Aids:** Using the Tech 1, observe the long term fuel trim values at different RPM and air flow conditions. The Tech 1 also displays the long term fuel trim cells, so the long term fuel trim values can be checked in each of the cells to determine when the DTC 44 may have been set. If the conditions for DTC 44 exist, the long term fuel trim values will be around 150.

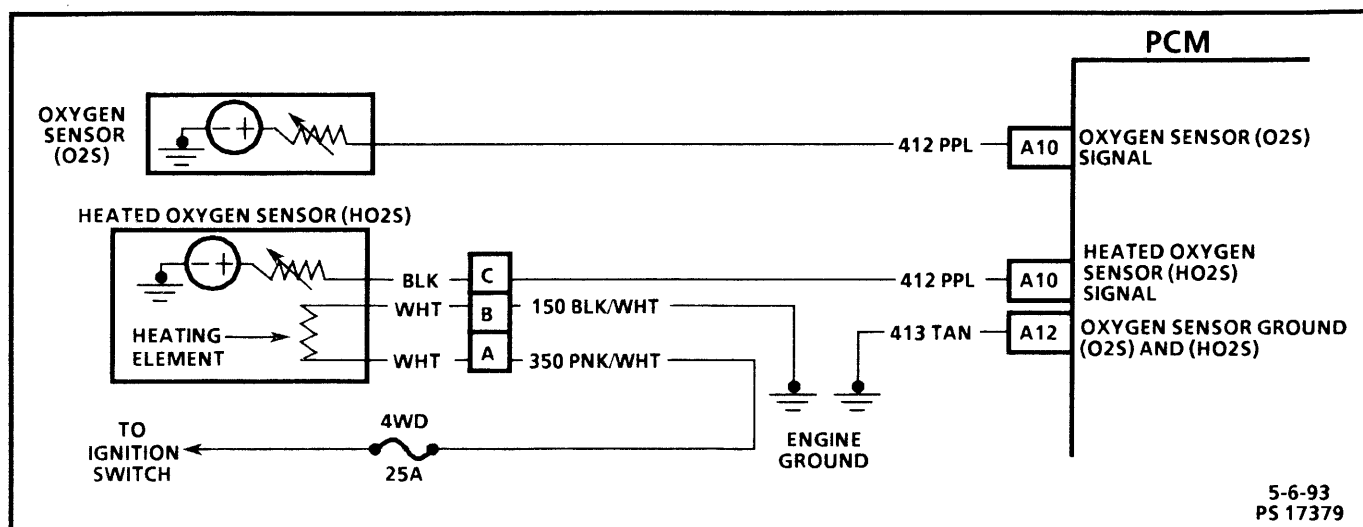
- **Heated Oxygen (HO2S) Sensor Wire** - An oxygen supply inside the HO2S is necessary for proper HO2S operation. This supply of oxygen is supplied through the HO2S wire. All HO2S wires and connections should be inspected for breaks or contamination that could prevent reference oxygen from reaching the HO2S.

- Check for intermittent ground in wire between connector and sensor.
- **Fuel Contamination** - Water, even in small amounts, near the in-tank fuel pump inlet, can be delivered to the injectors. The water causes a lean exhaust and can set a DTC 44.
- **Fuel Pressure** - System will be lean if pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. Refer to "Fuel System Diagnosis."
- **Exhaust Leaks** - If there is an exhaust leak, the engine can cause outside air to be pulled into the exhaust and past the sensor. Vacuum or crankcase leaks can cause a lean condition.
- **CKT 413** - If CKT 413 is open, the voltage at terminal "C14" will be about .45 volt. This may also cause DTC 13 to set.
- If all check OK, the Heated Oxygen Sensor (HO2S) is faulty.

**DTC 44**  
**LEAN EXHAUST**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-2-93  
NS 14243



## DTC 45

### RICH EXHAUST

#### Circuit Description:

This DTC chart applies to heated and non-heated oxygen sensors. The PCM supplies a voltage of about 450 mV between terminals "A10" and "A12". (If measured with a 10 megohm digital voltmeter, this may read as low as 320 mV.) The Heated Oxygen Sensor (HO<sub>2</sub>S) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 100 mV if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

#### DTC 45 Will Set When:

- Remains above 700 mV for 70 seconds, and in "Closed Loop."
- Engine time after start is 1 minute or more.
- Throttle angle less than 5% (about .2 volt above idle voltage).

**Action Taken (PCM will default to):** The PCM will enable the MIL.

**DTC 45 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

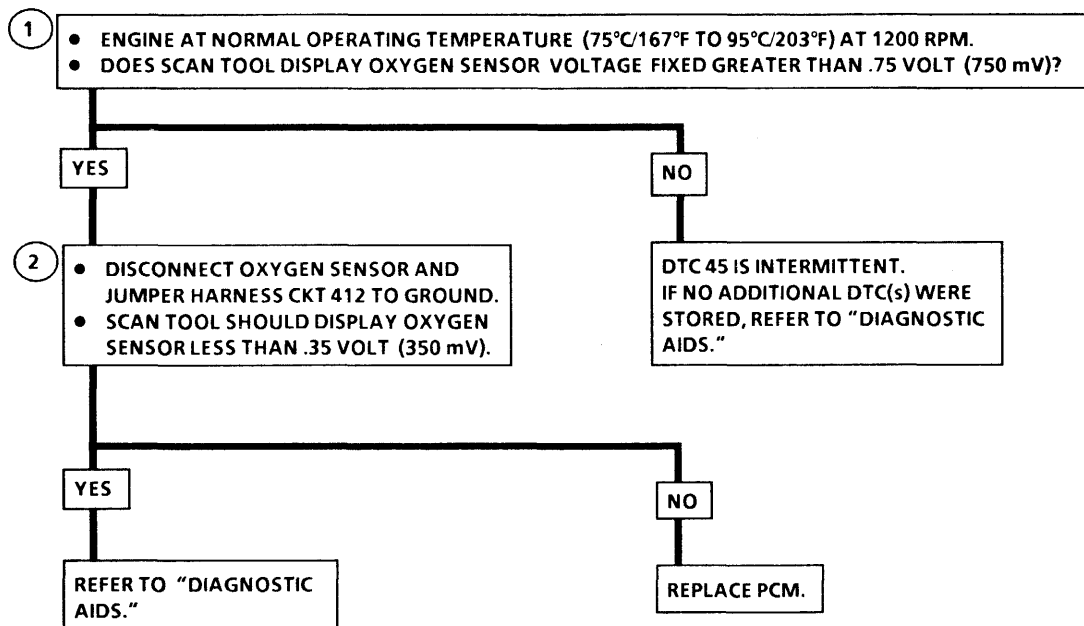
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Check operating temperature and HO<sub>2</sub>S voltage having a high reading.
2. Checks the PCM and refer to "Diagnostic Aids" to check other variables.

**Diagnostic Aids:** Using the Tech 1, observe the block learn values at different RPM and air flow conditions to determine when the DTC 45 may have been set. If the conditions for DTC 45 exist, the block learn values will be around 115.

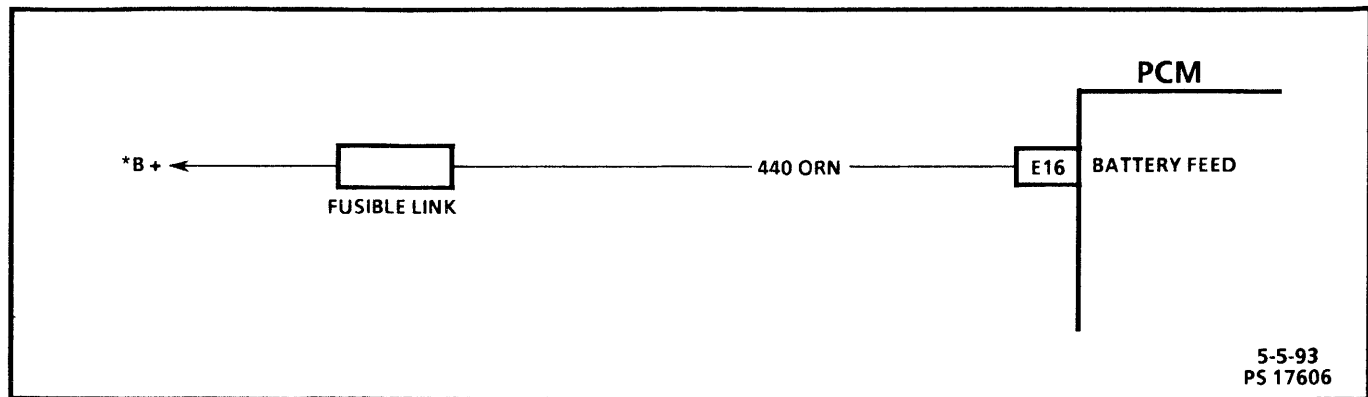
- **Fuel Pressure** - System will go rich if pressure is too high. The PCM can compensate for some increase. However, if it gets too high, a DTC 45 may be set. Refer to "Fuel System Diagnosis" chart.
- **Leaking Injector**.
- **Check for fuel contaminated oil.**
- **Heated Oxygen (HO<sub>2</sub>S) Sensor Wire** - An oxygen supply inside the HO<sub>2</sub>S is necessary for proper HO<sub>2</sub>S operation. This supply of oxygen is supplied through the HO<sub>2</sub>S wire. All HO<sub>2</sub>S wires and connections should be inspected for breaks or contamination that could prevent reference oxygen from reaching the HO<sub>2</sub>S.

- **DI Shielding** - An open ground CKT 453 (ignition system reference low) may result in EMI, or induced electrical "noise." The PCM looks at this "noise" as reference pulses. The additional pulses result in a higher than actual engine speed signal. The PCM then delivers too much fuel, causing system to go rich. Engine tachometer will also show higher than actual engine speed which can help in diagnosing this problem.
- **Canister Purge** - Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to SECTION 5.
- **MAP Sensor** - An output that causes the PCM to sensor a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the PCM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.
- **Pressure Regulator** - Check for leaking fuel pressure regulator diaphragm by checking for presence of liquid fuel.
- **TP Sensor** - An intermittent TP signal output will cause the system to go rich, due to a false indication of the engine accelerating.
- **ECT Sensor** - Check for a shifted sensor that could cause a rich exhaust but set a DTC 15, refer to chart for DTC 15.

**DTC 45**  
**RICH EXHAUST**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-2-93  
NS 14241



### DTC 53 SYSTEM VOLTAGE HIGH

#### Circuit Description:

CKT 440 is the battery feed for the PCM.

**DTC 53 Will Set When:** The ignition is "ON" and PCM terminal "E16" voltage is greater than 19.5 volts for 2 seconds.

**Action Taken (PCM will default to):** During the time the failure is present, the pressure control solenoid is turned "OFF," transmission shifts immediately to third gear, and TCC operation is inhibited. (The setting of additional diagnostic trouble codes may result.) The PCM will enable the MIL.

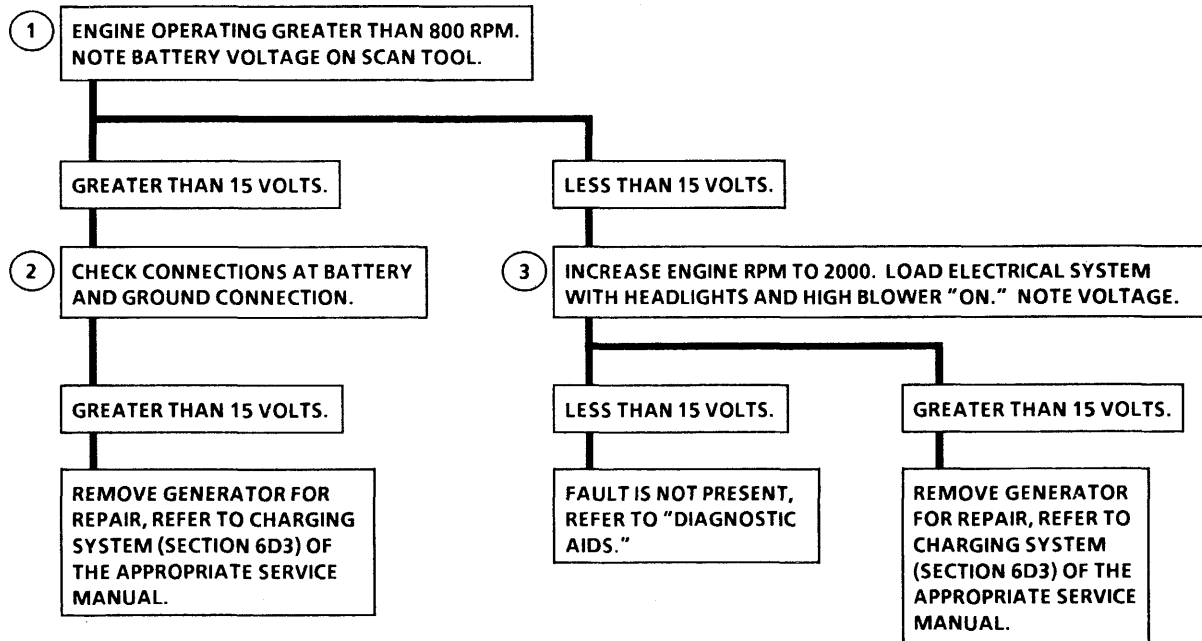
**DTC 53 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

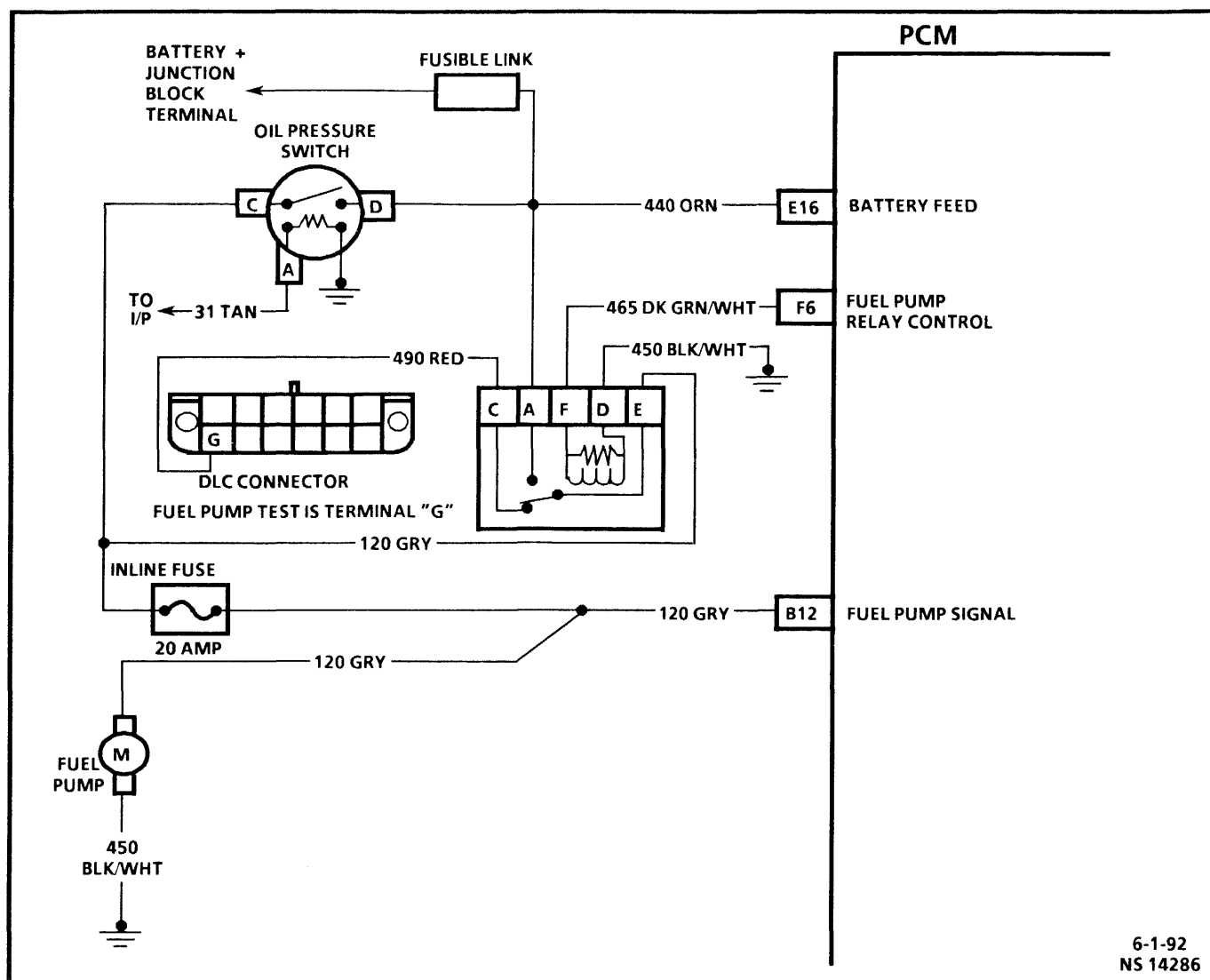
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the high voltage reading is due to the generator, CKT 440 or PCM, with engine operating, check voltage is above 15 volts, the PCM is OK.
3. This test checks to see if generator is faulty under load condition. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

**Diagnostic Aids:** CKT 440 supplies voltage to the PCM.

Charging battery with a battery charger and jump-starting engine may set DTC 53. If diagnostic trouble code sets when an accessory is operated, check for poor connections or excessive current draw. Refer to SECTION 6D3 of appropriate service manual for circuit details. Also, check for poor connections at starter solenoid or fusible link.

**DTC 53  
SYSTEM VOLTAGE HIGH**



## DTC 54

### FUEL PUMP RELAY (LOW VOLTAGE)

#### Circuit Description:

The status of the fuel pump CKT 120 is monitored by the PCM at terminal "B12" and is used to compensate fuel delivery based on system voltage. This signal is also used to store a DTC if the fuel pump relay is defective or fuel pump voltage is lost while the engine is running. There should be about 12 volts on CKT 120 for at least 2 seconds after the ignition is turned "ON," or any time reference pulses are being received by the PCM.

**DTC 54 Will Set When:** The voltage at terminal "B12" is less than 2 volts for 1.5 seconds since the last reference pulse was received. This DTC is designed to detect a faulty relay, causing extended crank time, and the DTC will help the diagnosis of an engine that "Crank But Will Not Run."

**Action Taken (PCM will default to):** The PCM will enable the MIL.

**DTC 54 Will Clear When:** Conditions for fault are no longer present and Tech 1 "clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**Diagnostic Aids:** Refer to "Intermittents" in SECTION 2.

## DTC 54 FUEL PUMP RELAY (LOW VOLTAGE)

DISCONNECT FUEL MODULE IF EQUIPPED

- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON."
- LISTEN FOR IN-TANK FUEL PUMP.
- PUMP SHOULD RUN AFTER IGNITION "ON."

NO

- IGNITION "OFF."
- USING A FUSED JUMPER WIRE, CONNECT FUEL PUMP TEST CONNECTOR TO FIXED 12 VOLTS.
- DOES PUMP OPERATE?

YES

- IGNITION "OFF."
- DISCONNECT FUEL PUMP RELAY.
- PROBE CKT 440 WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON"

CONNECT TEST LIGHT BETWEEN CKTs 440 AND 450.

TEST LIGHT "OFF"

REPAIR OPEN IN CKT 440

NO

- DISCONNECT FUEL PUMP RELAY.
- USING THE FUSED JUMPER WIRE, CONNECT CKT 120 TO 12 VOLTS.
- DOES PUMP OPERATE?

YES

FAULTY RELAY

NO

OPEN CKT 120, FAULTY IN-TANK PUMP OR FAULTY PUMP GROUND.

YES

- CLEAR DTCs.
- START AND RUN ENGINE FOR 30 SECONDS OR UNTIL DTC 54 SETS.
- DOES DTC SET?

YES

- BACKPROBE PCM TERMINAL "B12" WITH A TEST LIGHT TO GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- NOTE TEST LIGHT AFTER IGNITION "ON."

TEST LIGHT "ON"

FAULTY CONNECTION AT PCM OR FAULTY PCM.

NO

DTC 54 IS INTERMITTENT. REFER TO "DIAGNOSTIC AIDS."

TEST LIGHT "OFF"

OPEN CKT 120 TO PCM.

TEST LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN FUEL PUMP HARNESS CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- NOTE TEST LIGHT AFTER IGNITION "ON."

TEST LIGHT "ON" 2 SECONDS

- FAULTY CONNECTION AT RELAY TERMINAL "F" OR FAULTY RELAY.
- CONTINUE TEST IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT OPERATE."
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL. START ENGINE.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO OPERATE..

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

TEST LIGHT "OFF"

FUEL PUMP CIRCUIT OK

TEST LIGHT "OFF"

REPAIR OPEN CKT 450

TEST LIGHT "OFF"

CKT 465 OPEN, SHORTED TO GROUND, OR FAULTY PCM.

NO

FAULTY OIL PRESSURE SWITCH

TEST LIGHT "ON"

FAULTY OIL PRESSURE SWITCH

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.



**DTC 51**  
**DTC 55**

**DTC 51**  
**FAULTY PROM (MEM-CAL)**

CHECK THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET. IF OK, REPLACE PROM (MEM-CAL), CLEAR MEMORY, AND RECHECK. IF DTC 51 REAPPEARS, REPLACE PCM.

**DTC 55**  
**FAULTY PCM**

BE SURE PCM GROUNDS ARE OK AND THAT PROM (MEM-CAL) IS PROPERLY LATCHED. IF OK, REPLACE PCM.

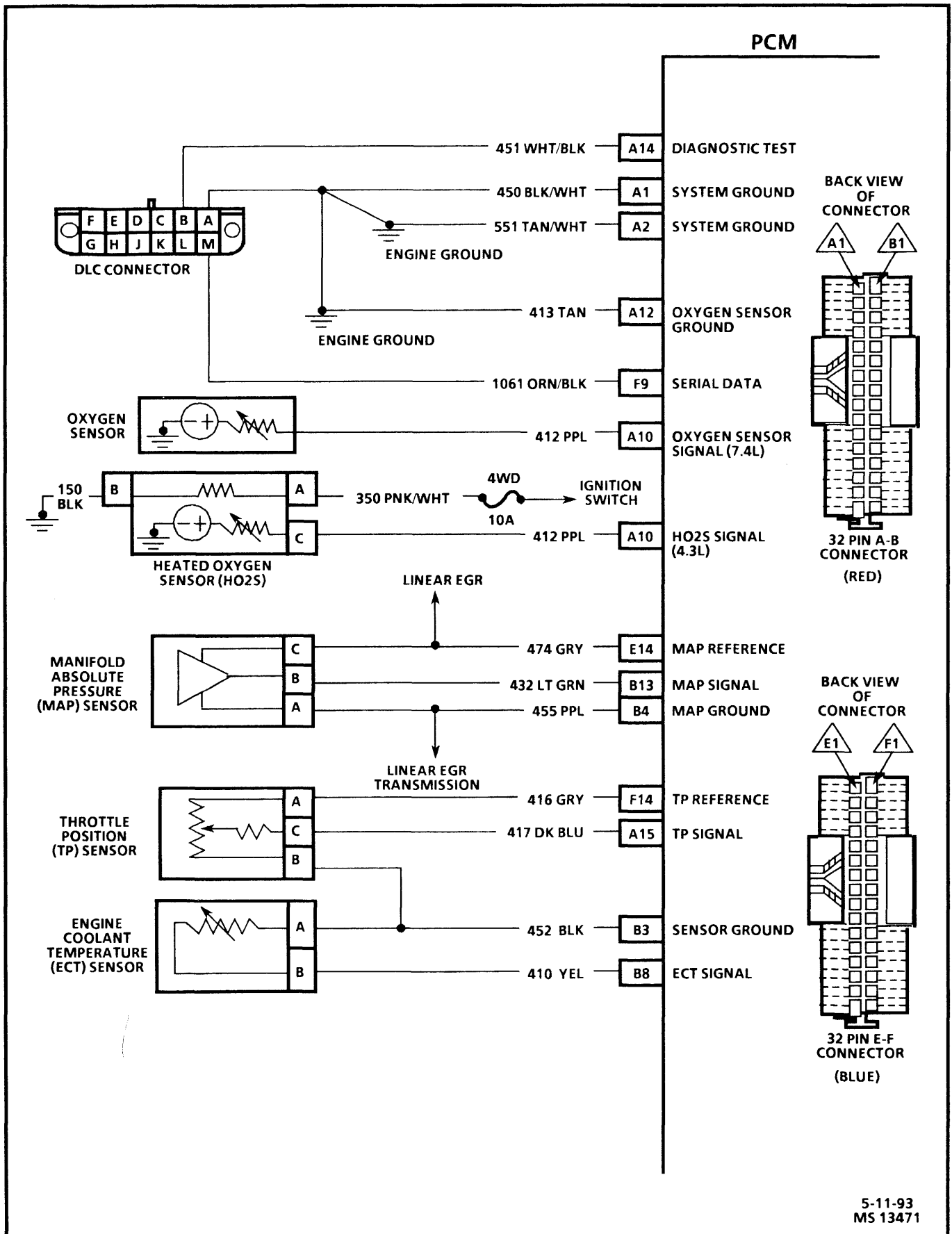


Figure 3A-4 - PCM Wiring Diagram 4.3L, 7.4L (C/K) Manual Transmission (1 of 4)

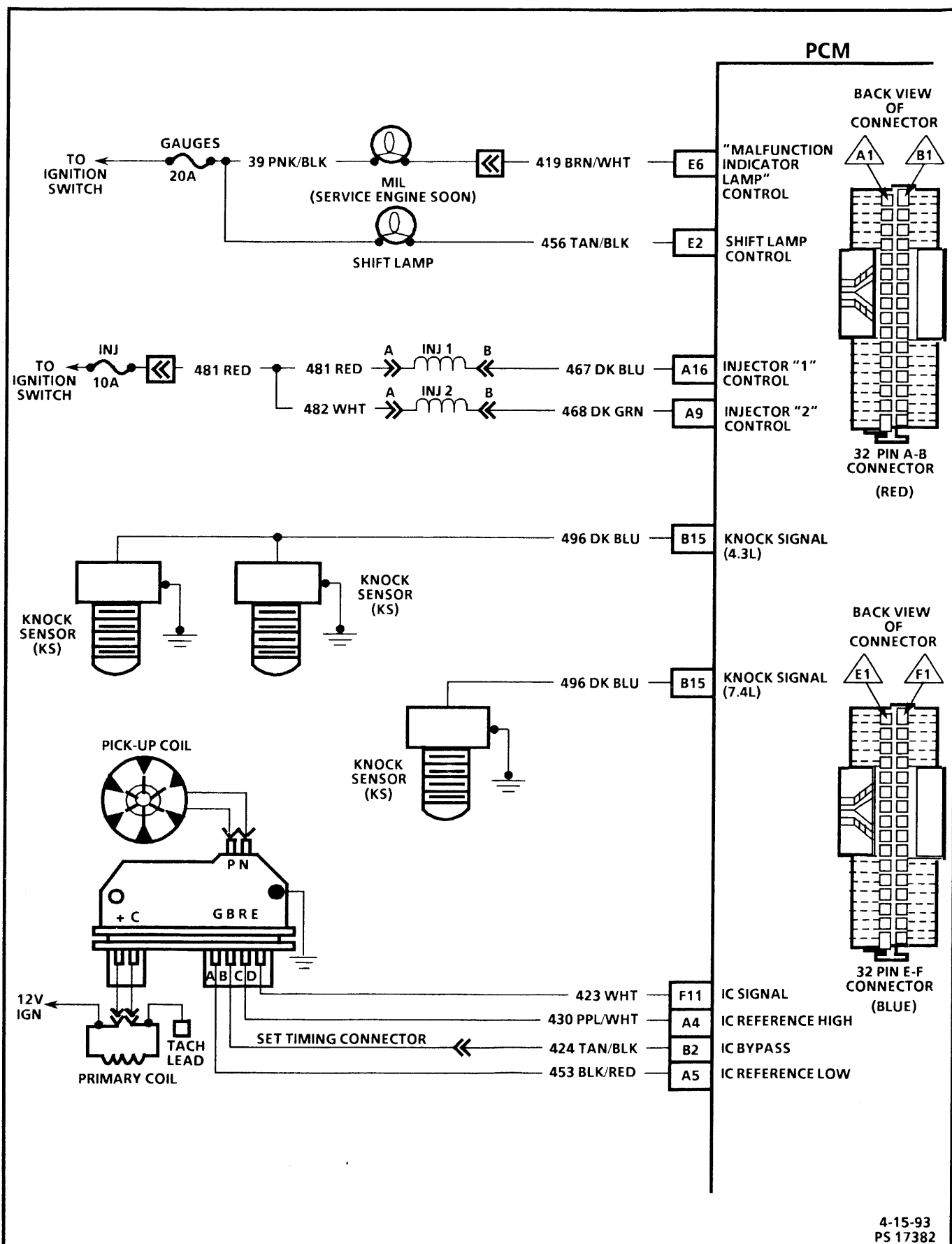
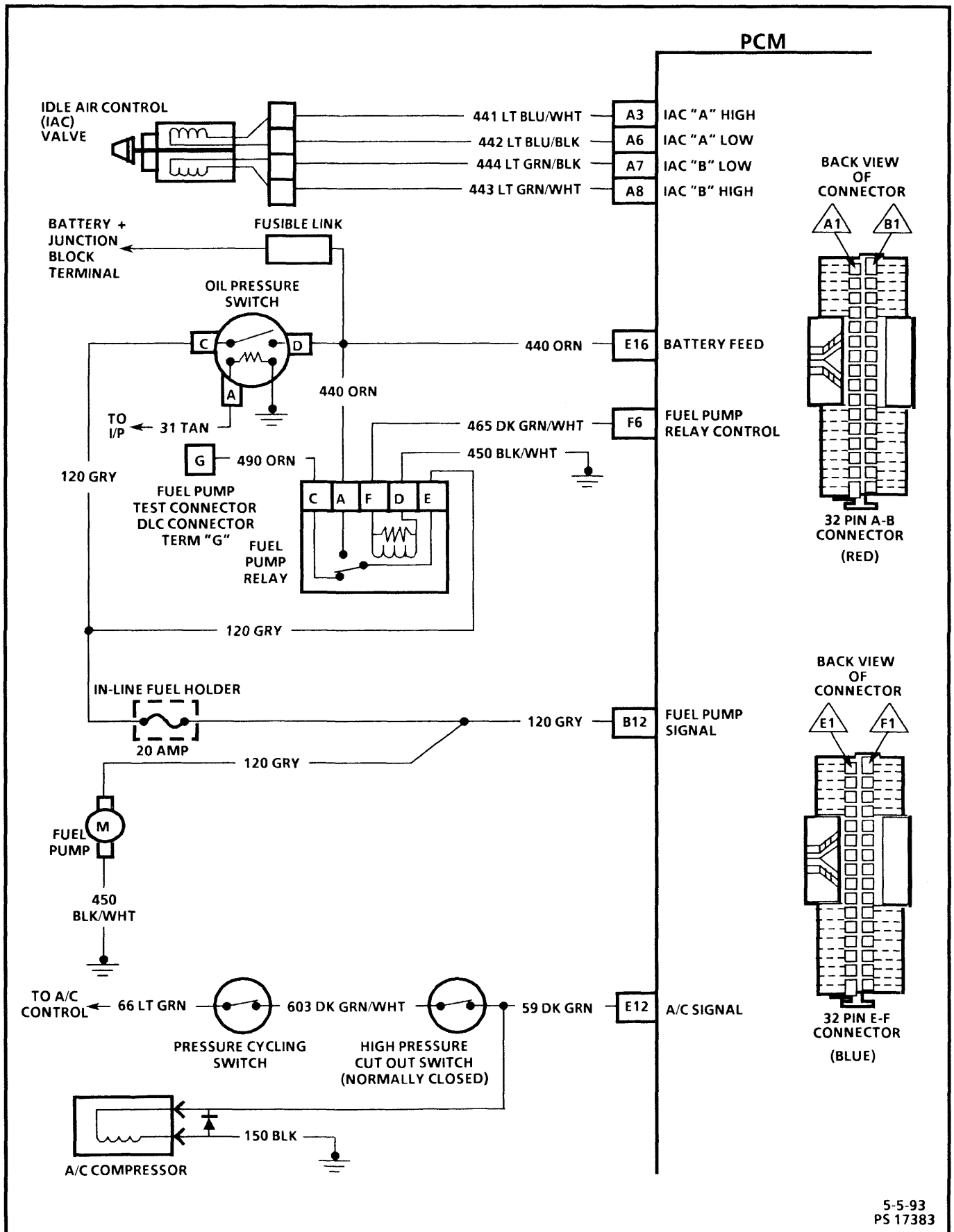


Figure 3A-5 - PCM Wiring Diagram 4.3L, 7.4L (C/K) Manual Transmission (2 of 4)



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PS 17383

Figure 3A-6 - PCM Wiring Diagram 4.3L, 7.4L (C/K) Manual Transmission (3 of 4)

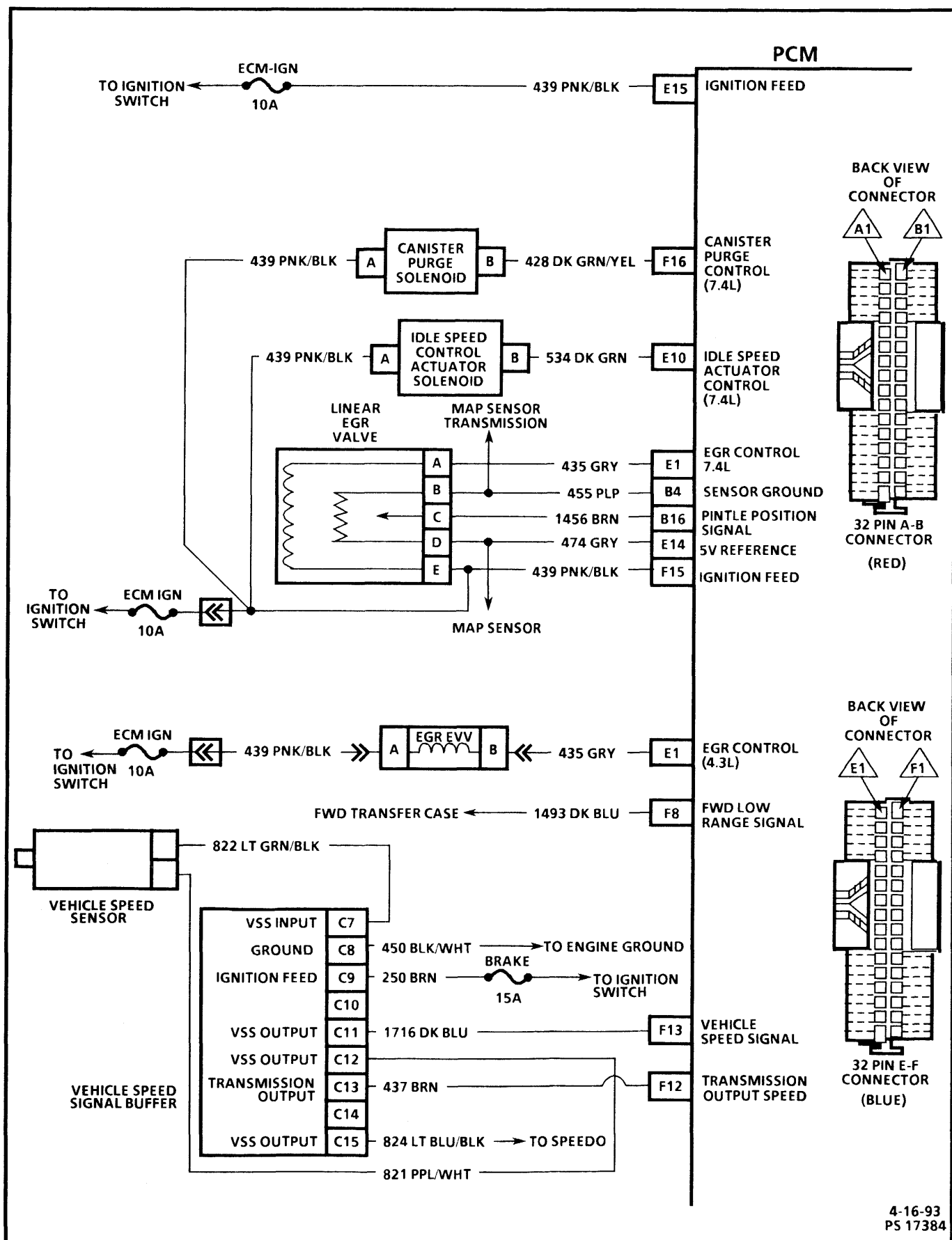


Figure 3A-7 - PCM Wiring Diagram 4.3L, 7.4L (C/K) Manual Transmission (4 of 4)

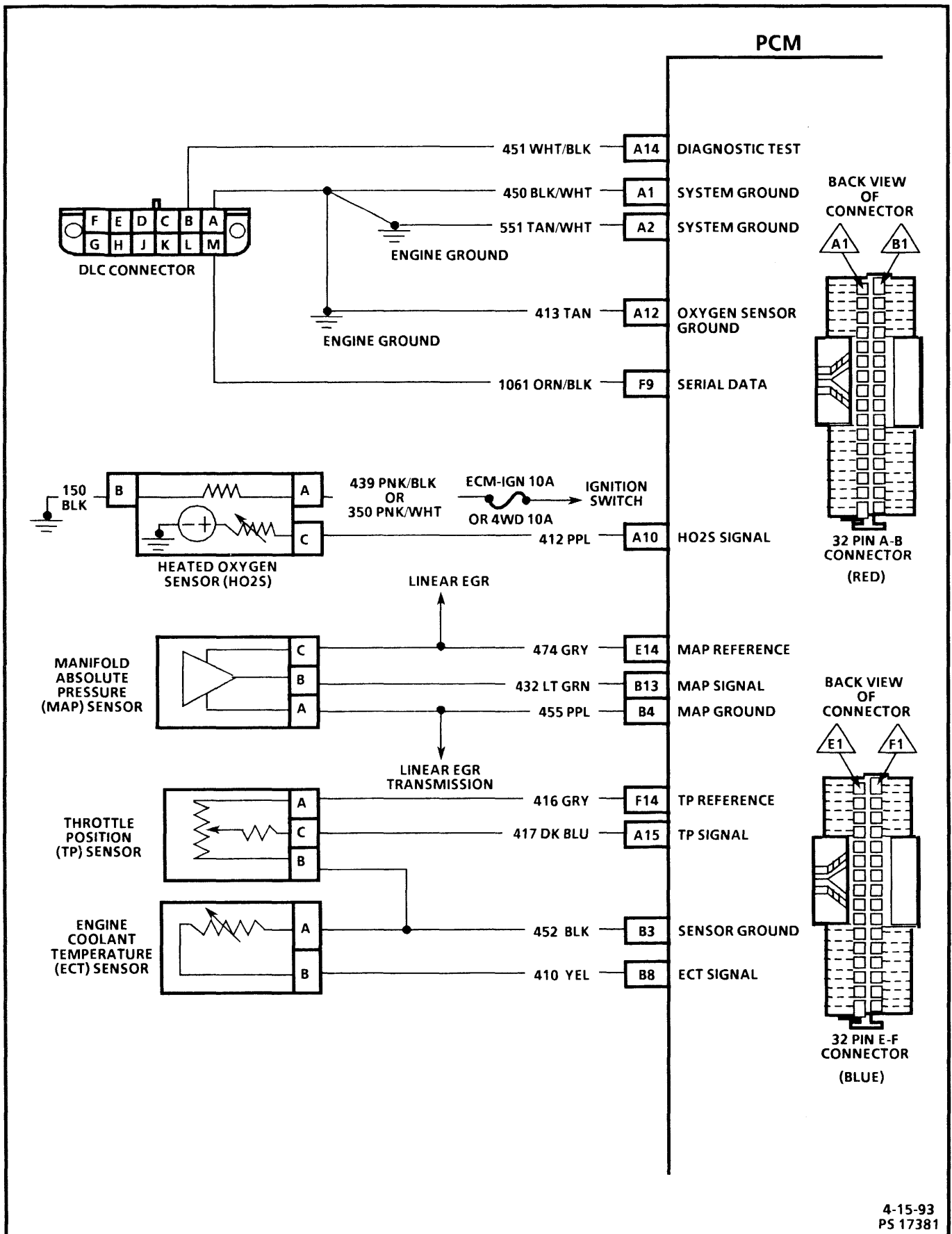
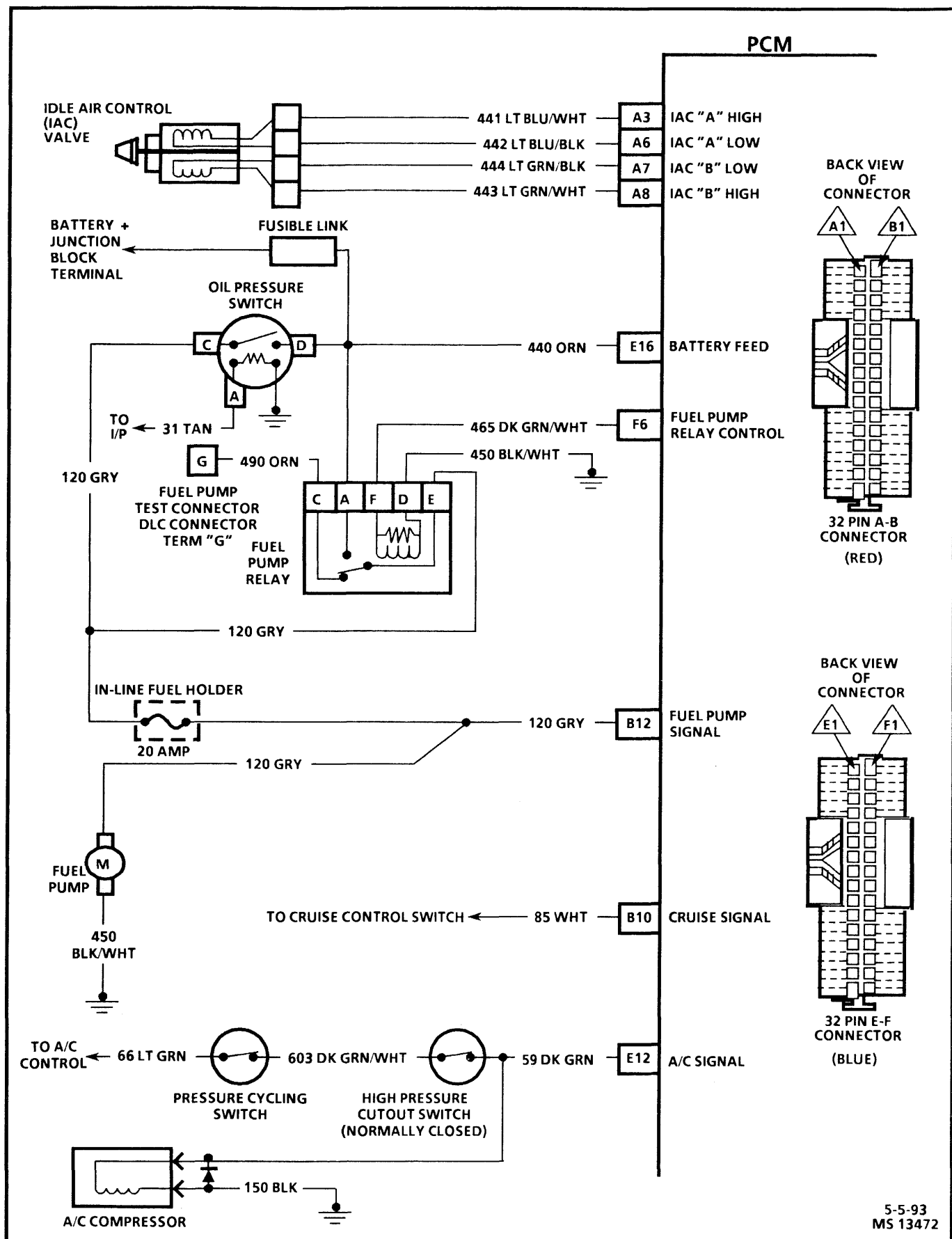


Figure 3A-8 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (1 of 6)



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MS 13472

Figure 3A-9 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (2 of 6)

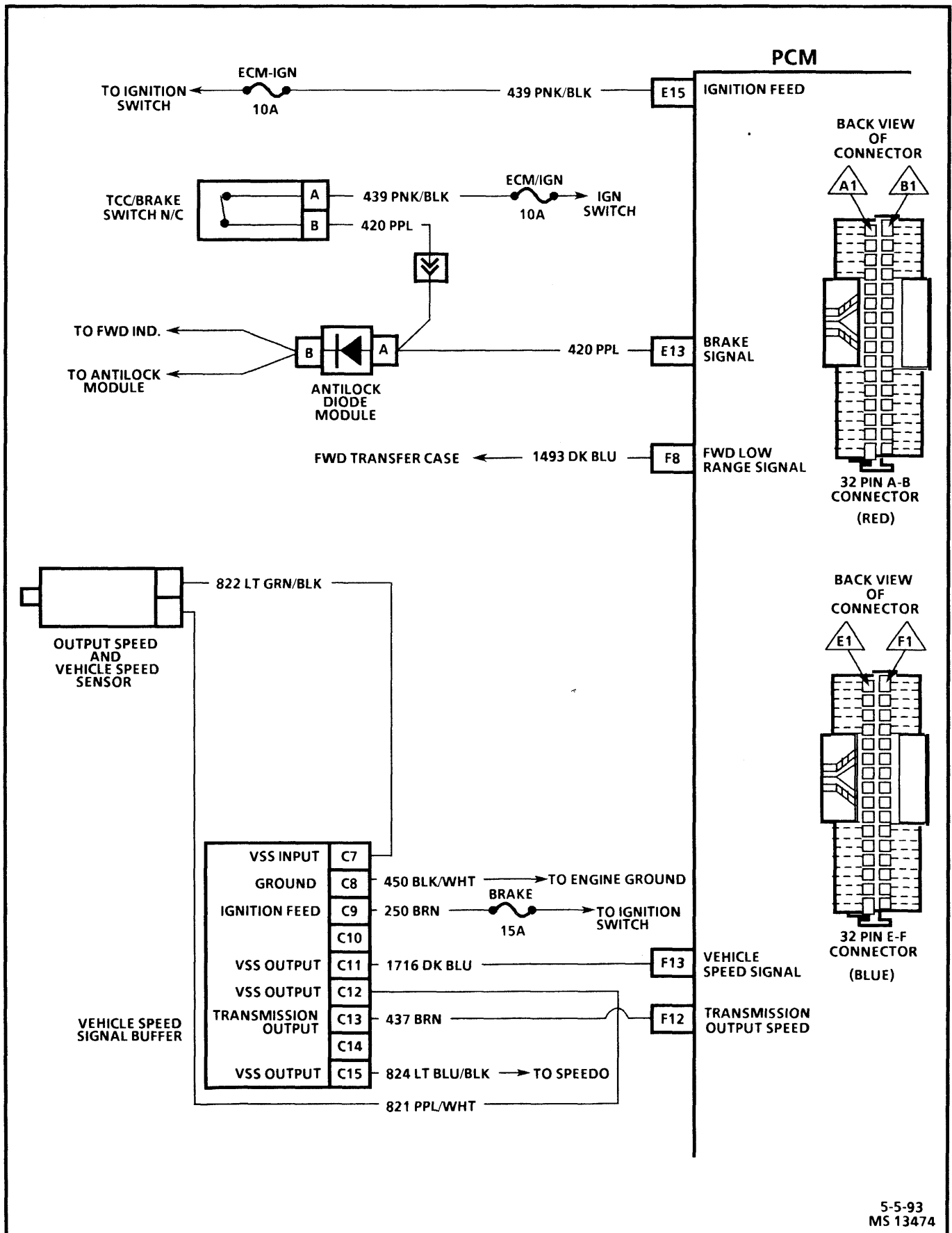


Figure 3A-10 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (3 of 6)



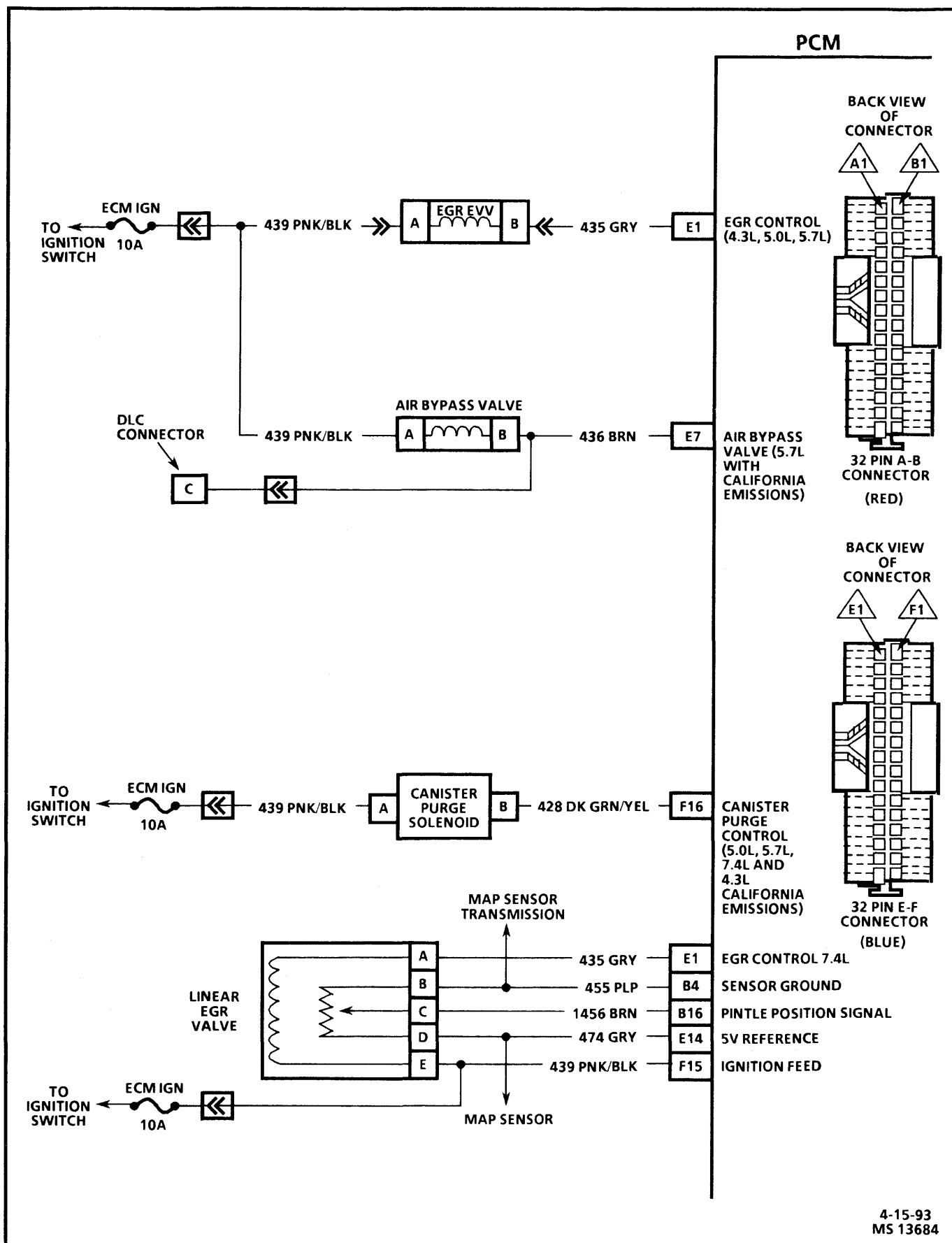


Figure 3A-11 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (4 of 6)

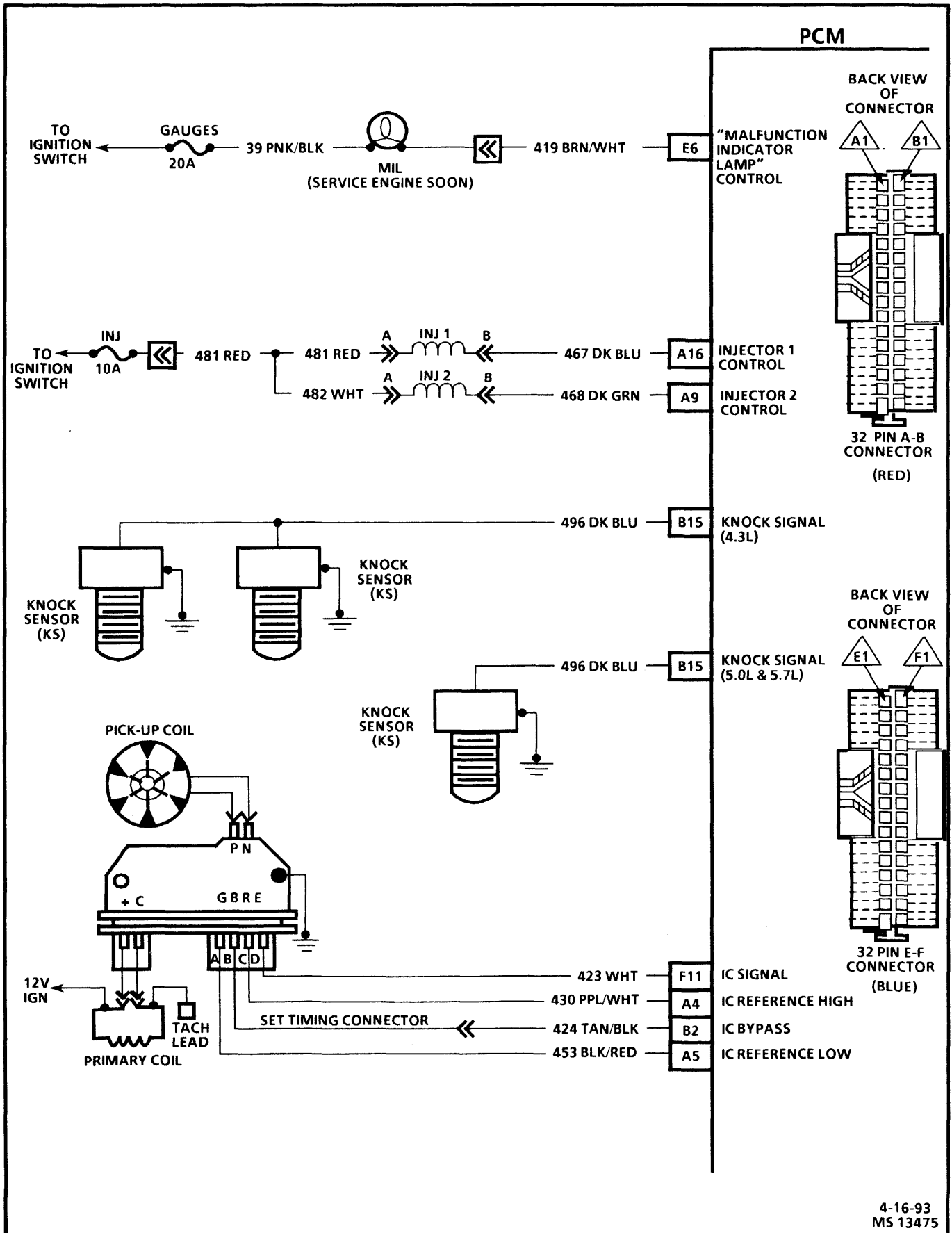


Figure 3A-12 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (5 of 6)

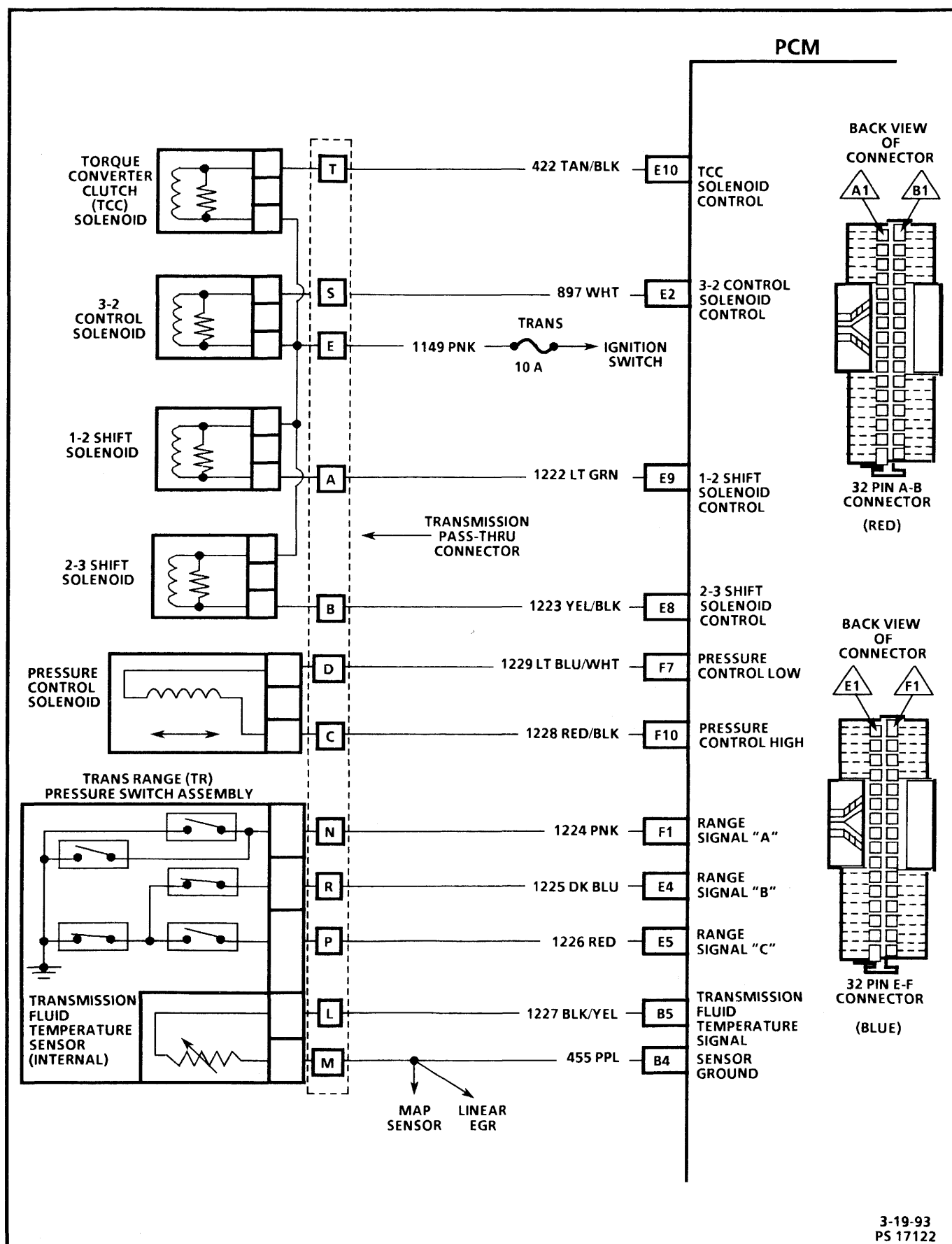


Figure 3A-13 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (6 of 6)

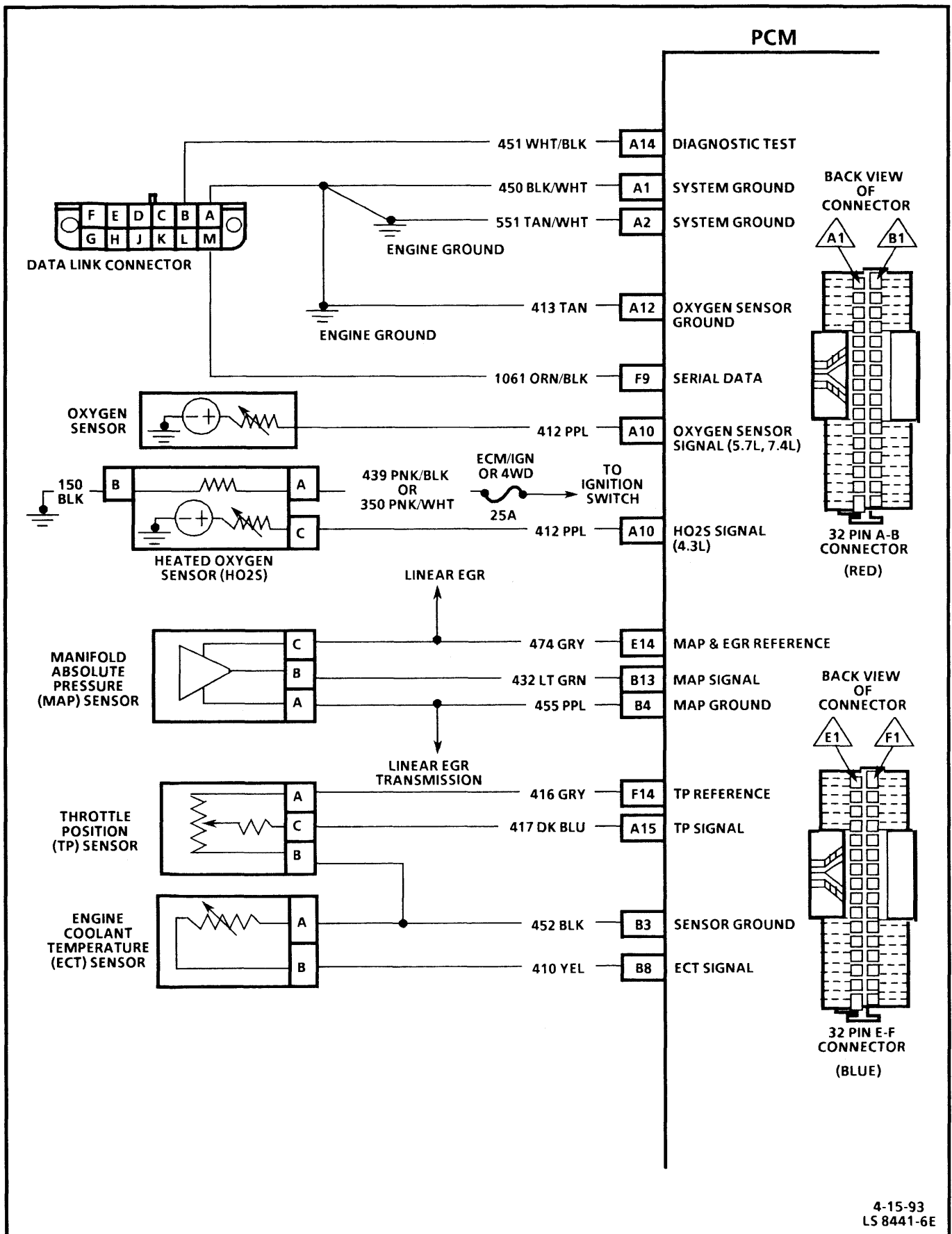


Figure 3A-14 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (1 of 6)

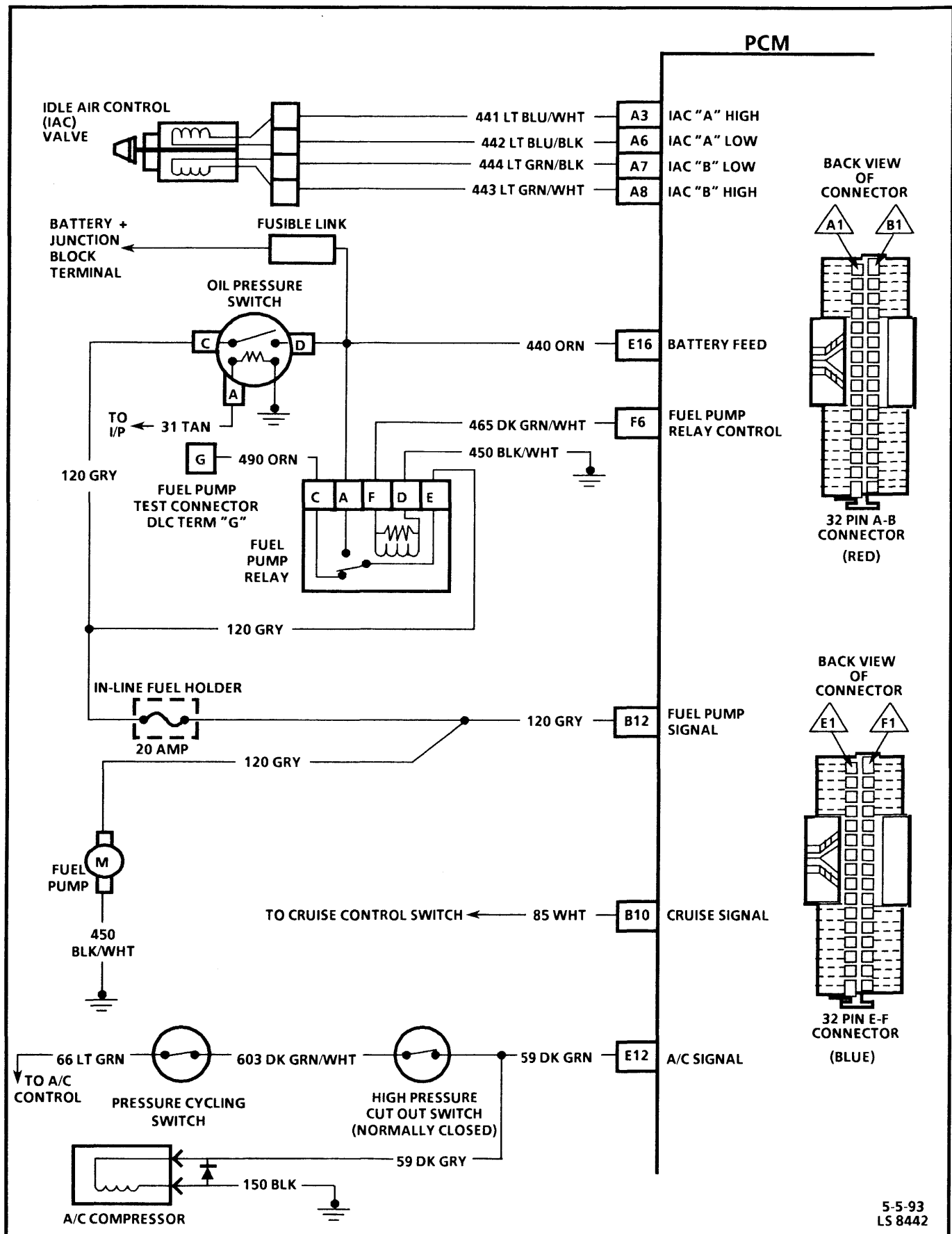


Figure 3A-15 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (2 of 6)

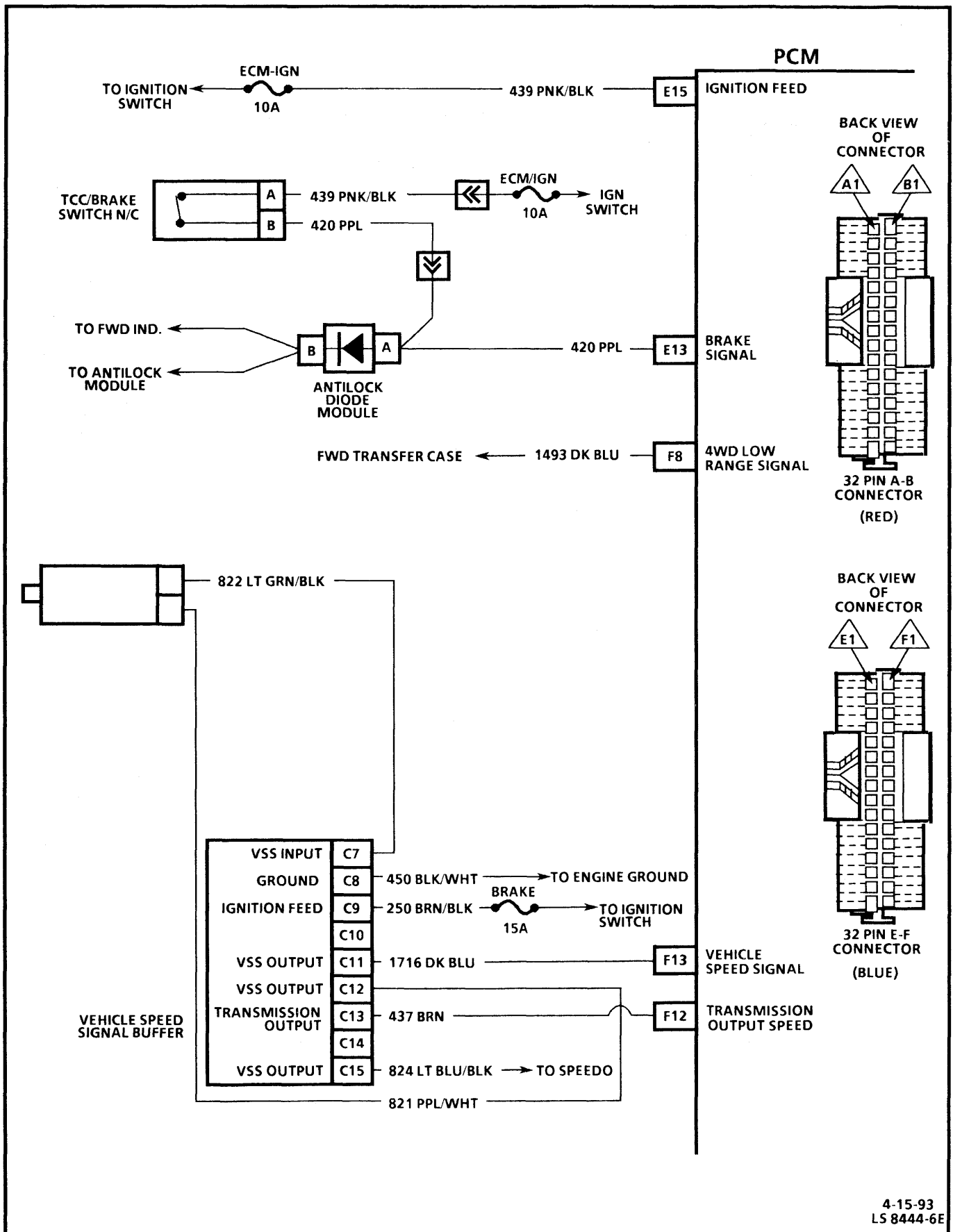


Figure 3A-16 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (3 of 6)

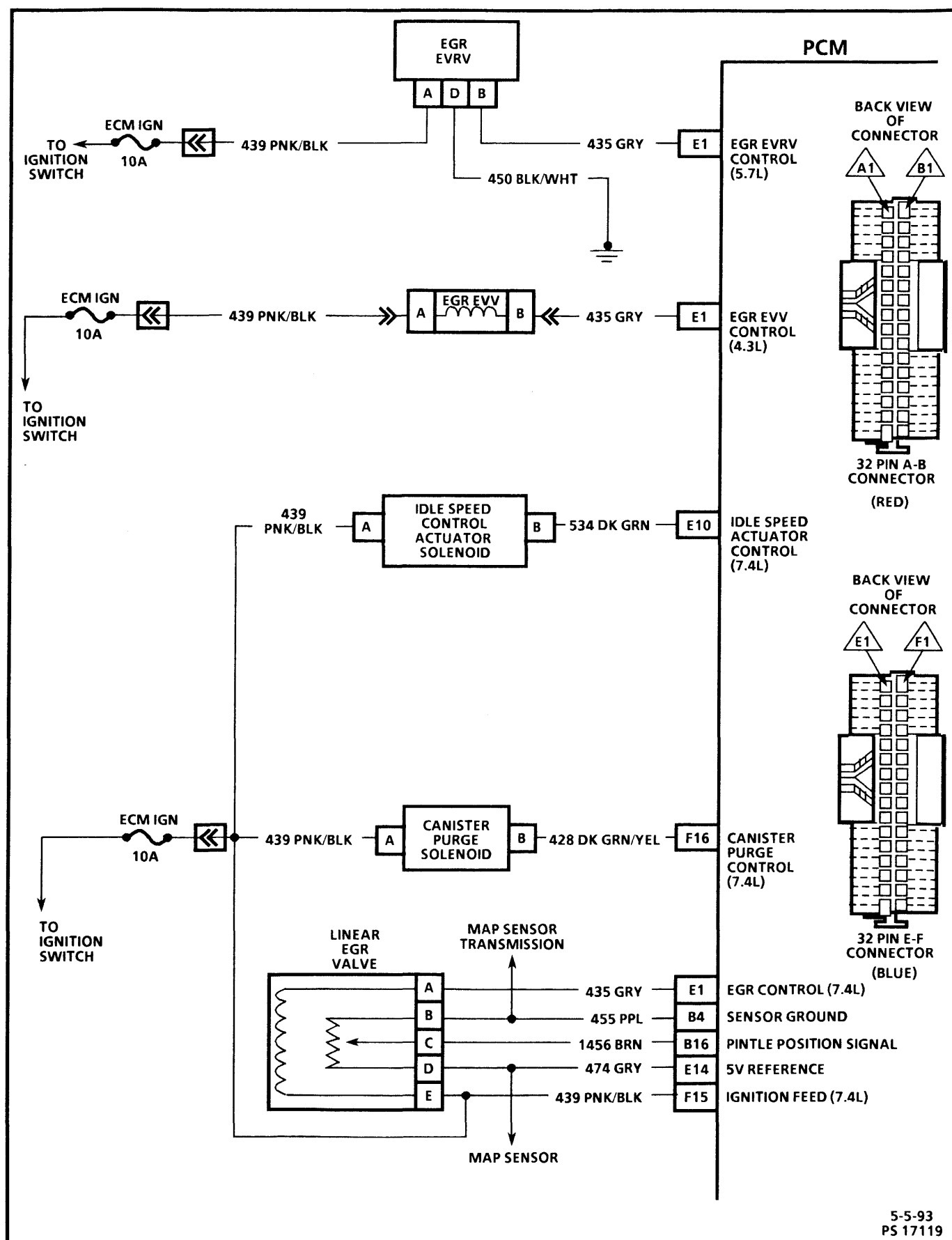
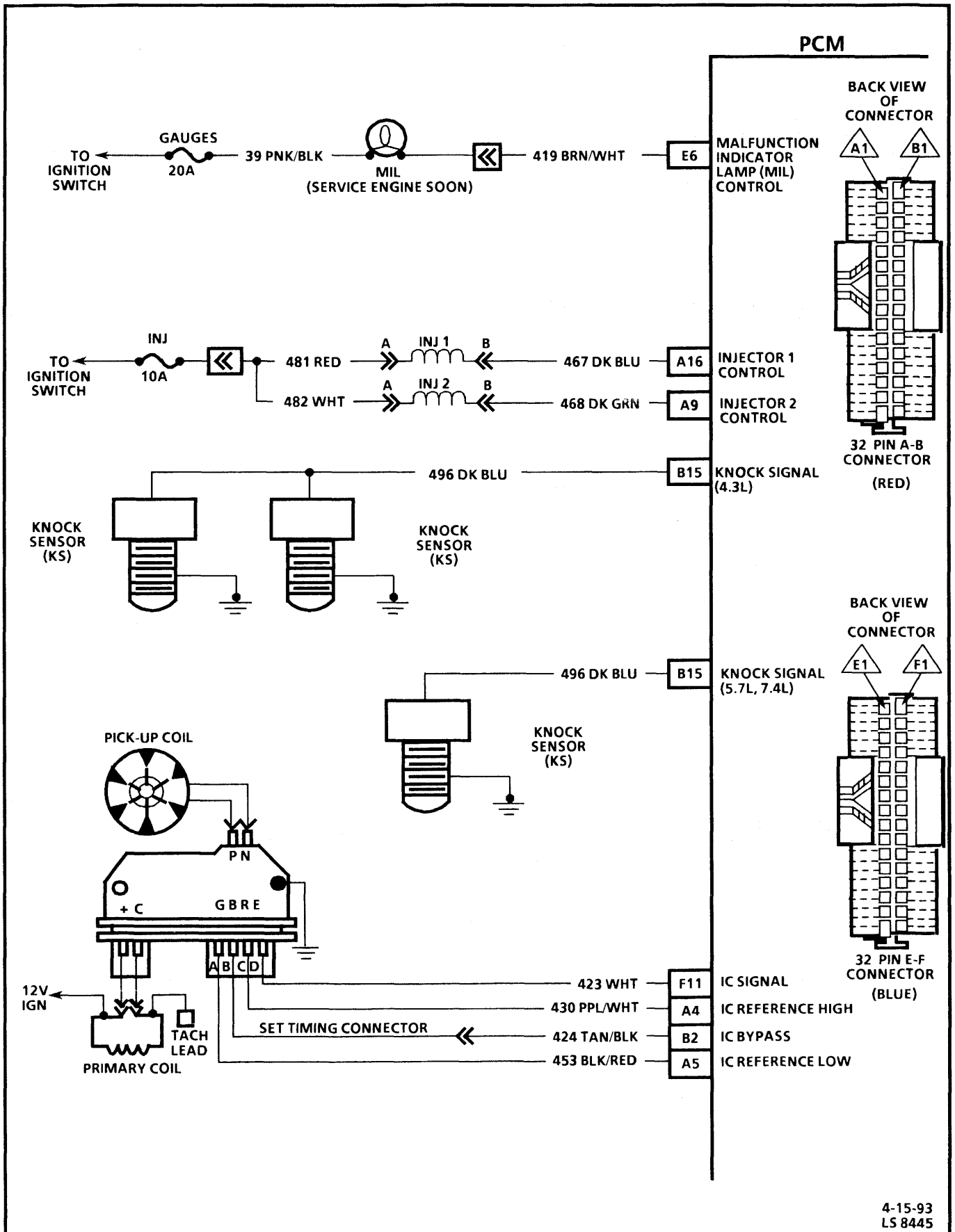


Figure 3A-17 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (4 of 6)



4-15-93  
LS 8445

Figure 3A-18 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (5 of 6)



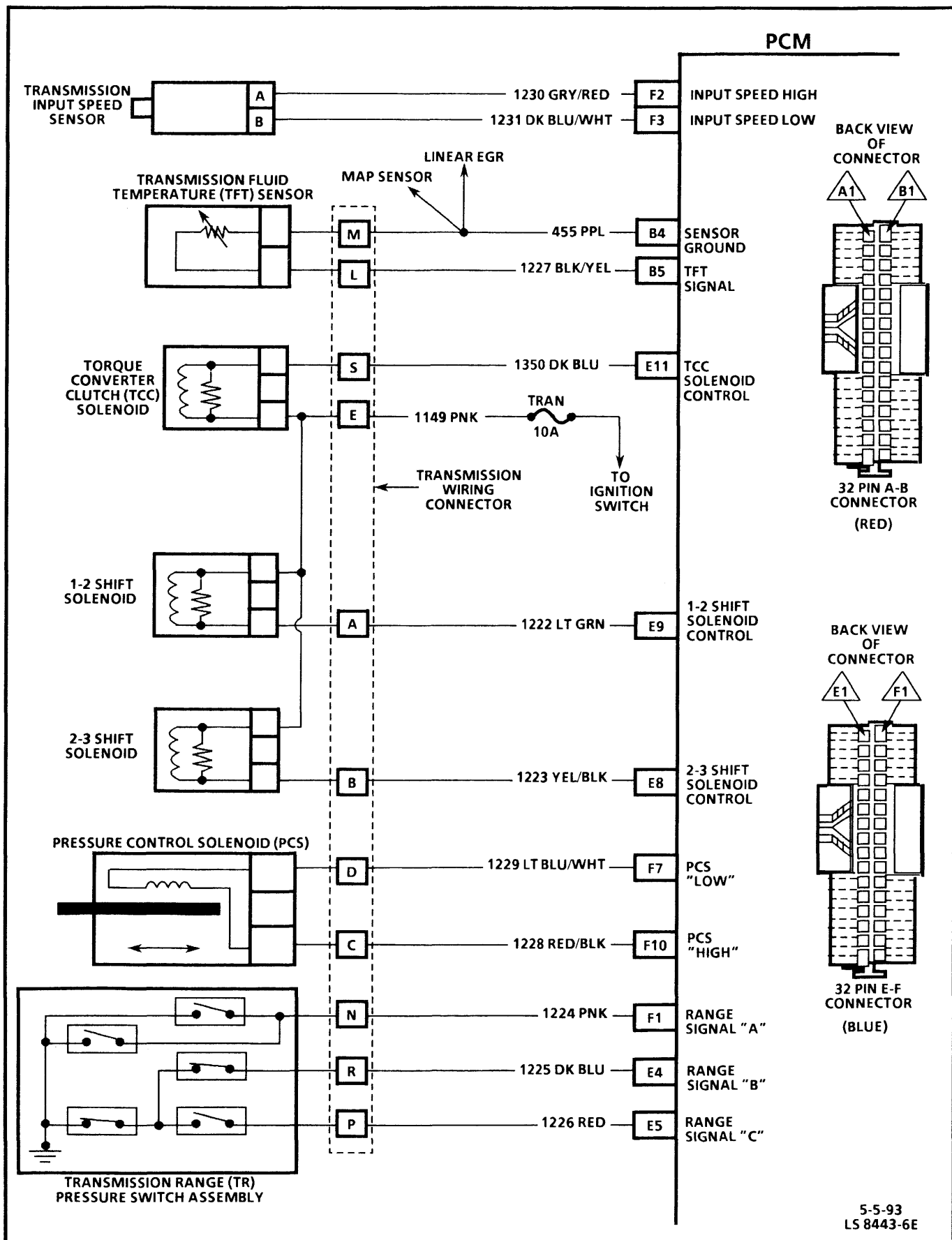


Figure 3A-19 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (6 of 6)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

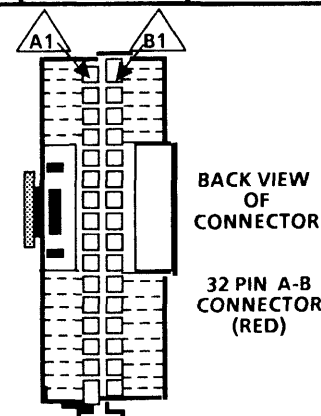
- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION         | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | SYMPTOMS                                    |
|-----|----------------------|-------|------------|---------------------|----------------|------------------|-----------------|---------------------------------------------|
|     |                      |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                             |
| A1  | SYSTEM GROUND        | 450   | BLK/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A2  | SYSTEM GROUND        | 551   | TAN/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A3  | IAC "A" HIGH         | 441   | LT BLU/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | 35              | OPERATION UNSTABLE                          |
| A4  | IC REF HIGH          | 430   | PPL/WHT    | DISTRIBUTOR         | 0*             | 1.2V             | NONE            | NO RESTART                                  |
| A5  | IC REF LOW           | 453   | BLK/RED    | DISTRIBUTOR         | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A6  | IAC "A" LOW          | 442   | LT BLU/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | 35              | OPERATION UNSTABLE                          |
| A7  | IAC "B" LOW          | 444   | LT GRN/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | 35              | OPERATION UNSTABLE                          |
| A8  | IAC "B" HIGH         | 443   | LT GRN/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | 35              | OPERATION UNSTABLE                          |
| A9  | INJECTOR "2" CONTROL | 468   | DR GRN     | INJECTOR            | B +            | B +              | NONE            | STALL - ROUGH IDLE                          |
| A10 | O2S SIGNAL           | 412   | PPL        | OXYGEN SENSOR       | (1)            | (1)              | 13<br>44        | EXHAUST ODOR, POOR PERFORMANCE              |
| A11 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A12 | O2S GROUND           | 413   | TAN        | ENGINE BLOCK        | 0*             | 0*               | 13<br>44        | FIXED O2                                    |
| A13 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A14 | DIAGNOSTIC TEST      | 451   | WHT/BLK    | DATA LINK CONNECTOR | 5V             | 5V               | NONE            | NO CHANGE                                   |
| A15 | TP SIGNAL            | 417   | DK BLU     | TP                  | .6 (2)         | .6 (2)           | 22              | POOR PERFORMANCE, HARSH TRANSMISSION SHIFTS |
| A16 | INJECTOR "1" CONTROL | 467   | DK BLU     | INJECTOR            | B +            | B +              | NONE            | STALL - ROUGH IDLE                          |

(1) VARIES.

(2) VARIES WITH THROTTLE MOVEMENT.

\* LESS THAN .5 VOLT (500 mV).



4-16-93  
PS 17385

Figure 3A-20 - PCM Connector Terminal End View 4.3L, 7.4L (C/K) Manual Transmission (1 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

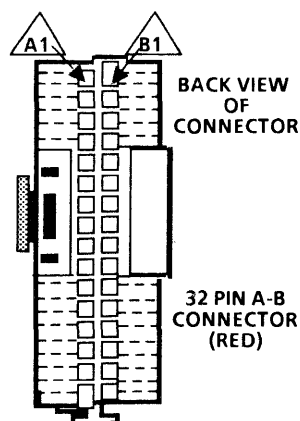
The "B + " indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION           | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS           |
|-----|------------------------|-------|------------|---------------------|----------------|------------------|-----------------|-----------------------------|
|     |                        |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                             |
| B1  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B2  | IC BYPASS              | 424   | TAN/BLK    | DISTRIBUTOR         | 0*             | 4.5V             | 42              | FIXED TIMING, LACK OF POWER |
| B3  | SENSOR GROUND          | 452   | BLK        | TP, ECT             | 0*             | 0*               | 14, 15, 21      | HIGH IDLE                   |
| B4  | SENSOR GROUND MAP, EGR | 455   | PPL        | MAP LINEAR EGR      | 0*             | 0*               | 58, 59, 33, 32  | IDLE SURGE, EXHAUST ODOR    |
| B5  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B6  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B7  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B8  | ECT SIGNAL             | 410   | YEL        | ECT                 | (4) 2.0 2.4V   | (4) 2.0 2.4V     | 14, 15          | POOR PERFORMANCE            |
| B9  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B10 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B11 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B12 | FUEL PUMP SIGNAL       | 120   | GRY        | INLINE FUSE         | 0* (1)         | B +              | 54              | NO CHANGE                   |
| B13 | MAP SIGNAL             | 432   | LT GRN     | MAP                 | 4.9V           | 1.46V (3)        | 33, 34          | POOR PERFORMANCE            |
| B14 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                           |
| B15 | KNOCK SENSOR           | 496   | DK BLU     | KNOCK SENSOR        | 2.4V           | 2.4V             | 43              | KNOCK RETARD                |
| B16 | EGR PINTLE 7.4L        | 1456  | BRN        | EGR                 | (2) .85        | (2) .85          | 32              | EGR INOP                    |

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS.  
 (2) VARIES WITH EGR MOVEMENT.  
 (3) VARIES WITH MANIFOLD VACUUM.  
 (4) VARIES WITH TEMPERATURE.  
 \* LESS THAN .5 VOLT (500 mV).



4-16-93  
PS 17386

Figure 3A-21 - PCM Connector Terminal End View 4.3L, 7.4L (C/K) Manual Transmission (2 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

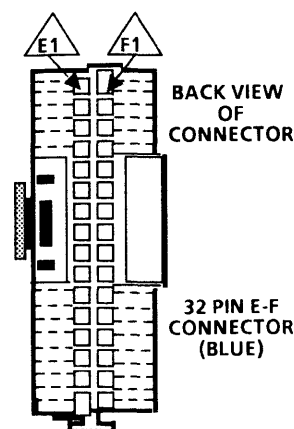
The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- "Closed Loop"
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded
- Scan tool not installed

| PIN | PIN FUNCTION                | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS              |
|-----|-----------------------------|-------|------------|---------------------|----------------|------------------|-----------------|--------------------------------|
|     |                             |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                |
| E1  | EGR CONTROL                 | 435   | GRY        | EGR                 | B +            | B +              | 32              | DETONATION                     |
| E2  | SHIFT LAMP CONTROL          | 456   | TAN/BLK    | I/P                 | B +            | B +              | NONE            | SHIFT LAMP INOP                |
| E3  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E4  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E5  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E6  | MIL                         | 419   | BRN/WHT    | I/P                 | 0*             | B +              | NONE            | MIL INOP                       |
| E7  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E8  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E9  | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E10 | IDLE SPEED ACTUATOR CONTROL | 534   | DK GRN     | TBI                 | B +            | B +              | 36              | HIGH IDLE WHEN WARM            |
| E11 | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E12 | A/C SIGNAL                  | 59    | DK/GRN     | A/C SWITCH          | 0* (1)         | 0* (1)           | NONE            | INCORRECT IDLE                 |
| E13 | NOT USED                    | -     | -          | -                   | -              | -                | -               | -                              |
| E14 | MAP, LINEAR EGR REFERENCE   | 474   | GRY        | MAP                 | 5V             | 5V               | 34, 32          | POOR PERFORMANCE<br>ROUGH IDLE |
| E15 | IGNITION FEED               | 439   | PNK/BLK    | SPLICE              | B +            | B +              | NONE            | NO START MIL INOP              |
| E16 | BATTERY FEED                | 440   | ORN        | SPLICE              | B +            | B +              | NONE            | NO START MIL INOP              |

- (1) 0 VOLTS A/C "OFF" B + "ON."  
 (2) B + BRAKE NOT APPLIED 0 VOLTS BRAKE APPLIED.  
 \* LESS THAN .5 VOLTS (500 mV)



4-16-93  
PS 17387

Figure 3A-22 - PCM Connector Terminal End View 4.3L, 7.4L (C/K) Manual Transmission (3 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

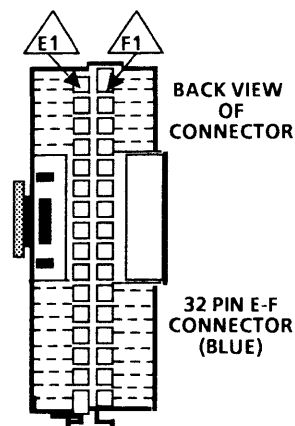
| PIN | PIN FUNCTION              | CKT # | WIRE COLOR  | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                          |
|-----|---------------------------|-------|-------------|---------------------|----------------|------------------|-----------------|--------------------------------------------|
|     |                           |       |             |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                            |
| F1  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F2  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F3  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F4  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F5  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F6  | FUEL PUMP RELAY CONTROL   | 465   | DK GRN/ WHT | FUEL PUMP RELAY     | 0* (2)         | B +              | 54              | LONG CRANK TIME BEFORE STARTING            |
| F7  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F8  | 4WD SWITCH                | 1493  | DK BLU      | 4WD INDICATOR       | B + (3)        | B + (3)          | NONE            | ERRATIC SHIFT PATTERNS                     |
| F9  | SERIAL DATA               | 1061  | ORN/BLK     | DATA LINK CONNECTOR | 5V             | 5V               | NONE            | NO SERIAL DATA                             |
| F10 | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F11 | IC SIGNAL                 | 423   | WHT         | DISTRIBUTOR         | 0*             | 1.2V             | 42              | RESTART FIXED TIMING                       |
| F12 | TRANSMISSION OUTPUT SPEED | 437   | BRN         | VSS BUFFER          | 0* (1)         | 0* (1)           | 72, 24          | ERRATIC SHIFT PATTERNS, POOR SHIFT QUALITY |
| F13 | VSS SIGNAL                | 1716  | DK BLU      | VSS BUFFER          | 0* (1)         | 0* (1)           | 16              | FUEL CUTOFF                                |
| F14 | TP REFERENCE              | 416   | GRY         | TP                  | 5V             | 5V               | 22              | LACK OF POWER HARSH SHIFTS                 |
| F15 | IGNITION FEED             | 439   | PNK/BLK     | SPLICE              | B +            | B +              | NONE            | NONE                                       |
| F16 | PURGE CONTROL             | 1428  | DK GRN      | PURGE SOLENOID      | B +            | B +              | NONE            | PURGE INOP                                 |

(1) VARIES FROM 0 TO 5 VOLTS, DEPENDING ON POSITION OF DRIVE WHEELS.

(2) BATTERY VOLTAGE 1<sup>ST</sup> 2 SECONDS.

(3) 0 VOLTS IN 4WD.

\* LESS THAN .5 VOLT (500 mV).



4-15-93  
PS 17388

Figure 3A-23 - PCM Connector Terminal End View 4.3L, 7.4L (C/K) Manual Transmission (4 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

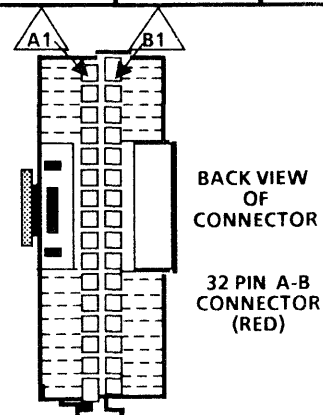
The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION         | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | SYMPTOMS                                    |
|-----|----------------------|-------|------------|---------------------|----------------|------------------|-----------------|---------------------------------------------|
|     |                      |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                             |
| A1  | SYSTEM GROUND        | 450   | BLK/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A2  | SYSTEM GROUND        | 551   | TAN/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A3  | IAC "A" HIGH         | 441   | LT BLU/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A4  | IC REF HIGH          | 430   | PPL/WHT    | DISTRIBUTOR         | 0*             | 1.2              | NONE            | NO RESTART                                  |
| A5  | IC REF LOW           | 453   | BLK/RED    | DISTRIBUTOR         | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A6  | IAC "A" LOW          | 442   | LT BLU/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A7  | IAC "B" LOW          | 444   | LT GRN/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A8  | IAC "B" HIGH         | 443   | LT GRN/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A9  | INJECTOR "2" CONTROL | 468   | DK GRN     | INJECTOR            | B +            | B +              | NONE            | STALL - ROUGH IDLE                          |
| A10 | HO2S SIGNAL          | 412   | PPL        | OXYGEN SENSOR       | (1)            | (1)              | 13<br>44        | EXHAUST ODOR, POOR PERFORMANCE              |
| A11 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A12 | HO2S GROUND          | 413   | TAN        | ENGINE BLOCK        | 0*             | 0*               | 13<br>44        | FIXED O2                                    |
| A13 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A14 | DIAGNOSTIC TEST      | 451   | WHT/BLK    | DATA LINK CONNECTOR | 5V             | 5V               | NONE            | NO CHANGE                                   |
| A15 | TP SIGNAL            | 417   | DK BLU     | TP                  | .6 (2)         | .6 (2)           | 22              | POOR PERFORMANCE, HARSH TRANSMISSION SHIFTS |
| A16 | INJECTOR "1" CONTROL | 467   | DK BLU     | INJECTOR            | B +            | B +              | NONE            | STALL - ROUGH IDLE                          |

- (1) VARIES.  
 (2) VARIES WITH THROTTLE MOVEMENT.  
 \* LESS THAN .5 VOLT (500 mV).



5-5-93  
PS 17380

Figure 3A-24 - PCM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (1 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

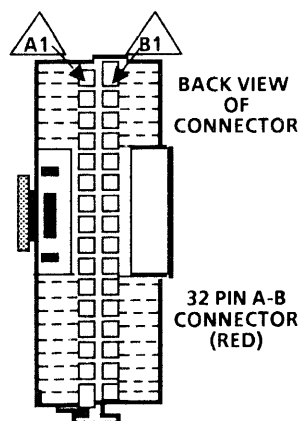
The "B + " indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION                        | CKT # | WIRE COLOR | COMPONENT CONNECTOR         | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                      |
|-----|-------------------------------------|-------|------------|-----------------------------|----------------|------------------|-----------------|----------------------------------------|
|     |                                     |       |            |                             | IGNITION "ON"  | ENGINE OPERATING |                 |                                        |
| B1  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B2  | IC BYPASS                           | 424   | TAN/BLK    | DISTRIBUTOR                 | 0*             | 4.5V             | 42              | FIXED TIMING, LACK OF POWER            |
| B3  | SENSOR GROUND                       | 452   | BLK        | TP, ECT                     | 0*             | 0*               | 14, 15, 21      | HIGH IDLE                              |
| B4  | SENSOR GROUND MAP, EGR TRANSMISSION | 455   | PPL        | MAP TRANSMISSION LINEAR EGR | 0*             | 0*               | 58, 59, 33, 32  | IDLE SURGE, TRANSMISSION, EXHAUST ODOR |
| B5  | TFT SIGNAL                          | 1227  | BLK/YEL    | TRANSMISSION                | 3.5V           | 3.5V             | 58, 59, 33      | EARLY TCC                              |
| B6  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B7  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B8  | ECT SIGNAL                          | 410   | YEL        | ECT                         | (4) 2.4V       | (4) 2.4V         | 14, 15          | POOR PERFORMANCE                       |
| B9  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B10 | CRUISE SIGNAL                       | 85    | WHT        | CRUISE                      | B +            | B +              | NONE            | NO CHANGE                              |
| B11 | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B12 | FUEL PUMP SIGNAL                    | 120   | GRY        | INLINE FUSE                 | 0* (1)         | B +              | 54              | NO CHANGE                              |
| B13 | MAP SIGNAL                          | 432   | LT GRN     | MAP                         | 4.9V           | 1.46V (3)        | 33, 34          | POOR PERFORMANCE                       |
| B14 | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B15 | KNOCK SENSOR                        | 496   | DK BLU     | KNOCK SENSOR                | 2.4V           | 2.4V             | 43              | KNOCK RETARD                           |
| B16 | EGR PINTLE                          | 1456  | BRN        | EGR                         | (2) .85        | (2) .85          | 32              | EGR INOP                               |

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS.  
(2) VARIES WITH EGR MOVEMENT.  
(3) VARIES WITH MANIFOLD VACUUM.  
(4) VARIES WITH TEMPERATURE.  
\* LESS THAN .5 VOLT (500 mV).



5-5-93  
MS 13412

Figure 3A-25 - PCM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (2 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

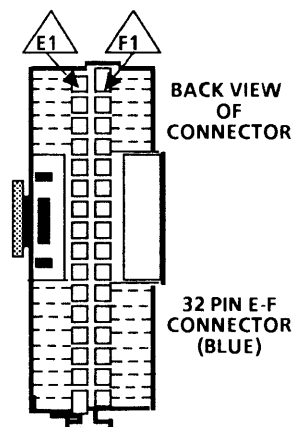
- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION                 | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS              |
|-----|------------------------------|-------|------------|---------------------|----------------|------------------|-----------------|--------------------------------|
|     |                              |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                |
| E1  | EGR CONTROL                  | 435   | GRY        | EGR                 | B +            | B +              | 32              | DETONATION                     |
| E2  | 3-2 CONTROL SOLENOID CONTROL | 897   | WHT        | TRANSMISSION        | B +            | B +              | 66              | TIC UP OR FLAIR 3-2 DOWNSHIFT  |
| E3  | NOT USED                     |       | -          | -                   | -              | -                | -               | -                              |
| E4  | RANGE SIGNAL "B"             | 1225  | DK BLU     | TRANSMISSION        | 0*             | 0*               | 28              | ERRATIC MANUAL DOWNSHIFTS      |
| E5  | RANGE SIGNAL "C"             | 1226  | RED        | TRANSMISSION        | "B"            | B +              | 28              | ERRATIC MANUAL DOWNSHIFTS      |
| E6  | MIL                          | 419   | BRN/WHT    | I/P                 | 0*             | B +              | NONE            | MIL INOP                       |
| E7  | AIR BYPASS VALVE             | 421   | DK BLU/WHT | AIR BYPASS VALVE    | B +            | B +              | 44, 45          | AIR BYPASS INOP                |
| E8  | 2-3 SHIFT SOLENOID CONTROL   | 1223  | YEL/BLK    | TRANSMISSION        | B +            | .4V              | 81              | INCORRECT GEAR STATE           |
| E9  | 1-2 SHIFT SOLENOID CONTROL   | 1222  | LT GRN     | TRANSMISSION        | B +            | .4V              | 82              | INCORRECT GEAR STATE           |
| E10 | TCC SOLENOID CONTROL         | 422   | TAN/BLK    | TRANSMISSION        | B +            | B +              | 67, 69          | POOR FUEL ECONOMY              |
| E11 | NOT USED                     | -     | -          | -                   | -              | -                | -               | -                              |
| E12 | A/C SIGNAL                   | 59    | DK/GRN     | A/C SWITCH          | 0* (1)         | 0* (1)           | NONE            | INCORRECT IDLE                 |
| E13 | BRAKE SIGNAL                 | 420   | PPL        | SPLICE              | B + (2)        | B + (2)          | 37, 38          | NO TCC                         |
| E14 | MAP, LINEAR EGR REFERENCE    | 474   | GRY        | MAP                 | 5V             | 5V               | 34, 32          | POOR PERFORMANCE<br>ROUGH IDLE |
| E15 | IGNITION FEED                | 439   | PNK/BLK    | SPLICE              | B +            | B +              | NONE            | NO START MIL INOP              |
| E16 | BATTERY FEED                 | 440   | ORN        | SPLICE              | B +            | B +              | NONE            | NO START MIL INOP              |

(1) 0 VOLTS A/C "OFF" B + "ON."

(2) B + BRAKE NOT APPLIED 0 VOLTS BRAKE APPLIED.

\* LESS THAN .5 VOLTS (500 mV)



4-15-93  
MS 13413

Figure 3A-26 - PCM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (3 of 4)



### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

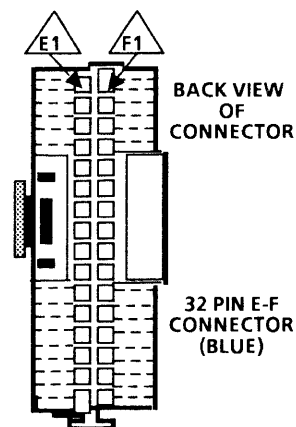
| PIN | PIN FUNCTION              | CKT # | WIRE COLOR  | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                          |
|-----|---------------------------|-------|-------------|---------------------|----------------|------------------|-----------------|--------------------------------------------|
|     |                           |       |             |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                            |
| F1  | RANGE SIGNAL "A"          | 1224  | PNK         | TRANSMISSION        | B +            | B +              | 28              | ERRATIC MANUAL DOWNSHIFTS                  |
| F2  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F3  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F4  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F5  | NOT USED                  | -     | -           | -                   | -              | -                | -               | -                                          |
| F6  | FUEL PUMP RELAY CONTROL   | 465   | DK GRN/ WHT | FUEL PUMP RELAY     | 0* (2)         | B +              | 54              | LONG CRANK TIME BEFORE STARTING            |
| F7  | PCS "LOW"                 | 1229  | DK BLU/ WHT | TRANSMISSION        | 0*             | 1.5V             | 73              | POOR SHIFT QUALITY                         |
| F8  | 4WD SWITCH                | 1493  | DK BLU      | 4WD INDICATOR       | B + (3)        | B + (3)          | NONE            | ERRATIC SHIFT PATTERNS                     |
| F9  | SERIAL DATA               | 1061  | ORN/BLK     | DATA LINK CONNECTOR | 5V             | 5V               | NONE            | NO SERIAL DATA                             |
| F10 | PCS "HIGH"                | 1228  | RED/BLK     | TRANSMISSION        | 0*             | 7.0V             | 73              | POOR SHIFT QUALITY                         |
| F11 | IC SIGNAL                 | 423   | WHT         | DISTRIBUTOR         | 0*             | 1.2V             | 42              | RESTART FIXED TIMING                       |
| F12 | TRANSMISSION OUTPUT SPEED | 437   | BRN         | VSS BUFFER          | 0* (1)         | 0* (1)           | 72, 24          | ERRATIC SHIFT PATTERNS, POOR SHIFT QUALITY |
| F13 | VSS SIGNAL                | 1716  | DK BLU      | VSS BUFFER          | 0* (1)         | 0* (1)           | 16              | FUEL CUTOFF                                |
| F14 | TP REFERENCE              | 416   | GRY         | TP                  | 5V             | 5V               | 22              | LACK OF POWER HARSH SHIFTS                 |
| F15 | IGNITION FEED             | 439   | PNK/BLK     | SPLICE              | B +            | B +              | NONE            | NONE                                       |
| F16 | PURGE CONTROL             | 1428  | DK GRN      | PURGE SOLENOID      | B +            | B +              | NONE            | PURGE INOP                                 |

(1) VARIES FROM 0 TO 5 VOLTS, DEPENDING ON POSITION OF DRIVE WHEELS.

(2) BATTERY VOLTAGE 1<sup>ST</sup> 2 SECONDS.

(3) 0 VOLTS IN 4WD.

\* LESS THAN .5 VOLT (500 mV).



4-15-93  
MS 13414

Figure 3A-27 - PCM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission (4 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

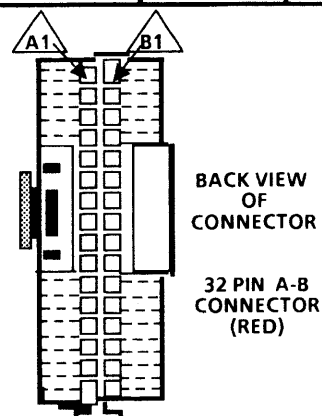
- Engine at operating temperature ● "Closed Loop" ● Engine idling (for "Engine Operating" column)
- Test terminal not grounded ● Scan tool not installed

| PIN | PIN FUNCTION         | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | SYMPTOMS                                    |
|-----|----------------------|-------|------------|---------------------|----------------|------------------|-----------------|---------------------------------------------|
|     |                      |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                             |
| A1  | SYSTEM GROUND        | 450   | BLK/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A2  | SYSTEM GROUND        | 551   | TAN/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A3  | IAC "A" HIGH         | 441   | LT BLU/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A4  | IC REF HIGH          | 430   | PPL/WHT    | DISTRIBUTOR         | 0*             | 1.3V             | NONE            | NO RESTART                                  |
| A5  | IC REF LOW           | 453   | BLK/RED    | DISTRIBUTOR         | 0*             | 0*               | NONE            | NO CHANGE                                   |
| A6  | IAC "A" LOW          | 442   | LT BLU/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A7  | IAC "B" LOW          | 444   | LT GRN/BLK | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A8  | IAC "B" HIGH         | 443   | LT GRN/WHT | IAC VALVE           | NOT USABLE     | NOT USABLE       | NONE            | OPERATION UNSTABLE                          |
| A9  | INJECTOR CONTROL "2" | 468   | DK GRN     | INJECTOR            | B +            | B +              | NONE            | POOR PERFORMANCE                            |
| A10 | O2S SIGNAL           | 412   | PPL        | OXYGEN SENSOR       | (1)            | (1)              | 13<br>44        | EXHAUST ODOR, POOR PERFORMANCE              |
| A11 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A12 | O2S GROUND           | 413   | TAN        | ENGINE BLOCK        | 0*             | 0*               | 13<br>44        | FIXED O2                                    |
| A13 | NOT USED             | -     | -          | -                   | -              | -                | -               | -                                           |
| A14 | DIAGNOSTIC TEST      | 451   | WHT/BLK    | DATA LINK CONNECTOR | 5V             | 5V               | NONE            | NO CHANGE                                   |
| A15 | TP SIGNAL            | 417   | DK BLU     | TP                  | .6 (2)         | .6 (2)           | 22              | POOR PERFORMANCE, HARSH TRANSMISSION SHIFTS |
| A16 | INJECTOR CONTROL "1" | 467   | DK BLU     | INJECTOR            | B +            | B +              | NONE            | POOR PERFORMANCE                            |

(1) VARIES.

(2) VARIES WITH THROTTLE MOVEMENT.

\* LESS THAN .5 VOLT (500 mV).



5-5-93  
PS 17854

Figure 3A-28 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (1 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

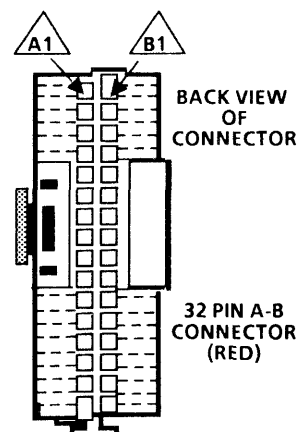
The "B + " indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION                        | CKT # | WIRE COLOR | COMPONENT CONNECTOR         | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                      |
|-----|-------------------------------------|-------|------------|-----------------------------|----------------|------------------|-----------------|----------------------------------------|
|     |                                     |       |            |                             | IGNITION "ON"  | ENGINE OPERATING |                 |                                        |
| B1  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B2  | IC BYPASS                           | 424   | TAN/BLK    | DISTRIBUTOR                 | 0*             | 4.5V             | 42              | FIXED TIMING, LACK OF POWER            |
| B3  | SENSOR GROUND                       | 452   | BLK        | TP, ECT                     | 0*             | 0*               | 14, 15, 21      | HIGH IDLE                              |
| B4  | SENSOR GROUND MAP, EGR TRANSMISSION | 455   | PPL        | MAP TRANSMISSION LINEAR EGR | 0*             | 0*               | 58, 59, 33, 32  | IDLE SURGE, TRANSMISSION, EXHAUST ODOR |
| B5  | TFT SIGNAL                          | 1227  | BLK/YEL    | TRANSMISSION                | 3.5V           | 2.8V             | 58, 59, 33      | EARLY TCC                              |
| B6  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B7  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B8  | ECT SIGNAL                          | 410   | YEL        | ECT                         | (4) 2.0 3.4V   | (4) 2.0 3.0V     | 14, 15          | POOR PERFORMANCE                       |
| B9  | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B10 | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B11 | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B12 | FUEL PUMP SIGNAL                    | 120   | GRY        | INLINE FUSE                 | 0* (1)         | B +              | 54              | NO CHANGE                              |
| B13 | MAP SIGNAL                          | 432   | LT GRN     | MAP                         | 4.9V           | 1.46V (3)        | 33, 34          | POOR PERFORMANCE                       |
| B14 | NOT USED                            | -     | -          | -                           | -              | -                | -               | -                                      |
| B15 | KNOCK SIGNAL                        | 496   | DK BLU     | KNOCK SENSOR                | 2.4V           | 2.4V             | 43              | KNOCK RETARD                           |
| B16 | EGR PINTLE POSITION                 | 1456  | BRN        | EGR                         | (2) .85        | (2) .85          | 32              | EGR INOP                               |

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS.
  - (2) VARIES WITH EGR MOVEMENT.
  - (3) VARIES WITH MANIFOLD VACUUM.
  - (4) VARIES WITH TEMPERATURE.
- \* LESS THAN .5 VOLT (500 mV).



5-5-93  
PS 17855

Figure 3A-29 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (2 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

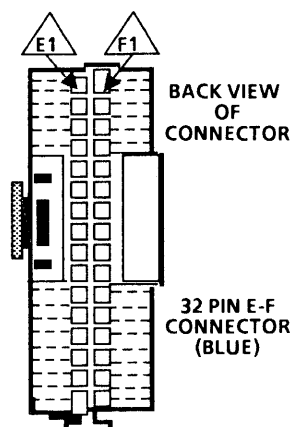
- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION                | CKT # | WIRE COLOR | COMPONENT CONNECTOR                  | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS              |
|-----|-----------------------------|-------|------------|--------------------------------------|----------------|------------------|-----------------|--------------------------------|
|     |                             |       |            |                                      | IGNITION "ON"  | ENGINE OPERATING |                 |                                |
| E1  | EGR CONTROL                 | 435   | GRY        | EGR                                  | B +            | B +              | 32              | DETONATION                     |
| E2  | NOT USED                    | -     | -          | -                                    | -              | -                | -               | -                              |
| E3  | NOT USED                    | -     | -          | -                                    | -              | -                | -               | -                              |
| E4  | RANGE SIGNAL "B"            | 1225  | DK BLU     | TRANSMISSION                         | 0*             | 0*               | 28              | ERRATIC MANUAL DOWNSHIFTS      |
| E5  | RANGE SIGNAL "C"            | 1226  | RED        | TRANSMISSION                         | "B"            | B +              | 28              | ERRATIC MANUAL DOWNSHIFTS      |
| E6  | MIL                         | 419   | BRN/WHT    | I/P                                  | 0*             | B +              | NONE            | MIL INOP                       |
| E7  | NOT USED                    | -     | -          | -                                    | -              | -                | -               | -                              |
| E8  | 2-3 SHIFT SOLENOID CONTROL  | 1223  | YEL/BLK    | TRANSMISSION                         | B +            | .4V              | 81              | INCORRECT GEAR STATE           |
| E9  | 1-2 SHIFT SOLENOID CONTROL  | 1222  | LT GRN     | TRANSMISSION                         | B +            | .4V              | 82              | INCORRECT GEAR STATE           |
| E10 | IDLE SPEED ACTUATOR CONTROL | 534   | DK GRN     | IDLE SPEED ACTUATOR CONTROL SOLENOID | B +            | B +              | 36              | HIGH WARM IDLE                 |
| E11 | TCC SOLENOID CONTROL        | 1350  | DK BLU     | TRANSMISSION                         | -              | -                | -               | -                              |
| E12 | A/C SIGNAL                  | 59    | DK/GRN     | A/C SWITCH                           | 0* (1)         | 0* (1)           | NONE            | INCORRECT IDLE                 |
| E13 | BRAKE SIGNAL                | 420   | PPL        | SPLICE                               | B + (2)        | B + (2)          | 37, 38          | NO TCC                         |
| E14 | MAP, LINEAR EGR REFERENCE   | 474   | GRY        | MAP                                  | 5V             | 5V               | 34, 32          | POOR PERFORMANCE<br>ROUGH IDLE |
| E15 | IGNITION FEED               | 439   | PNK/BLK    | SPLICE                               | B +            | B +              | NONE            | NO START MIL INOP              |
| E16 | BATTERY FEED                | 440   | ORN        | SPLICE                               | B +            | B +              | NONE            | NO START MIL INOP              |

(1) 0 VOLTS A/C "OFF" B + "ON."

(2) B + BRAKE NOT APPLIED 0 VOLTS BRAKE APPLIED.

\* LESS THAN .5 VOLTS (500 mV)



4-15-93  
MS 10038

Figure 3A-30 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (3 of 4)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

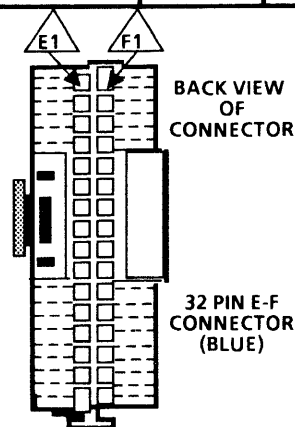
The "B + " symbol indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION              | CKT # | WIRE COLOR  | COMPONENT CONNECTOR             | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                          |
|-----|---------------------------|-------|-------------|---------------------------------|----------------|------------------|-----------------|--------------------------------------------|
|     |                           |       |             |                                 | IGNITION "ON"  | ENGINE OPERATING |                 |                                            |
| F1  | RANGE SIGNAL "A"          | 1224  | PNK         | TRANSMISSION                    | B +            | B +              | 28              | ERRATIC MANUAL DOWNSHIFTS                  |
| F2  | INPUT SPEED HIGH          | 1230  | GRY/RED     | SPEED SENSOR TRANSMISSION INPUT | -              | -                | -               | -                                          |
| F3  | INPUT SPEED LOW           | 1231  | DK BLU/WHT  | SPEED SENSOR TRANSMISSION INPUT | -              | -                | -               | -                                          |
| F4  | NOT USED                  | -     | -           | -                               | -              | -                | -               | -                                          |
| F5  | NOT USED                  | -     | -           | -                               | -              | -                | -               | -                                          |
| F6  | FUEL PUMP RELAY CONTROL   | 465   | DK GRN/ WHT | FUEL PUMP RELAY                 | 0* (2)         | B +              | 54              | LONG CRANK TIME BEFORE STARTING            |
| F7  | PCS "LOW"                 | 1229  | LT BLU/ WHT | TRANSMISSION                    | 0*             | 1.5V             | 73              | POOR SHIFT QUALITY                         |
| F8  | 4WD SIGNAL                | 1493  | DK BLU      | 4WD INDICATOR                   | B +            | B +              | NONE            | LATE OR EARLY SHIFT POINTS                 |
| F9  | SERIAL DATA               | 1061  | ORN/BLK     | DATA LINK CONNECTOR             | 5V             | 5V               | NONE            | NO SERIAL DATA                             |
| F10 | PCS "HIGH"                | 1228  | RED/BLK     | TRANSMISSION                    | 0*             | 7.0V             | 73              | POOR SHIFT QUALITY                         |
| F11 | IC SIGNAL                 | 423   | WHT         | DISTRIBUTOR                     | 0*             | 1.2V             | 42              | RESTART FIXED TIMING                       |
| F12 | TRANSMISSION OUTPUT SPEED | 437   | BRN         | VSS BUFFER                      | 0* (1)         | 0* (1)           | 72, 24          | ERRATIC SHIFT PATTERNS, POOR SHIFT QUALITY |
| F13 | VSS SIGNAL                | 1716  | DK BLU      | VSS BUFFER                      | 0* (1)         | 0* (1)           | 16              | FUEL CUTOFF                                |
| F14 | TP REFERENCE              | 416   | GRY         | TP                              | 5V             | 5V               | 22              | LACK OF POWER HARSH SHIFTS                 |
| F15 | IGNITION FEED             | 439   | PNK/BLK     | SPLICE                          | B +            | B +              | NONE            | NONE                                       |
| F16 | CANISTER PURGE SIGNAL     | 428   | DK GRN/YEL  | PURGE SOLENOID                  | B +            | B +              | NONE            | PURGE INOP                                 |

- (1) VARIES FROM 0 TO 5 VOLTS, DEPENDING ON POSITION OF DRIVE WHEELS.  
(2) BATTERY VOLTAGE 1<sup>st</sup> 2 SECONDS.  
\* LESS THAN .5 VOLT (500 mV).



5-5-93  
PS 17856

Figure 3A-31 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission (4 of 4)

## ON-VEHICLE SERVICE

## POWERTRAIN CONTROL MODULE

Replacement of the Powertrain Control Module (PCM) consists of a service controller, without a PROM (MEM-CAL).

If the diagnostic procedures require the PCM to be replaced, the PCM, PROM (MEM-CAL) should be checked for the correct part number. If they are correct, remove the PROM (MEM-CAL), and install them in the control module. The control module will not contain a PROM (MEM-CAL).

 **Important**

- When replacing a production PCM with a control module, transfer the broadcast code and production PCM part number to the control module label. Do not record information on the access cover.

**NOTICE:** The ignition must be "OFF," and disconnect negative battery cable when disconnecting or reconnecting the PCM connector, to prevent internal damage to the PCM.

**NOTICE:** To prevent possible Electrostatic Discharge damage to the PCM, Do Not touch the connector pins or soldered components on the circuit board.

**PCM REPLACEMENT**  
*Figure 3A-34*

The MEM-CAL service is listed in this section.

 **Remove or Disconnect**

1. Negative battery cable.
2. Glove box.
3. PCM harness connectors.
4. PCM from tray.
5. Mounting brackets and modules if equipped.
6. Access cover PROM (MEM-CAL). Refer to PROM (MEM-CAL) service.

 **Install or Connect**

1. PROM (MEM-CAL) access cover in new PCM.
2. Mounting brackets and modules if equipped.
3. PCM into tray until clips lock.
4. PCM harness connectors.
5. Glove box.
6. Negative battery cable.
7. Perform functional check.

**MEM-CAL REPLACEMENT***Figure 3A-33*

The replacement PCM is supplied without a PROM (MEM-CAL). Care should be taken when removing the PROM from the defective PCM for use in the replacement PCM.

Using two fingers, push both retaining clips back away from the PROM (MEM-CAL). At the same time, grasp it at both ends and lift it up out of the socket. Do not remove the cover of the PROM (MEM-CAL). Use of unapproved PROM (MEM-CAL) removal methods may cause damage to the PROM (MEM-CAL) or socket.

 **Inspect***Figure 3A-32*

- For alignment notches of the PROM (MEM-CAL) and carefully set it aside. Do not open the PROM (MEM-CAL).

 **Remove or Disconnect**

1. New PCM from its packaging and check the service number to make sure it is the same as the defective PCM.
2. Access cover.

 **Install or Connect**

1. PROM (MEM-CAL) in PROM (MEM-CAL) socket.

 **Important**

Press only on the ends of the PROM (MEM-CAL). Small notches in the PROM (MEM-CAL) must be aligned with the small notches in the PROM (MEM-CAL) socket. Gently press down on the ends of the PROM (MEM-CAL) until the clips are against the side of the PROM (MEM-CAL). Press inward on the clips until they snap into place. Listen for the click.

2. Access cover on PCM.
3. PCM in passenger compartment.
4. Connectors to PCM.

**Functional Check**

1. Turn ignition "ON."
2. Enter diagnostics.
  - A. DTC 12 should flash four times (if no other DTC(s) are present). This indicates the PROM (MEM-CAL) is installed properly, and the PCM is functioning.

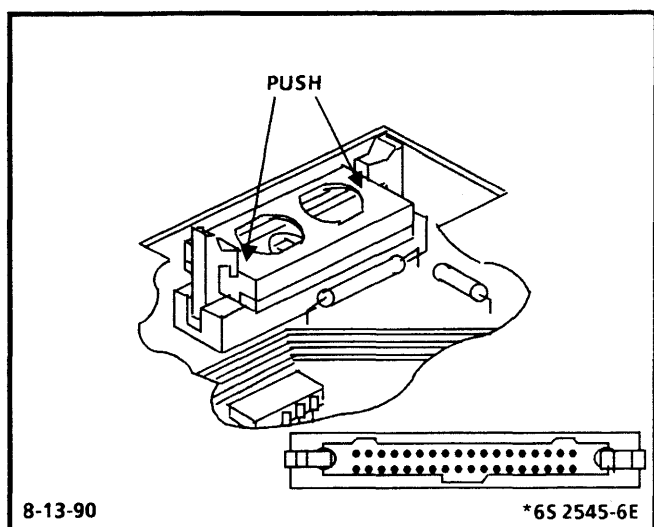


Figure 3A-32 - PROM (MEM-CAL) Unit Installation

B. If DTC 51 occurs, or if the MIL is "ON" constantly with no DTC(s), the PROM (MEM-CAL) is not fully seated or is defective.

- If not fully seated, press firmly on the ends of the PROM (MEM-CAL).
- If it is necessary to remove the PROM (MEM-CAL), follow the previous removal instructions.

**NOTICE:** To prevent possible Electrostatic Discharge damage to the PROM (MEM-CAL), Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

## ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Figures 3A-36 and 3A-37

**NOTICE:** Care must be taken, when handling coolant sensor. Damage to coolant sensor will affect proper operation of the fuel control system.

### Remove or Disconnect

1. Negative battery cable.
2. Drain cooling system below level of sensor.
3. Electrical connector releasing locking tab.
4. Coolant sensor from engine.

### Install or Connect

1. Coolant sensor in engine.
2. Electrical connector.
3. Refill coolant system.
4. Negative battery cable.

## MAP SENSOR

Figure 3A-39

Other than checking for loose hoses and electrical connections, the only service possible is unit replacement, if diagnosis shows sensor to be faulty.

### Remove or Disconnect

1. Negative battery cable.
2. Vacuum harness assembly.
3. Electrical connector releasing locking tab.
4. Bolts or release lock tabs and remove sensor.

### Install or Connect

1. Bolts or snap sensor on bracket.
2. Electrical connector.
3. Vacuum harness.
4. Negative battery cable.

## OXYGEN SENSOR (O2S)

Figure 3A-38

**NOTICE:** The Oxygen Sensor (O2S) uses a permanently attached pigtail and connector. This pigtail should not be removed from the Oxygen Sensor (O2S). Damage or removal of the pigtail or connector could affect proper operation of the oxygen sensor.

Take care when handling the Oxygen Sensor (O2S). The in-line electrical connector and louvered end must be kept free of grease, dirt, or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the oxygen sensor.

### Remove or Disconnect

- The Oxygen Sensor (O2S) may be difficult to remove, when engine temperature is below 48°C (120°F). Excessive force may damage threads in exhaust manifold or exhaust pipe.
1. Negative battery cable.
  2. Electrical connector releasing locking tab.
  3. Carefully back out oxygen sensor.

### Install or Connect

#### Important

- A special anti-seize compound is used on the Oxygen Sensor (O2S) threads. The compound consists of liquid graphite and glass beads. The graphite will tend to burn away, but the glass beads will remain, making the sensor easier to remove.

## Remove or Disconnect (Figures 1 and 2)

1. PCM access cover.

## Important

DO NOT remove any of the other screws.

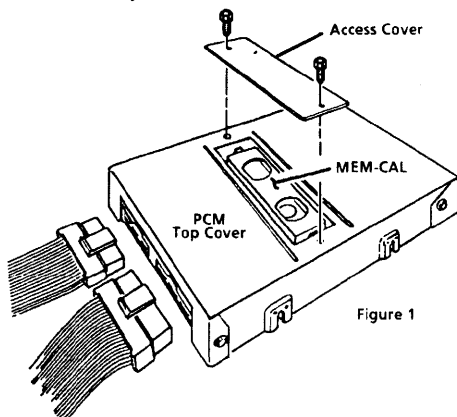


Figure 1

2. PCM access cover.

## Important

Replacement Powertrain Control Module (PCM) is supplied without a Memory-Calibration unit PROM (MEM-CAL) so care should be taken when removing the PROM (MEM-CAL) from the defective PCM as it will be reused in the new PCM.

Using two fingers, push both retaining clips back away from the PROM (MEM-CAL) at the same time. Grasp the PROM (MEM-CAL) at both ends and lift straight up out of the PROM (MEM-CAL) socket. Do not remove the cover of the PROM (MEM-CAL). Use of unapproved PROM (MEM-CAL) removal methods will cause damage to the PROM (MEM-CAL) or PROM (MEM-CAL) socket.

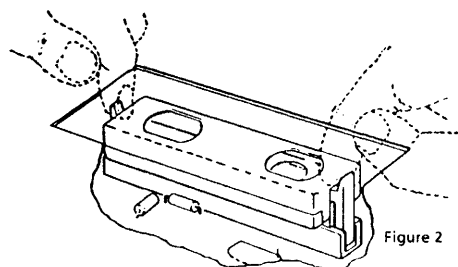


Figure 2

## Inspect

For alignment notches of the PROM (MEM-CAL) and carefully set aside. Do not open the PROM (MEM-CAL).



Figure 3

## Remove or Disconnect (Figures 1 and 2)

1. New Powertrain Control Module (PCM) from its packaging and check the service number to make sure it is the same as the defective PCM.
2. Access cover.

## Install or Connect (Figures 4, 5, 6, 7 and 8)

1. PROM (MEM-CAL) in PROM (MEM-CAL) socket.

## Inspect

Type of clips used on the PROM (MEM-CAL) sockets.

There are two types of clips used on the PROM (MEM-CAL) sockets. A "solid" type is used on the early production models. See Figure 3.

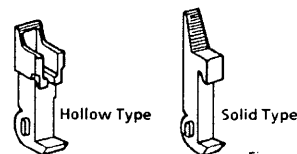


Figure 4

## Important

Press only on the ends of the PROM (MEM-CAL).

Small notches in the PROM (MEM-CAL) must be aligned with the small notches in the PROM (MEM-CAL) socket.

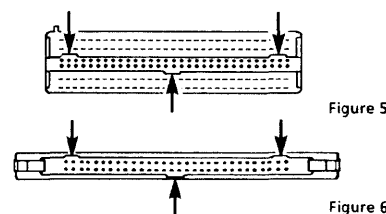


Figure 5

Figure 6

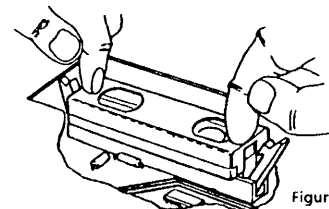


Figure 7

Gently press down on the ends of the PROM (MEM-CAL) until the clips are against the side of the PROM (MEM-CAL). Press inward on the clips until they snap into place. Listen for the click.

## Important

Do not press on the ends of the PROM (MEM-CAL) until the clips snap into place because the controller circuit board and/or clips may be damaged.

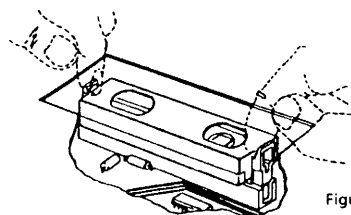


Figure 8

## Inspect

Retaining clip have snapped into place.

## Install or Connect (Figures 1)

1. Access cover on PCM.
2. PCM to mounting bracket in correct location and perform "On-Board Diagnostic (OBD) System Checks" to confirm proper installation.



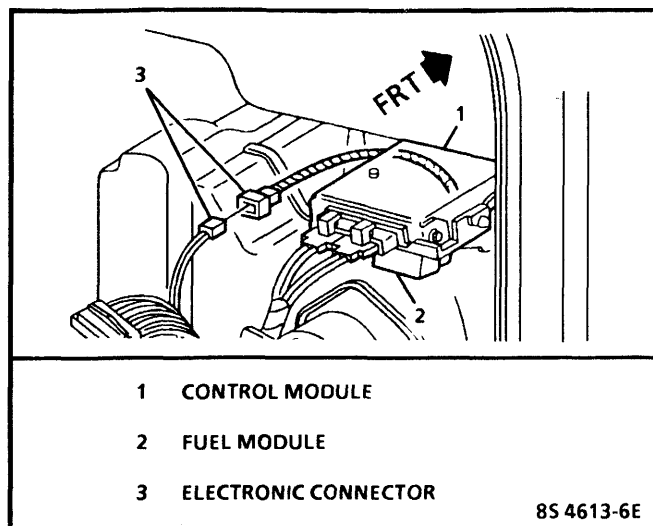


Figure 3A-34 - Powertrain Control Module

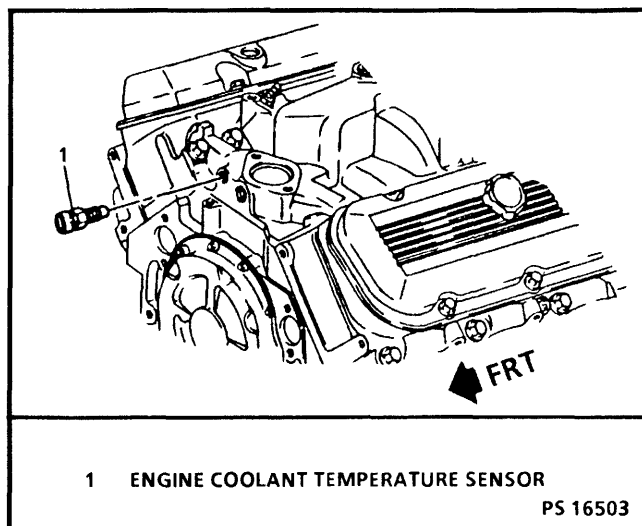


Figure 3A-37 - Engine Coolant Temperature Sensor - 7.4L

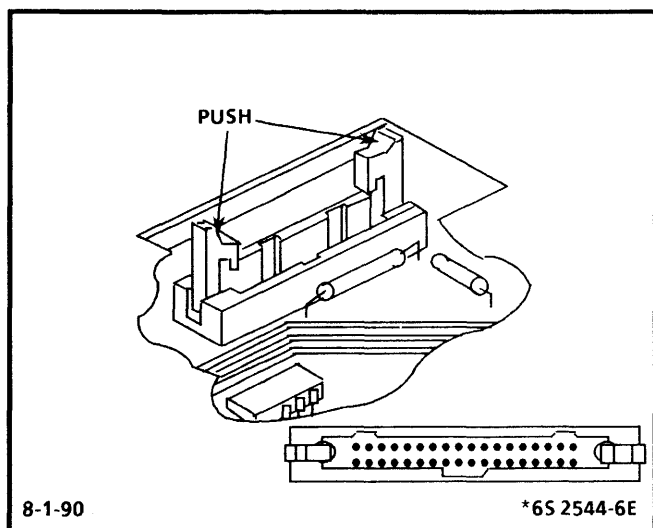


Figure 3A-35 - PROM (MEM-CAL) Unit Socket

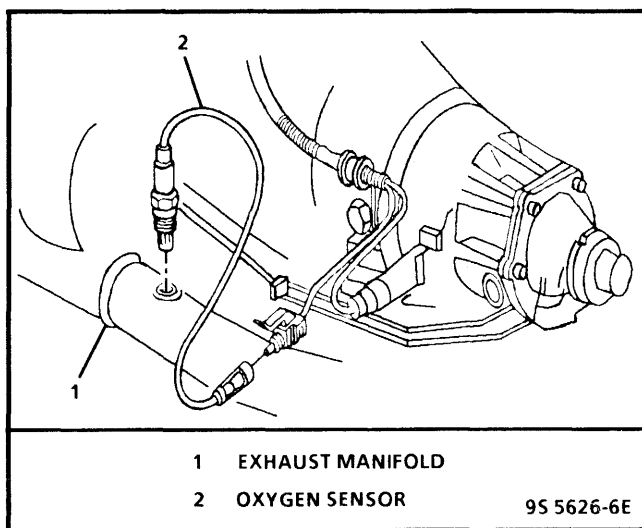


Figure 3A-38 - Oxygen Sensor (O2S)

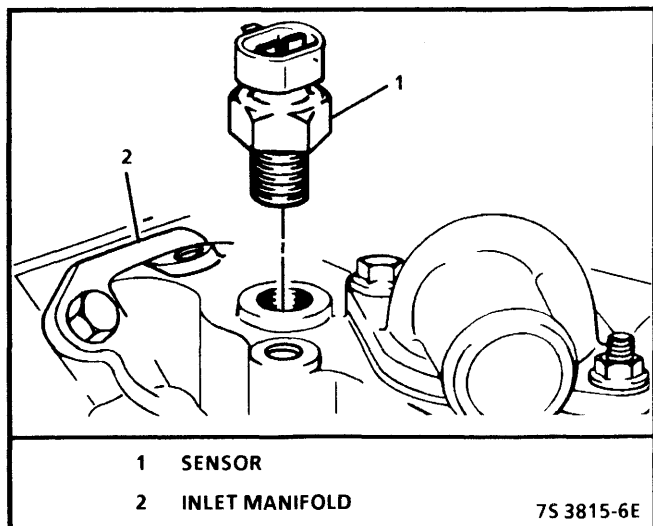


Figure 3A-36 - Engine Coolant Temperature Sensor - 4.3L, 5.0L, 5.7L

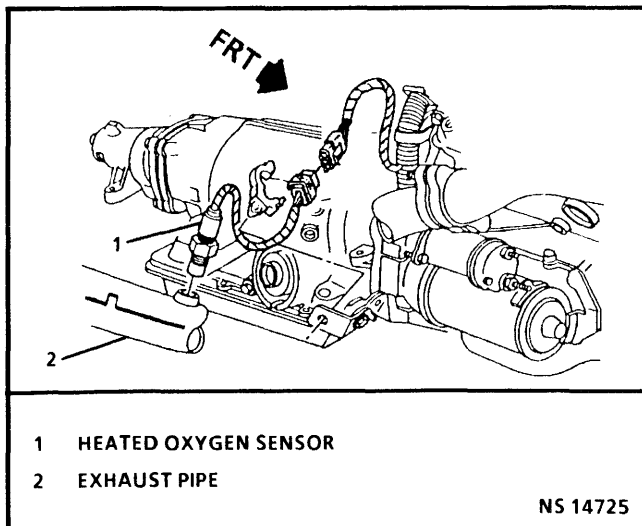


Figure 3A-39 - Heated Oxygen Sensor (HO2S)

New, or service replacement sensors will already have the compound applied to the threads. If a sensor is removed from an engine, and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of oxygen sensor with anti-seize compound (GM P/N 5613695 or equivalent), if necessary.
2. Sensor, and torque to 41 N·m (30 lb. ft.).
3. Electrical connector.
4. Negative battery cable.

## HEATED OXYGEN SENSOR (HO2S)

Figure 3A-39

**NOTICE:** The Heated Oxygen Sensor (HO2S) uses a permanently attached pigtail and connector. This pigtail should not be removed from the Heated Oxygen Sensor (HO2S). Damage or removal of the pigtail or connector could affect proper operation of the oxygen sensor.

Take care when handling the Heated Oxygen Sensor (HO2S). The in-line electrical connector and louvered end must be kept free of grease, dirt, or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the heated oxygen sensor.

If the heated oxygen sensor pigtail wiring, connector or terminal is damaged, the entire oxygen sensor assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have provided to it a clean air reference.

This clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degraded oxygen sensor performance.

The following guidelines should be used when servicing the heated oxygen sensor:

- Do not apply contact cleaner or other materials to the sensor or vehicle harness connectors. These materials may get into the sensor causing poor performance. Also, the sensor pigtail and harness wires must not be damaged in such a way that the wires inside are exposed. This could provide a path for foreign materials to enter the sensor and cause performance problems.
- Neither the sensor or vehicle lead wires should be bent sharply or kinked. Sharp bends, kinks, etc., could block the reference air path through the lead wire.
- Do not remove or defeat the oxygen sensor ground wire (where applicable). Vehicles that utilize the ground wired sensor may rely on this ground as the only ground contact to the sensor. Removal of the ground wire will also cause poor engine performance.
- To prevent damage due to water intrusion, be sure that the peripheral seal remains intact on the vehicle harness connector.

The engine harness may be repaired using Packard's Crimp and Splice Seals Terminal Repair Kit J 38125-A. Under no circumstances should repairs be soldered since this could result in the air reference being obstructed.

### ↔ Remove or Disconnect

- The Heated Oxygen Sensor (HO2S) may be difficult to remove, when engine temperature is below 48°C (120°F). Excessive force may damage threads in exhaust manifold or exhaust pipe.
1. Negative battery cable.
  2. Electrical connector releasing locking tab.
  3. Carefully back out oxygen sensor.

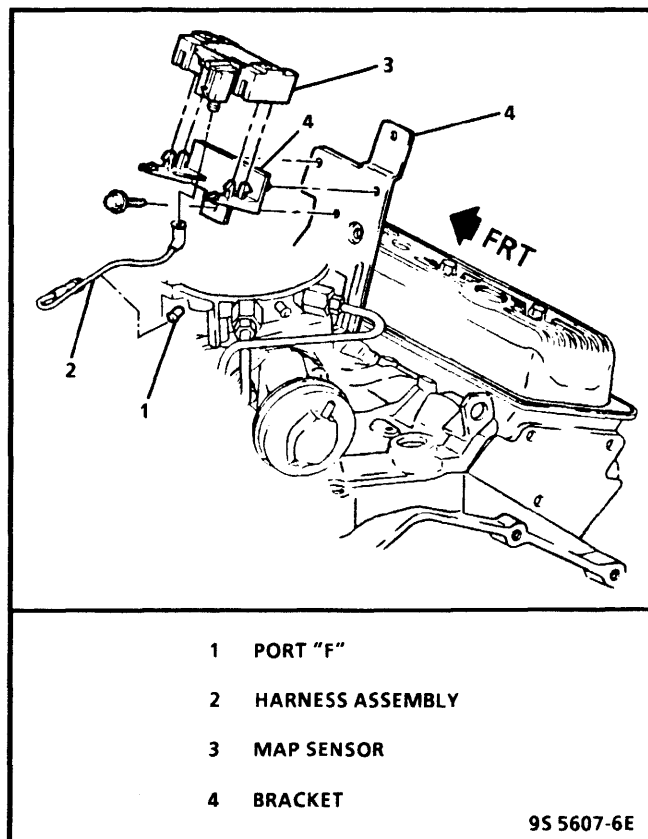


Figure 3A-40 - MAP Sensor - TBI

## Install or Connect

### Important

- A special anti-seize compound is used on the Heated Oxygen Sensor (HO2S) threads. The compound consists of liquid graphite and glass beads. The graphite will tend to burn away, but the glass beads will remain, making the sensor easier to remove.

New, or service replacement sensors will already have the compound applied to the threads. If a sensor is removed from an engine, and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

- Coat threads of heated oxygen sensor with anti-seize compound (GM P/N 5613695 or equivalent), if necessary.
- Sensor, and torque to 41 N·m (30 lb. ft.).
- Electrical connector.
- Negative battery cable.

## THROTTLE POSITION (TP) SENSOR

### Replacement - TBI

Figure 3A-41

## Remove or Disconnect

- Air cleaner and adapter.
- Electrical connector releasing locking tab.
- Two TP sensor attaching screw assemblies.
- TP sensor from throttle body assembly.
- TP sensor seal.

**NOTICE:** The TP sensor is an electrical component and must not be soaked in any liquid cleaner, or solvent, as damage may result.

## Install or Connect

- TP sensor seal over throttle shaft as shown in Figure 3A-41.
- With throttle valve closed, install TP sensor on throttle shaft. Rotate counterclockwise to align mounting holes.
- Two TP sensor attaching screw assemblies.
  - Refer to "Thread-Locking Materials."

### Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in.).
- Electrical connector.
  - Air cleaner and adapter.

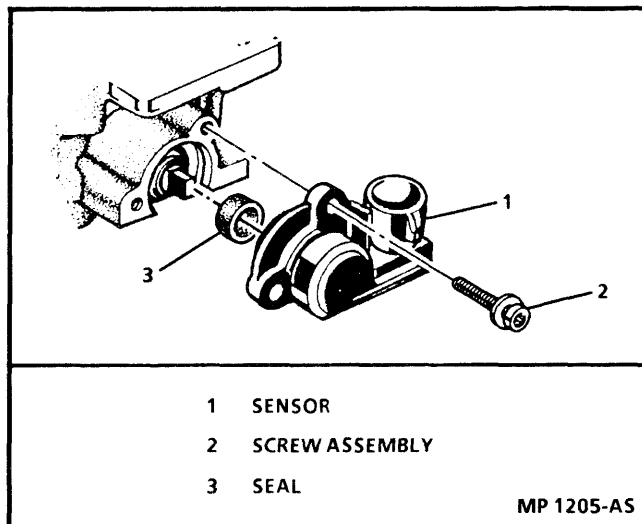


Figure 3A-41 - Throttle Position (TP) Sensor - TBI

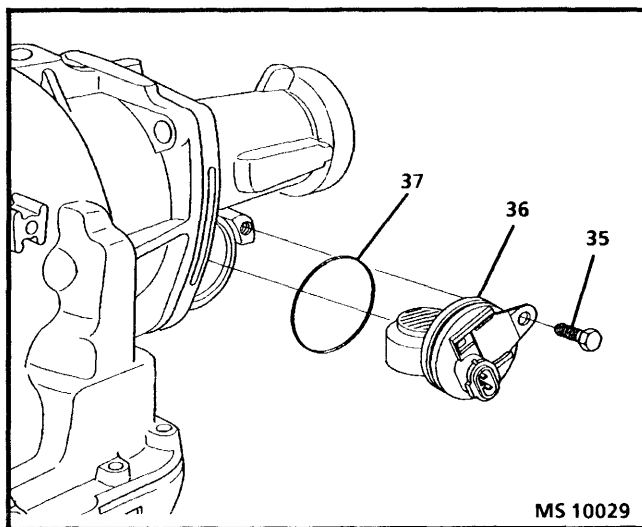


Figure 3A-42 - Vehicle Speed Sensor (VSS) Automatic Transmission

## KNOCK SENSOR (KS)

Refer to SECTION 7 for replacement of the knock sensor.

## VEHICLE SPEED SENSOR (VSS)

Figures 3A-42 through 3A-44

Refer to SECTION 10 for Vehicle Speed Sensor (VSS) service, which is located on the transmission or transfer case.

## VEHICLE SPEED SIGNAL (VSS) BUFFER MODULE

Figure 3A-45

Refer to SECTION 8, in the appropriate service manual for vehicle speed signal buffer module.

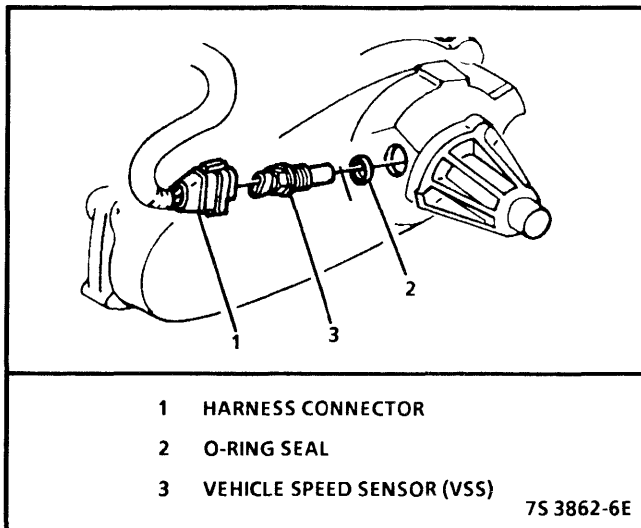


Figure 3A-43 - Vehicle Speed Sensor (VSS) 4WD

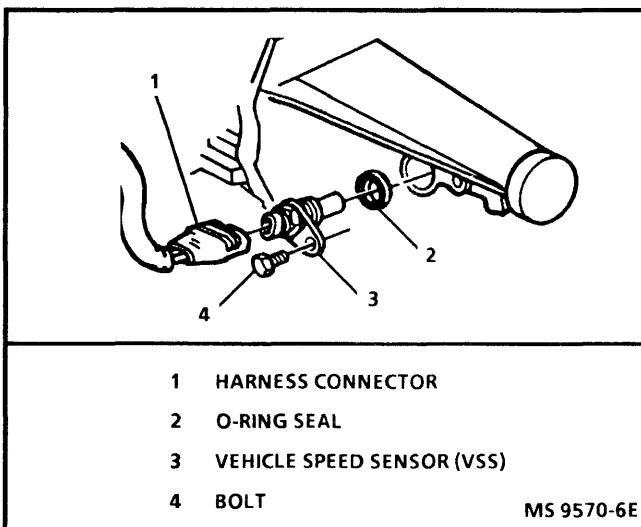


Figure 3A-44 - Vehicle Speed Sensor (VSS) Manual Transmission

The VSS buffer module is located on the right hand side of steering column, attached to the instrument panel.

## TRANSMISSION RANGE (TR) POSITION SWITCH

Refer to SECTION 10.

## PARTS INFORMATION

| PART NAME                          | GROUP |
|------------------------------------|-------|
| Control Module, PCM                | 3.670 |
| PROM (MEM-CAL)                     | 3.670 |
| Sensor, Engine Coolant Temp.       | 3.682 |
| Sensor, Exhaust Oxygen (O2)        | 3.682 |
| Sensor, MAP                        | 3.682 |
| Sensor, Throttle Position: Part of |       |
| Sensor Kit, Throttle Position      | 3.440 |

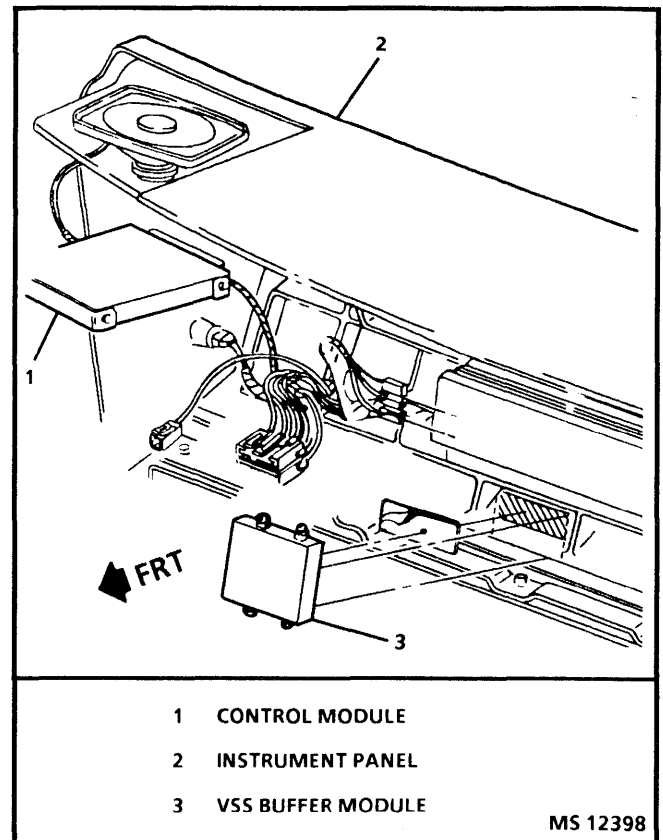


Figure 3A-45 - VSS Buffer

|                                    |       |
|------------------------------------|-------|
| Sensor, Throttle Position: Part of |       |
| Sensor Kit, Throttle Position      | 3.764 |
| Sensor, Knock (KS)                 | 2.383 |
| Sensor, Vehicle Speed (VSS)        | 3.682 |
| Buffer, Vehicle Speed (VSS)        | 3.682 |

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# SECTION 3B

## CONTROL MODULE SYSTEM (ECM/GMCM)

### 5.0L, 5.7L (C/K)

### (WITH MANUAL TRANSMISSION)

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## 3B-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

---

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## GENERAL DESCRIPTION

This section applies to all manual transmission equipped vehicles listed below:

5.0L, 5.7L (C/K)

These engines have controls to reduce exhaust emissions, while maintaining good driveability and fuel economy.

An Engine Control Module (ECM) is the main control system and constantly monitors sensors used to provide information about engine operation and the various systems. Basic operation, diagnosis, functional checks, and on-vehicle service are covered in this section.

The ECM has the ability to perform some diagnosis of itself, as well as other parts of the system. When a fault is detected, it lights a Malfunction Indicator Lamp (MIL) "Service Engine Soon" on the instrument panel and a Diagnostic Trouble Code (DTC) will be stored in the ECM memory. This does not mean that the engine should be stopped right away, but that the cause of the lamp coming "ON" should be checked as soon as reasonably possible.

Diagnostic charts incorporate diagnosis procedures using a Data Link Connector (DLC) scan tool, such as the Tech 1 where possible. The scan tool has the ability to save time in diagnosis and prevent the replacement of good parts. **The key to using the scan tool successfully for diagnosis lies in the technician's ability to understand the system being diagnosed, as well as an understanding of the scan tool's limitations. See SECTION 3 for more information.**

### ENGINE CONTROL MODULE (ECM)

**Figure 3B-1**

The Engine Control Module (ECM) is located in the passenger compartment and is the control center of the control module system.

The ECM constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL, and store a DTC or DTC(s), thereby identifying the problem area(s) to aid the technician in making repairs.

The ECM is designed to process the various input information and then sends the necessary electrical responses to control fuel delivery, spark timing and other emission control functions. The input information has an interrelation to more than one output, therefore, if the one input failed it could effect more than one systems operation.

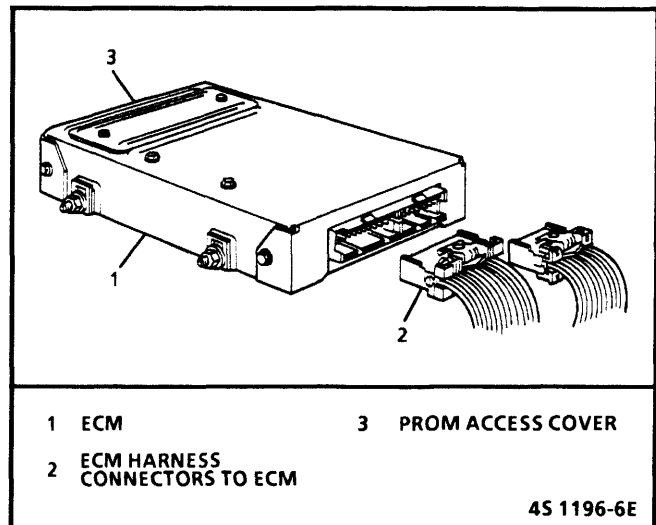
### ECM LEARNING ABILITY

The ECM has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected to clear DTC(s), or for repair, the "learning" process has to begin all over again.

A change may be noted in the vehicle's performance. To "teach" the vehicle make sure the engine is at operating temperature, drive at part throttle with moderate acceleration and idle conditions until normal performance returns.

**NOTICE:** The ECM must be maintained at a temperature below 85°C (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The ECM will become inoperative if its temperature exceeds 85°C (185°F). It is recommended that temporary insulation be placed around the ECM or removed from the vehicle during the time the vehicle is in a paint oven or other high temperature processes. Do not operate the vehicle if insulation is on the ECM.

Vehicles referred to in this section have an ECM (referred to as GMCM) with three parts for service. A controller (an ECM without a PROM [CAL-PAK]), a PROM (CAL-PAK) with specific program information for an engine and vehicle, and a PROM (CAL-PAK) with specific calibration information on some vehicles. The PROM (CAL-PAK) is soldered in.



**Figure 3B-1 - Engine Control Module (GMCM)**



## 3B-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

### PROM Figure 3B-2

Information for specific engine and vehicle is programmed using an integrated circuit called a PROM, (Programmable Read-Only Memory). In the parts book, it is listed as a calibrator. This allows one model of controller to be used for many different vehicles. The PROM is located inside the ECM and has information on the vehicle's weight, engine, transmission, axle ratio, and several others. While one ECM part number can be used by many vehicle lines, a PROM is very specific and must be used for the right vehicle. For this reason, it is very important to check the latest parts book and service bulletin information for the correct part number when replacing a PROM.

### PROM (CAL-PAK) Figure 3B-2

A PROM (CAL-PAK) is used to allow fuel delivery if other parts of the ECM are damaged. If the PROM (CAL-PAK) is missing, it will result in a no start condition.

**NOTICE:** On some vehicles, the PROM (CAL-PAK) is soldered in.

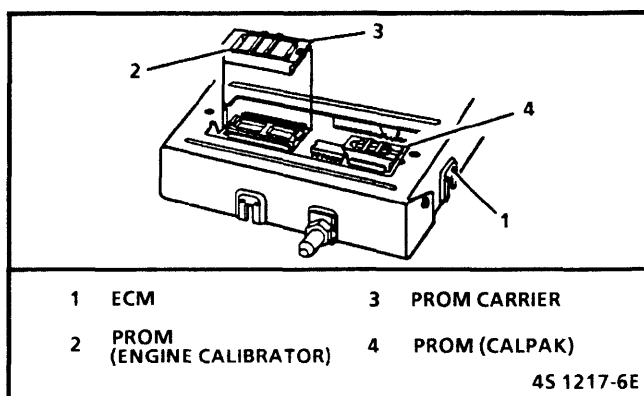


Figure 3B-2 - PROM and PROM (CAL-PAK)

## DIAGNOSIS

The control module system has a diagnostic system built into the ECM to indicate a failed circuit. An amber Malfunction Indicator Lamp (MIL) "Service Engine Soon" on the instrument panel will illuminate if a problem has been detected when the engine and vehicle are running. This lamp is also used for a bulb and system check.

The "On-Board Diagnostic System Check" is the starting point for the diagnostic procedures or an emissions test failure. The diagnostic charts are related to the ECM and will determine if the ECM is working properly. This section diagnoses the fuel system controlled by the ECM and has charts to diagnose a circuit when the ECM has displayed a DTC.

The system requires a scan tool, test light, digital voltmeter with 10 megohms impedance (J 39200), vacuum gage and jumper wires for diagnosis. Refer to SECTION 13 for additional information about special tools.

With the ignition "ON" and engine not running, the MIL should illuminate, which indicates that the ECM has completed the circuit to turn "ON" the lamp.

If the MIL is not "ON," refer to CHART A-1 for diagnosis.

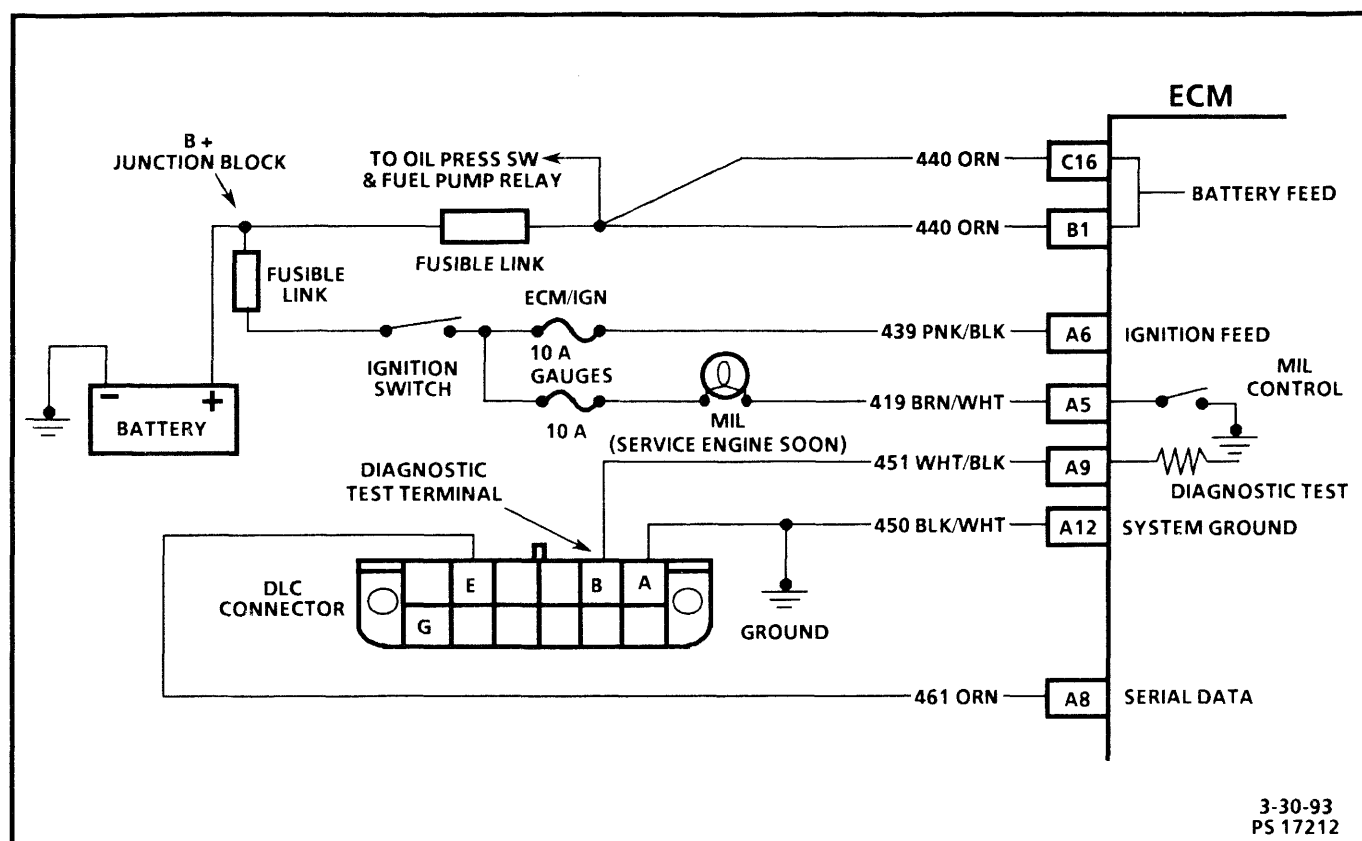
When the engine is started, the lamp will turn "OFF." If the lamp remains "ON," refer to "On-Board Diagnostic System Check."

### ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, always begin here.

The circuit check is performed through the twelve terminal assembly line Data Link Connector (DLC) under the instrument panel in the passenger compartment.

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## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

(With Tech 1 Scan Tool)

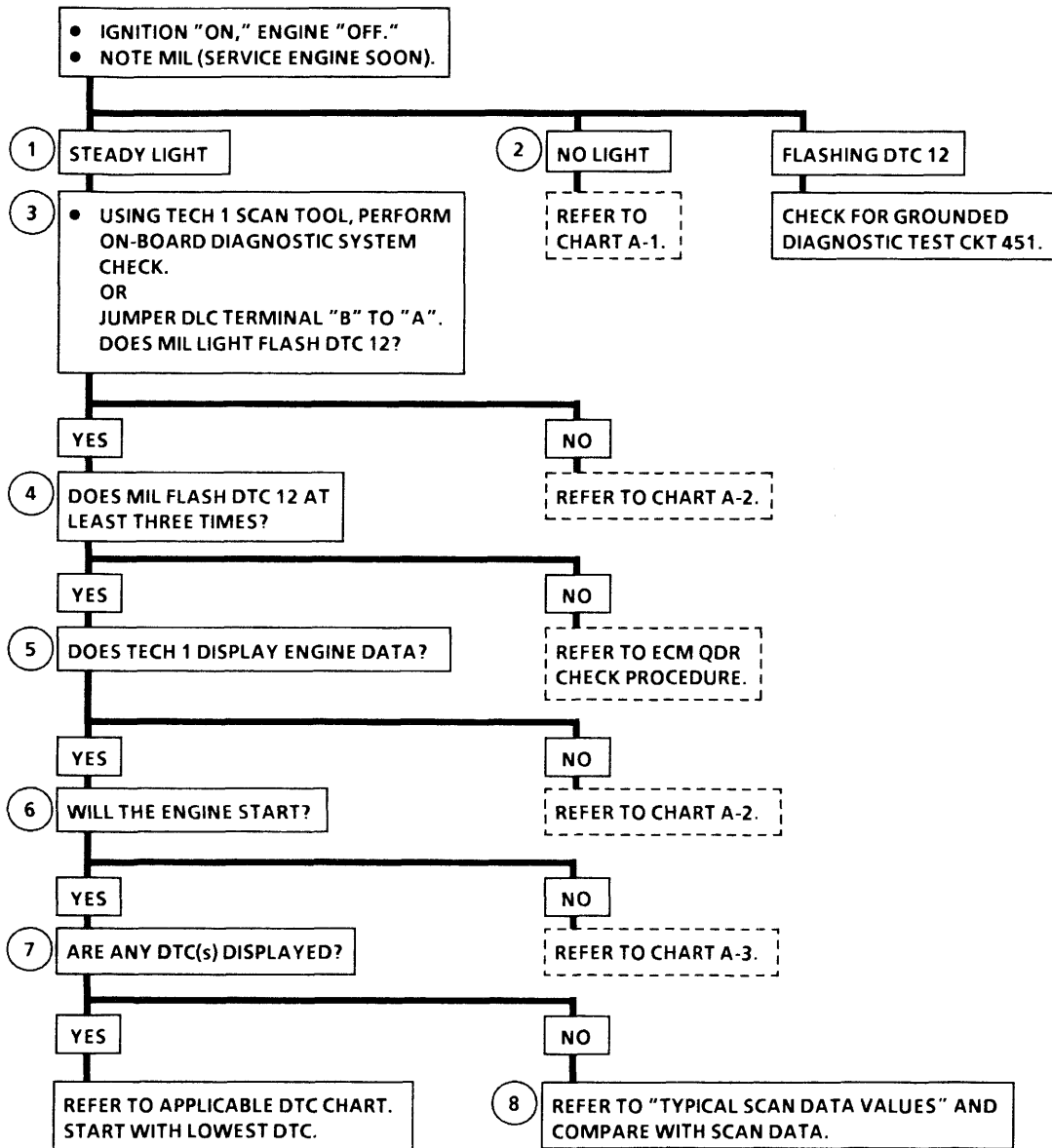
The diagnostic circuit check is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, because it directs the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it correctly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step is a check for the proper operation of the Malfunction Indicator Lamp (MIL). The MIL should be "ON" steady.
2. No MIL at this point indicates that there is a problem with the MIL circuit or the ECM control of that circuit.
3. This test checks the ability of the ECM to control the MIL. With the diagnostic terminal grounded, the MIL should flash a DTC 12 three times, followed by any DTC stored in memory. Depending upon the type of ECM or PROM (CAL-PAK) error may result in the inability to flash DTC 12.
4. This test checks the "Quad-Driver" circuit. If the MIL flashes less than three times, there is a problem with the MIL circuit or the ECM control of that circuit. Refer to "ECM QDR Check Procedure."
5. By using Tech 1 to aid diagnosis, serial data must be available. If a PROM (CAL-PAK) error is present, the ECM may have been able to flash DTC 12/51, but not enable serial data.
6. Although the ECM is powered up, a "Cranks But Will Not Run" symptom could exist because of an ECM or system problem.
7. This step will determine if the customer complaint is a MIL or a driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTC(s). An invalid DTC may be the result of a faulty scan tool, PROM or ECM.
8. Comparison of actual control system data with the typical scan data values is a quick check to determine if any parameter is not within limits. Keep in mind that a base engine problem (i.e. advanced cam timing) may substantially alter sensor values.

# ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

(With Tech 1 Scan Tool)



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

3-24-93  
NS 14030

## TYPICAL SCAN DATA VALUES

The scan data listed in this table may be used for comparison after completing the on-board diagnostic system check and finding the on-board diagnostics functioning properly with no diagnostic DTCs displayed. The "Typical Scan Data Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display. The values you get may vary due to low battery charge or other reasons, but they should be very close.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosis. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosis. For more description on the values and use of the scan tool to diagnosis ECM inputs, refer to the applicable "Component Systems" diagnosis. If all values are within the range illustrated, refer to SECTION 2.

## SCAN TOOL DATA

### Test Under Following Conditions:

- Engine at Operating Temperature • Engine Idling in "Closed Loop" • Closed Throttle • Park/Neutral
- All Accessories "OFF"

| <u>Scan Position</u> | <u>Units Displayed</u>             | <u>Typical Data Value</u>                                   | <u>Refer to Section</u> |
|----------------------|------------------------------------|-------------------------------------------------------------|-------------------------|
| ENGINE SPEED         | RPM                                | ± 100 RPM from desired                                      | "4"                     |
| DESIRED IDLE         | RPM                                | RPM in neutral (M/T)<br>ECM idle command (varies with temp) | "3"                     |
| ENG COOLANT TEMP     | °C, °F                             | 85°C - 105°C/190°F - 210°F                                  | "3"                     |
| MAP                  | kPa/Volts<br>barometric pressures) | (varies with manifold and                                   | "3"                     |
| THROT POSITION       | Volts                              | .45-1.25                                                    | "3"                     |
| THROTTLE ANGLE       | 0 - 100%                           | 0                                                           | "3"                     |
| O2S                  | Millivolts                         | 100-999 (Varies continuously)                               | "3"                     |
| LOOP STATUS          | Open Loop/Closed Loop              | Closed Loop                                                 | "3"                     |
| RICH/LEAN STATUS     | Rich/Lean                          | Rich/lean changing constantly                               | "3"                     |
| O2S CROSS COUNTS     | Counts                             | Always changing                                             | "3"                     |
| KNOCK SIGNAL         | No/Yes                             | No                                                          | "3"                     |
| SHORT TERM FUEL TRIM | Counts                             | 110-145                                                     | "3"                     |
| LONG TERM FUEL TRIM  | Counts                             | 118-138                                                     | "3"                     |
| IDLE AIR CONTROL     | Counts                             | 1 to 50                                                     | "3"                     |
| AC CLUTCH            | On/Off                             | Off                                                         | "3"                     |
| MPH/Km/h             | 0-255                              | 0                                                           | "3"                     |
| SHIFT LIGHT          | Off/On                             | Off                                                         | "3"                     |
| SYSTEM VOLTS         | 0-25.5                             | 13.5 to 14.5                                                | "3"                     |
| FUEL PUMP VOLTS      | 0-25.5                             | 13.5 to 14.5                                                | "3"                     |
| CALIBRATION ID       | 0-9999                             | Internal ID only                                            | "3"                     |
| AIR CONTROL SOL      | Port/Atmosphere                    | Atmosphere                                                  | "3"                     |

\* Varies with manifold and barometric pressures.

\*\* SECTION 4 or SECTION 6D of appropriate service manual.

† The PROM (CAL-PAK) identification parameter describes the particular PROM (CAL-PAK) used in the ECM being tested.

## TECH 1 SCAN TOOL POSITIONS AND DEFINITIONS

The following positions may not be applicable to all engines:

**ENGINE SPEED** - Engine speed is computed by the ECM from the fuel control reference input. It should remain close to desired idle under various engine loads with engine idling.

**DESIRED IDLE** - The idle speed commanded by the ECM. The ECM will compensate for various engine loads to keep the engine at the desired idle speed.

**ENGINE COOLANT TEMP** - The Engine Coolant Temperature (ECT) sensor is mounted in the intake manifold and sends engine temperature information to the ECM. The ECM supplies 5 volts to the coolant temperature sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the ECM monitors a high signal voltage which it interprets as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

**MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR** - The MAP sensor produces a low signal voltage when manifold pressure is low (high vacuum) and a high voltage when the pressure is high (low vacuum). With the ignition "ON," and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude and is referred to as BARO. Comparison of this BARO reading with a known good vehicle with the same sensor \*\* is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

**THROT POSITION** - Used by the ECM to determine the amount of throttle demanded by the driver. Should read .45-.85 volt at idle to above 4 volts at Wide Open Throttle (WOT).

**THROTTLE ANGLE** - Computed by the ECM from TP signal voltage (Throt position) should read 0% at idle, 100% at Wide Open Throttle (WOT).

**O2S** - Represents the exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 100 mV (lean exhaust) and 1000 mV (rich exhaust) when operating in "Closed Loop."

**RICH/LEAN STATUS** - Indicates whether exhaust oxygen sensor voltage is above (rich) or below (lean) the 450 mV oxygen sensor threshold voltage. Should

change constantly indicating that the ECM is controlling the air/fuel mixture properly.

**O2S CROSS COUNTS** - The number of times the oxygen sensor voltage crosses over the rich/lean threshold during a one second interval.

**LOOP STATUS** - This position will indicate whether the engine control system is operating in "Open" or "Closed Loop." Most systems go "Closed Loop" after a certain amount of run time, when coolant temperature is high enough, and the oxygen sensor becomes active.

**KNOCK SIGNAL - Tech 1 Scan Tool Displays "YES" OR "NO"** - Indicates whether or not a knock signal is being detected by the ECM.

**SHORT TERM FUEL TRIM (Formerly Integrator)** - Represents a short-term correction to fuel delivery by the ECM in response to the amount of time the oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage has mainly been below 450 mV, indicating a lean air/fuel mixture, short-term fuel trim will increase to tell the ECM to add fuel. If the oxygen sensor voltage stays mainly above the threshold, the ECM will reduce fuel delivery to compensate for the indicated rich condition.

**LONG TERM FUEL TRIM** - Is derived from the short-term fuel trim value and is used for long term correction of fuel delivery. A value of 128 counts indicates that fuel delivery requires no compensation to maintain a 14.7:1 air/fuel ratio. A value below 128 counts means that the fuel system is too rich and fuel delivery is being reduced (decreased injector pulse width). A value above 128 counts indicates that a lean condition exists and the ECM is compensating by adding fuel (increased injector pulse width).

**IDLE AIR CONTROL (IAC)** - The system is used to control engine idle speed to the desired RPM for different operating conditions. In this mode, the numbers will indicate the position the ECM thinks the valve is in. The ECM moves the IAC in counts and these counts are displayed on a Tech 1 scan tool.

**A/C CLUTCH** - Displays "ON" when the ECM has commanded the A/C clutch "ON."

**MPH KM/H** - Vehicle speed is an ECM internal parameter. It is computed by timing pulses coming from the Vehicle Speed Sensor (VSS). Vehicle speed is used in checking TCC lock-up speed or speedometer accuracy. Speed is displayed in both miles per hour (mph) or kilometer per hour (km/h).

## 3B-10 DRIVEABILITY AND EMISSIONS (GASOLINE)

**SHIFT LIGHT** - The shift light is used in manual transmissions to indicate the optimum point for upshifting. The ECM uses engine speed, vehicle speed, and engine load to determine the state of the shift light.

**SYSTEM VOLTS** - Battery/Ignition voltage is an analog input signal read by the ECM. It is the ignition switched battery voltage and is mainly used for diagnostics. Certain ECM functions will be modified if the battery voltage falls below or rises above programmed thresholds.

**FUEL PUMP VOLTS** - This parameter is a reading of the voltage found at the fuel pump. It is used by the ECM as the system voltage. The ECM uses fuel pump volts as a reference to determine electrical loading.

**CALIBRATION ID** - The PROM (CAL-PAK) identification parameter describes the particular PROM (CAL-PAK) used in the ECM being tested. The PROM (CAL-PAK) contains the ECM program. PROM ID is used when it is necessary to replace the PROM (CAL-PAK). PROM ID must be specified when ordering new PROM(s). PROM ID should not be confused with "Part Number."

**AIR CONTROL SOL** - When the Air Injector Reaction Divert Solenoid (Air Control) is "ON" (LOW, NORMAL, PORT), air from the AIR pump is sent to the AIR switch. When it is "OFF" (HIGH, DIVER, ATMOSPHERE), the air is vented to the atmosphere or air cleaner.

### PROM (CAL-PAK)

A no start and run condition will result if the PROM (CAL-PAK) is not installed in the ECM. A PROM (CAL-PAK) that is removed will set a DTC 52.

### FUEL CONTROL

Fuel delivery is controlled by the control module system.

The diagnosis of fuel control starts with "Engine Cranks But Will Not Run" CHART A-3. This chart will test the fuel system and if there is a problem will lead you to check and diagnose the fuel pump relay circuit, the injector circuit or the fuel system.

### Fuel Injector

Testing the fuel injector circuit is in CHART A-3 with additional diagnosis in CHART A-4.

A fuel injector which does not open may cause a "no start" condition. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

### Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3 and A-4.

If the pressure regulator in the TBI supplies pressure which is too low, poor performance could result. If the pressure is too high, unpleasant exhaust odor may result.

### Idle Air Control (IAC)

The diagnosis of Idle Air Control (IAC) can be found in SECTION 4.

If the IAC valve is disconnected or connected with the engine running, the idle RPM may be wrong. The IAC valve may be reset by turning the ignition switch "ON" and "OFF" one time. The Tech 1 also can reset IAC.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed in the manifold and idle speed will be high. If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

### Fuel Pump Circuit

DTC 54 indicates a failure in the fuel pump circuit. The fuel pump relay has a terminal to test the fuel pump operation. This is located at terminal "G" in the DLC connector. By applying voltage at this terminal, it can be determined if the fuel pump will operate. This terminal will also prime the fuel line to the TBI unit.

Refer to CHART A-5 for diagnosis of the fuel pump relay circuit.

An inoperative fuel pump will cause a "no start" condition. A fuel pump which does not provide enough pressure can result in poor performance.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn "ON" the fuel pump, as soon as oil pressure reaches about 28 kPa (4 psi).

### Fuel Module

On all 5.7L engines over 8500 GVW, the fuel module will override the ECM two second timer and the fuel pump will run for twenty seconds and then shut "OFF" if the vehicle is not started. This circuit corrects a hot restart vapor lock during high ambient temperatures.

## Fuel Module Check

1. Disconnect the fuel module. (CHART A-5.)
2. With a test light and ignition "ON," probe connector terminal "C" to ground. Circuit is OK if light is "ON." There is an open if the light is "OFF."
3. Probe connector terminals "C" to "D" with test light. Circuit is OK if light is "ON." There is an open in ground circuit if light is "OFF."
4. Ignition "OFF." Probe connector terminals "A" to "D" with test light. Ignition "ON," test light should illuminate for two seconds. There is an open in the circuit if the light is "OFF."
5. Replace fuel module if there is no twenty second fuel pump operation.

## ENGINE COOLANT TEMPERATURE (ECT) SENSOR

DTC 14 or DTC 15 indicates a failure in the engine coolant temperature sensor circuit.

Most scan tools display engine coolant temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

## MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

DTC 33 or DTC 34 indicates a failure in the MAP sensor circuit. Also refer to "MAP Output Check Diagnosis" to check the MAP sensor if there is no DTC.

## OXYGEN SENSOR (O2S)

DTC 13 indicates an open in the O2S circuit. DTC 44 indicates a low voltage (lean) on the O2S circuit. DTC 45 indicates a high voltage (rich) on the O2S circuit. If a DTC is set, the engine will always run in the "Open Loop" mode. The O2S voltage output can be measured with a digital voltmeter having at least a 10 megohm input impedance. Use of a standard shop type voltmeter will result in an inaccurate reading.

Normal scan voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." DTC 13 sets in one minute if voltage remains between .35 and .55 volt, but the system will go "Open Loop" in about 15 seconds.

Using the scan, observe the long term fuel trim values at different RPM and air flow conditions to determine when DTC 44 or DTC 45 may have been set. If the condition for DTC 44 exists, the long term fuel trim values will be around 150. If the condition for DTC 45 exists, the long term fuel trim values will be around 115.

## THROTTLE POSITION (TP) SENSOR

When a DTC is set, the ECM will use an artificial value for throttle position and some engine performance will return.

A broken TP sensor can cause intermittent bursts of fuel from the injector(s) and an unstable idle because the ECM thinks the throttle is moving.

The scan tool reads throttle position in volts and should read about .60 with the throttle closed, ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Scan TP sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at wide open throttle position.

## TP Sensor Output

This check should be performed when TP sensor attaching parts have been replaced. A Tech 1 scan tool can be used to read the TP sensor output voltage, or:

1. Connect digital voltmeter J 39200 or equivalent, from TP sensor connector terminal "B" (BLK wire) to terminal "C" (DK BLU wire). Jumpers for terminal access can be made using terminals "1214836" and "12014837".
2. With ignition "ON," engine stopped, the TP sensor voltage should be less than .85 volt if more than .85 volt verify free throttle movement. If still more than .85 volt, replace TP sensor.
3. Remove the voltmeter and jumpers, reconnect the TP sensor connector to the sensor.

## VEHICLE SPEED SENSOR (VSS)

The vehicle speed sensor circuit diagnosis is in DTC 24 chart.

Scan reading should closely match speedometer readings, with the drive wheels turning.

## EXHAUST GAS RECIRCULATION (EGR) SYSTEM

DTC 32 indicates that there is a failure in the EGR system circuit.



## 3B-12 DRIVEABILITY AND EMISSIONS (GASOLINE)

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### IDLE SPEED

Refer to "Diagnosis" in SECTION 4 for Idle Air Control (IAC).

- System too lean (High air/fuel ratio) - Idle speed may be too high or too low. Engine speed may vary up and down, disconnecting IAC does not help. May set DTC 44.  
Scan tool and/or voltmeter will read an Oxygen Sensor (O2S) output less than 300 mV (.3 volt). Check for low regulated fuel pressure or water in fuel. A lean exhaust with an O2S output fixed above 800 mV (.8 volt) will be a contaminated sensor, usually silicone. This may also set a DTC 45.
- System too rich (Low air/fuel ratio) - Idle speed too low. Scan counts usually above 80. System obviously rich and may exhibit black exhaust smoke. Scan tool and/or voltmeter will read an O2S signal fixed above 800 mV (.8 volt).

### IGNITION CONTROL (IC)

When the system is running on the ignition module, that is, no voltage on the bypass line, the ignition module grounds the IC signal. The ECM expects to see no voltage on the IC line during this condition. If it sees a voltage, it sets DTC 42 and will not go into the IC mode.

When the RPM for IC is reached (about 400 RPM), and bypass voltage is applied, the IC should no longer be grounded in the ignition module so the IC voltage should be varying.

If the bypass line is open or grounded, the ignition module will not switch to IC mode so the IC voltage will be low and DTC 42 will be set.

If the IC line is grounded, the ignition module will switch to IC, but because the line is grounded there will be no IC signal. A DTC 42 will be set.

DTC 42 sets if there is an open or a short to ground in the IC or bypass circuit.

### KNOCK SENSOR (KS)

DTC 43 sets if there is an open or short to ground in the KS circuit.

If the conditions for a DTC 43 are present, the scan tool will always display "YES." There should not be a knock at idle unless an internal engine problem, or a system problem exists.

### SYSTEM OVER VOLTAGE

DTC 53 sets if there is voltage greater than 17.1 volts for two seconds at ECM terminal "B1". This indicates that there is a basic generator problem.

### CRANK SIGNAL

Refer to "Crank Signal Diagnosis." If there is no crank signal to the ECM, the engine may be hard to start.

### DISTRIBUTOR REFERENCE SIGNAL

The distributor reference signal is covered in SECTION 6.

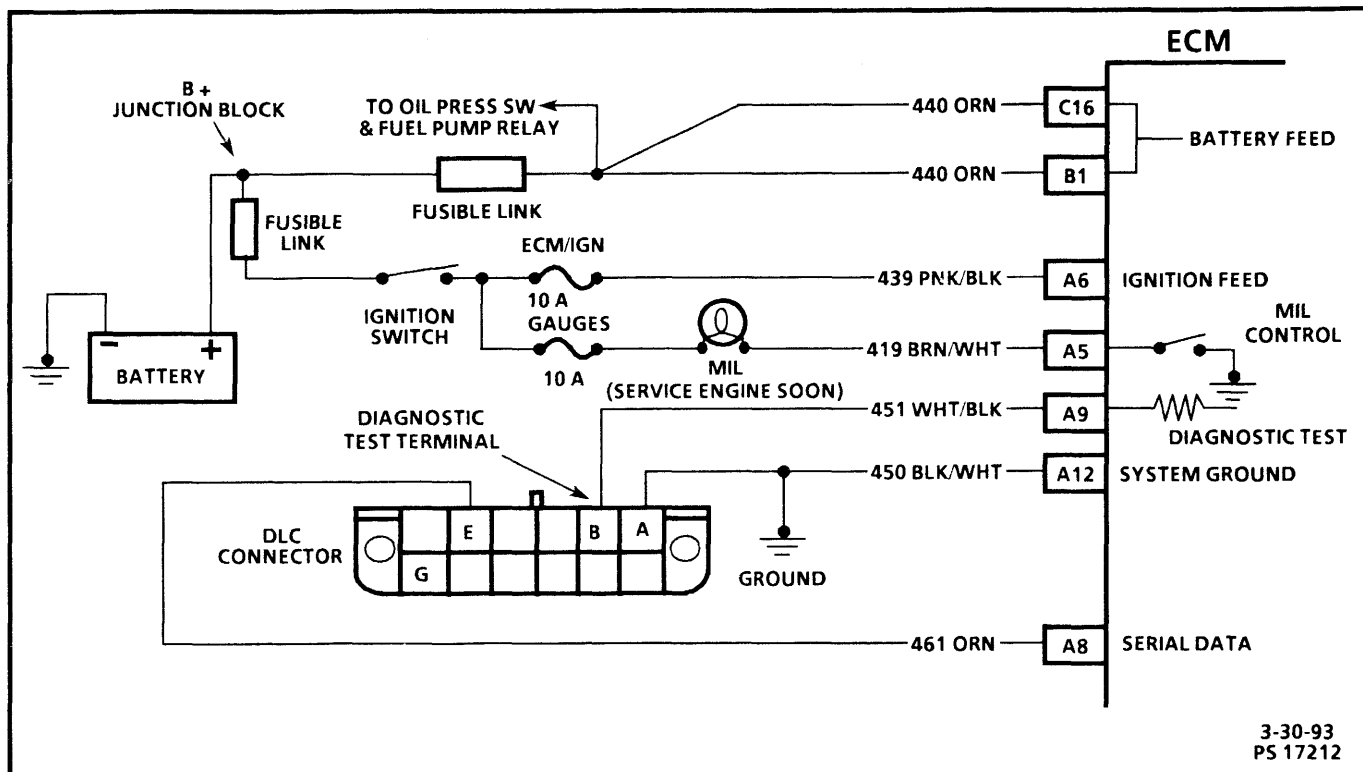
### A/C SIGNAL

Refer to "A/C Signal Diagnosis."

### EXHAUST SYSTEM

Refer to "Restricted Exhaust System Check."

**BLANK**



## CHART A-1

**NO MIL (SERVICE ENGINE SOON)**

### Circuit Description:

There should always be a steady MIL when the ignition is "ON" and engine stopped. Battery voltage is supplied to the lamp. The ECM will control the lamp and turn it "ON" by providing a ground path through CKT 419 to the ECM.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

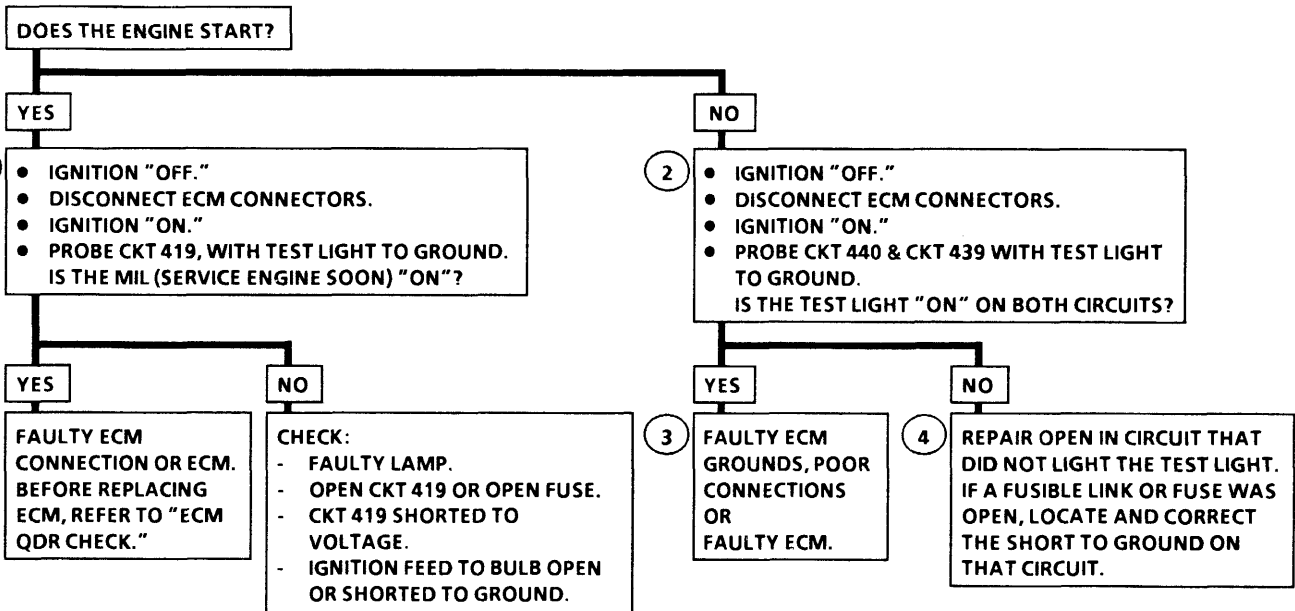
1. This step will isolate the problem in CKT 419.
2. If CKTs 440 and 439 have voltage, the ECM connections, grounds, or ECM is faulty.
3. Using a test light connected to 12 volts, probe each of the system ground circuits to be sure a good ground is present. Refer to ECM terminal end view in this section for ECM pin locations of ground circuits.
4. If the fuse/fusible link is open, refer to ECM wiring diagram for complete circuit.

**Diagnostic Aids:** If the engine runs OK, check:

- Faulty lamp.
  - CKT 419 open, shorted to ground or open fuse.
- If the engine cranks but will not run, check:
- Continuous battery-fuse or fusible link open.
  - ECM ignition fuse open.
  - Battery CKT 440 to ECM open.
  - Ignition CKT 439 to ECM open.
  - Poor connection to ECM.

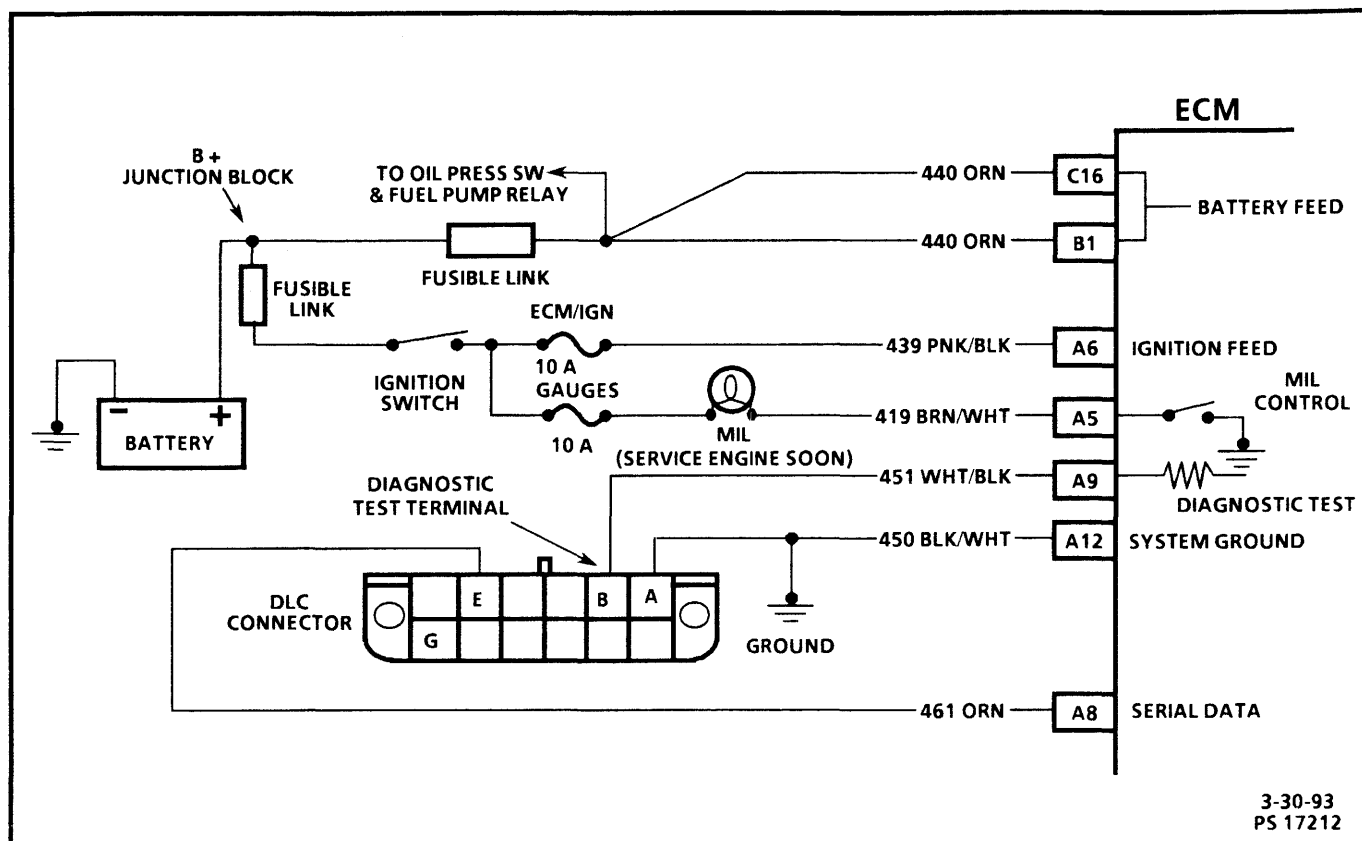
# CHART A-1

## NO MIL (SERVICE ENGINE SOON)



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-3-92  
7S 3687-6E



## CHART A-2

### NO SERIAL DATA OR WILL NOT FLASH DTC 12 MIL (SERVICE ENGINE SOON) "ON" STEADY

#### Circuit Description:

There should always be a steady MIL when the ignition is "ON" and engine stopped. Battery voltage is supplied to the lamp. The ECM will turn the lamp "ON" by grounding CKT 419 at the ECM.

With the diagnostic terminal grounded, the lamp should flash a DTC 12, followed by any DTC(s) stored in memory.

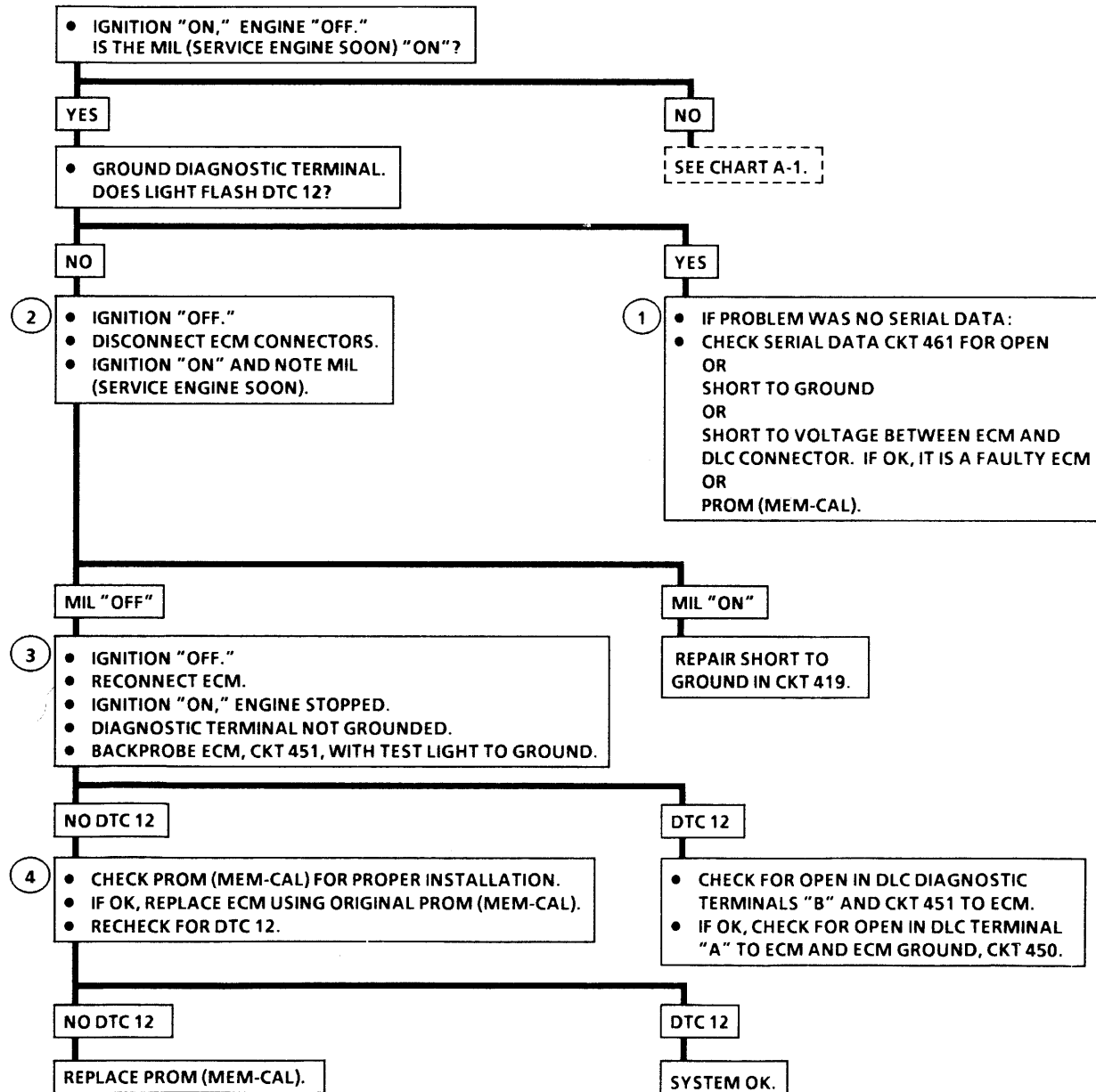
A steady lamp suggests a short to ground in the lamp control CKT 419, or an open in diagnostic CKT 451.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. If there is a problem with the ECM that causes a Tech 1 scan tool not to read serial data, then the ECM should not flash a DTC 12. If DTC 12 does flash, be sure the scan tool is working properly on another vehicle. If the scan is functioning properly and CKT 461 is OK, the PROM or ECM may be at fault for the No DLC symptom.
2. If the lamp goes "OFF" when the DLC is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point the MIL wiring is OK. The problem is a faulty ECM or PROM (CAL-PAK). If DTC 12 does not flash, the ECM should be replaced using the original PROM (CAL-PAK). Replace the PROM (CAL-PAK) only after trying an ECM, as a defective PROM (CAL-PAK) is an unlikely cause of the problem.

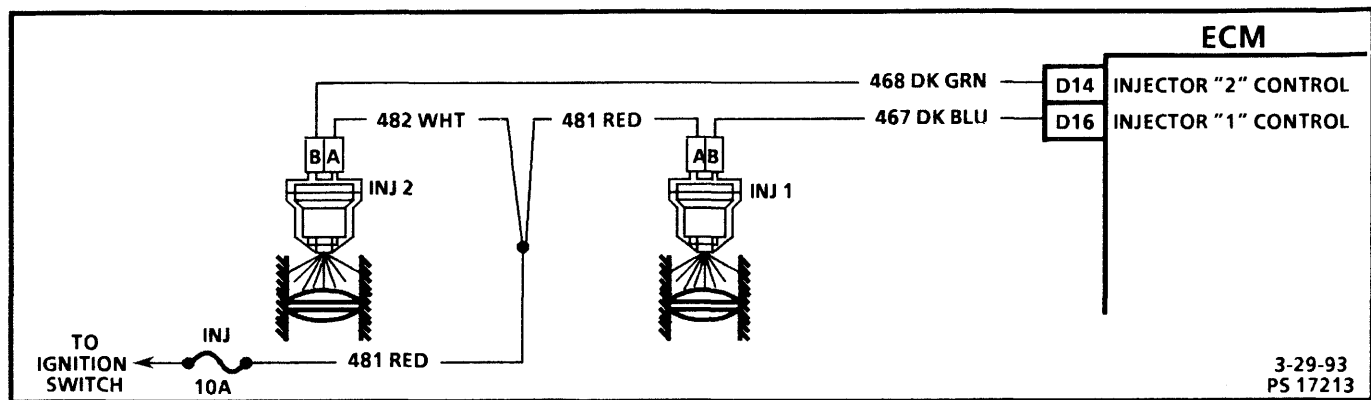
**CHART A-2**

**NO SERIAL DATA OR WILL NOT FLASH DTC 12  
MIL (SERVICE ENGINE SOON) "ON" STEADY**



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-2-92  
7S 3688-6E



## CHART A-3

### ENGINE CRANKS BUT WILL NOT RUN

#### Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, and there is adequate fuel in the tank. This chart should be used on engines using the Model 220 throttle body.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. A MIL "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to ECM. No serial data may be due to an ECM problem and CHART A-2 will diagnose the ECM. If TP signal is over 2.5 volts the engine may be in the clear flood mode which will cause starting problems. When the ECT sensor is below -30°C, the ECM will provide fuel for this extremely cold temperature and severely flood the engine.
2. Voltage at the spark plug is checked using spark tester tool ST-125 (J 26792) or equivalent. No spark indicates a basic ignition problem.
3. While cranking engine there should be no fuel spray with injectors disconnected. Replace an injector if it sprays fuel or drips like a leaking water faucet.

4. Use an injector test light like BT-8320, or equivalent, to test each injector circuit. A blinking light indicates the ECM is controlling the injectors.
5. This test will determine if there is fuel pressure at the injectors and if the injectors are operating.

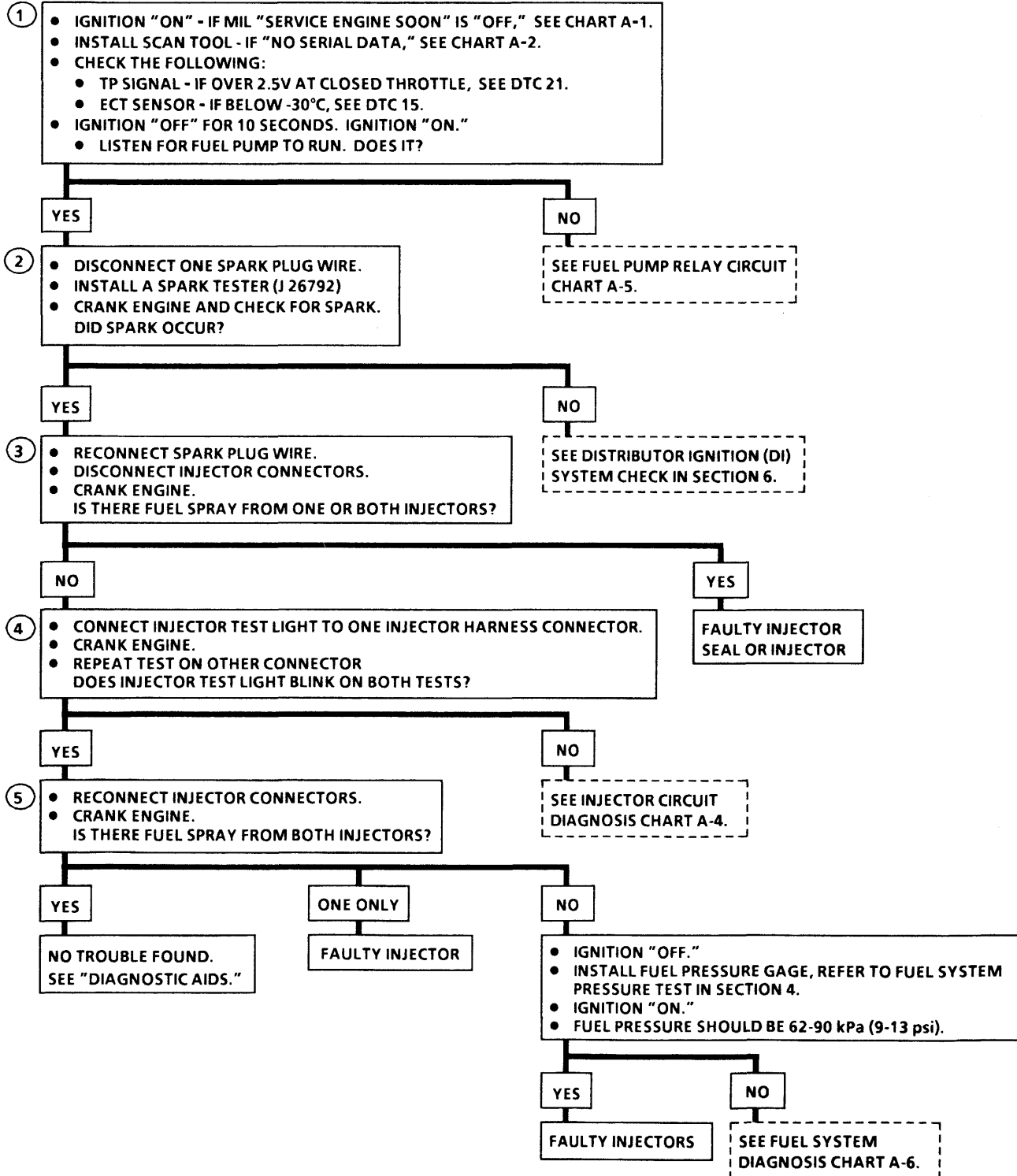
**Diagnostic Aids:** If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

- Fouled spark plugs.
- EGR valve stuck open.
- Low fuel pressure. Refer to CHART A-6.
- Water or foreign material in the fuel system.
- A grounded CKT 423 (IC) may cause a "No Start" or a "Start then Stall" condition.
- Basic engine problem.

IF DTC 54 IS STORED, USE THAT CHART FIRST.

# CHART A-3

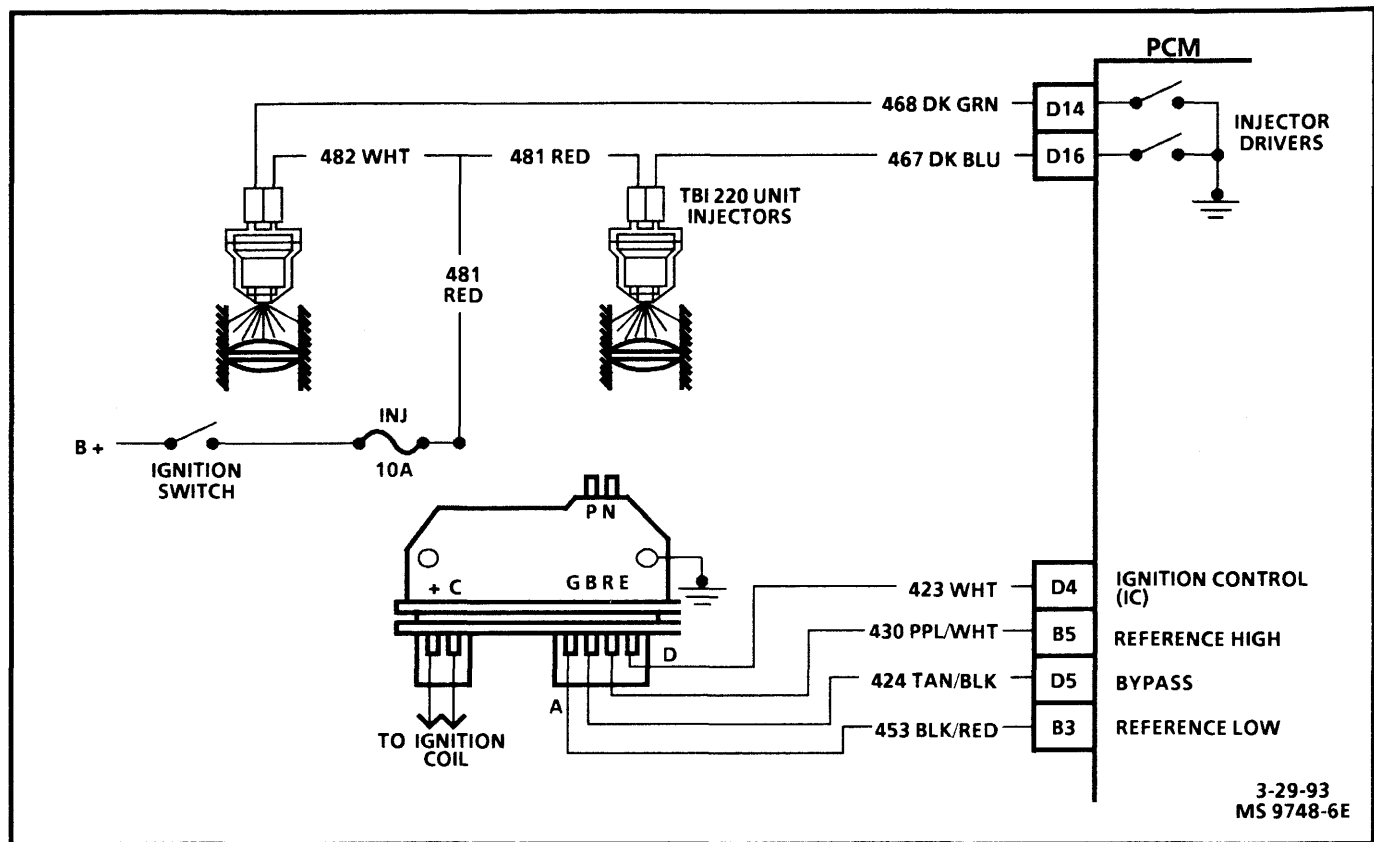
## ENGINE CRANKS BUT WILL NOT RUN



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-3-92  
75 3778-6E





**CHART A-4**  
**INJECTOR CIRCUIT DIAGNOSIS**

#### Circuit Description:

This chart should only be used if diagnosis in CHART A-3 indicated an injector circuit problem. If both injector circuits fail to blink when tested, diagnose one injector circuit at a time.

**Chart Test Description:** Number(s) below refer to circled numbers on the diagnostic chart.

1. This test will determine if the ignition module is generating a reference pulse; if not, check to see if the wiring is at fault or the ECM is at fault. By touching and removing a test light connected to 12 volts to CKT 430, a reference pulse should be generated. If injector test light blinks, the ECM and wiring are OK.
2. This step tests for 12 volts to the injector. It will also determine if there is a short to voltage on the ECM side of the circuit.
3. This test checks for continuity to the ECM.

## CHART A-4

### INJECTOR CIRCUIT DIAGNOSIS

FROM CHART A-3  
INJECTOR TEST LIGHT  
DOES NOT FLASH.

NO LIGHT, ONE OR BOTH

- ①
- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
  - IGNITION "ON."
  - MOMENTARILY TOUCH HARNESS CONNECTOR TERMINAL CKT 430 WITH TEST LIGHT TO 12 VOLTS.
- IMPORTANT:** INJECTOR TEST LIGHT SHOULD FLASH EACH TIME THE TEST LIGHT IS REMOVED FROM CKT 430.

NO FLASHING INJECTOR LIGHT

INJECTOR LIGHT FLASHES

FAULTY IGNITION MODULE  
OR  
CONNECTION.

STEADY LIGHT, ONE OR BOTH

CHECK FOR SHORT TO GROUND  
INJECTOR CKT 467 OR 468.

IF CIRCUIT IS NOT SHORTED TO  
GROUND, CHECK RESISTANCE ACROSS  
INJECTOR TERMINALS.  
SHOULD BE OVER 1.3 OHMS.

OK

FAULTY ECM.

NOT OK

FAULTY INJECTOR  
AND ECM.

- ②
- CHECK FOR:
- OPEN OR GROUNDED CKT 430.
  - FAULTY CONNECTION AT ECM CONNECTOR TERMINAL "B5".
- IF "OK":
- REMOVE INJECTOR TEST LIGHT.
  - IGNITION "ON."
  - PROBE EACH INJECTOR HARNESS CONNECTOR TERMINAL WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON"  
ONE TERMINAL

- ③
- IGNITION "OFF."
  - RECONNECT INJECTOR CONNECTOR.
  - DISCONNECT C-D (32 PIN) ECM CONNECTOR.
  - IGNITION "ON."
  - PROBE CONNECTOR TERMINAL "D14" OR "D16" WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON"

FAULTY ECM CONNECTION AT "D14" OR "D16"  
OR  
FAULTY ECM.

TEST LIGHT "OFF"  
BOTH TERMINALS

REPAIR OPEN IGNITION  
CKT 481 OR 482.

TEST LIGHT "ON"  
BOTH TERMINALS

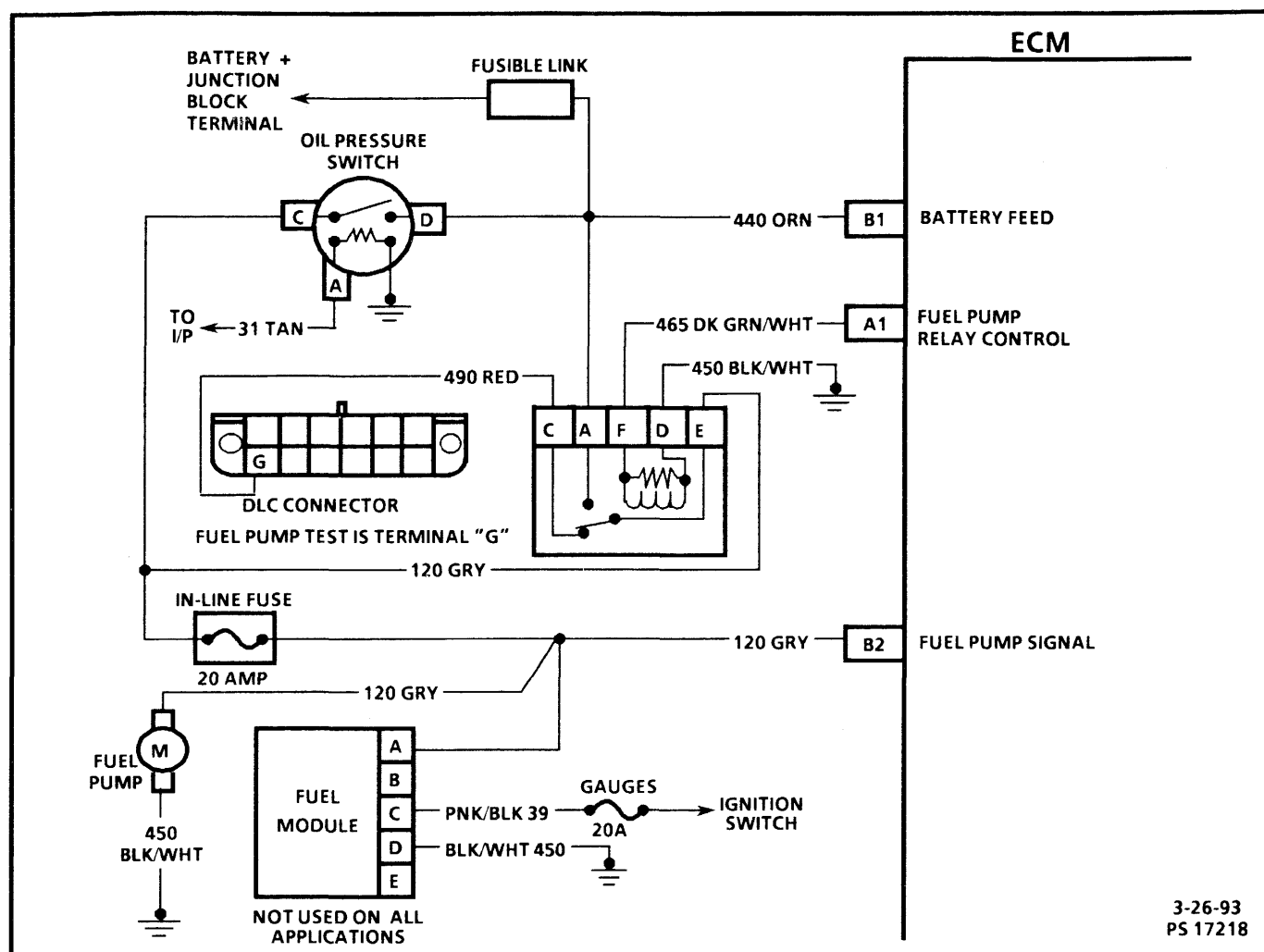
REPAIR SHORT TO VOLTAGE  
CKT 467 OR 468 AND RETEST  
WITH OLD ECM.

TEST LIGHT "OFF"

FAULTY CONNECTION  
OR  
OPEN CKT 467 OR 468.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

4-30-92  
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## CHART A-5

## FUEL PUMP RELAY CIRCUIT DIAGNOSIS

### Circuit Description:

When the ignition switch is turned "ON," the Engine Control Module (ECM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving distributor reference pulses. If there are no reference pulses, the ECM will shut "OFF" the fuel pump within 2 seconds after ignition "ON" or engine stops, except when a fuel module is used.

The pump will deliver fuel to the TBI unit where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

A fuel module is used on 5.7L (heavy duty) engines to correct a hot restart (vapor lock) during a high ambient condition. It is designed to over-ride the ECM two second pump operation, and will engage the fuel pump for twenty seconds at initial ignition "ON."

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This procedure applies direct voltage to engage the fuel pump. If the pump does not engage, it may be a fuel pump relay circuit problem which the following step will locate.
2. This step checks voltage from the battery and the ground circuit to the relay.
3. This test determines if there is voltage from the ECM, terminal "A", to terminal "D" on the relay connector.

4. This completes the fuel pump relay circuit; but if this diagnosis was used because the engine would not run, then oil pressure switch should also be diagnosed.

**Diagnostic Aids:** An inoperative fuel module may be the cause of a hot stall/no start condition. Check for power and ground circuit to and from the fuel module, including the power and grounds circuits at the fuel pump from terminal "A". If OK, and the fuel pump does not run for the specified 20 seconds at initial ignition "ON," replace the fuel module.

**CHART A-5****FUEL PUMP RELAY CIRCUIT DIAGNOSIS**

FROM CHART A-3  
FUEL PUMP DOES NOT OPERATE

1

- APPLY FUSED 12V TO FUEL PUMP TEST TERMINAL.
- LISTEN FOR IN-TANK FUEL PUMP. DOES IT OPERATE?

YES

- REMOVE 12V FROM TEST TERMINAL.
- IGNITION "OFF" FOR 10 SECONDS.
- DISCONNECT FUEL MODULE.\*
- IGNITION "ON." LISTEN FOR IN-TANK FUEL PUMP. PUMP SHOULD OPERATE FOR 2 SECONDS AFTER IGNITION IS ON. DOES IT?

NO

2

- DISCONNECT PUMP RELAY.
- IGNITION "ON," ENGINE STOPPED.
- PROBE RELAY HARNESS-CONNECTOR TERMINAL CKT 440 WITH A TEST LIGHT TO GROUND.

TEST LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINAL CKTs 450 AND 440.

TEST LIGHT "ON"

3

- CONNECT TEST LIGHT BETWEEN TERMINAL CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON." TEST LIGHT SHOULD LIGHT FOR 2 SECONDS. DOES IT?

YES

4

- FAULTY CONNECTION AT RELAY TERMINAL "D" OR FAULTY RELAY. CONNECT FUEL MODULE IF REMOVED. IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN," CONTINUE TESTING OIL PRESSURE SWITCH.
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN. DOES IT?

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

NO TEST LIGHT

NO TROUBLE FOUND.

NO

DISCONNECT CHASSIS HARNESS FUEL PUMP CONNECTOR. CONNECT A TEST LIGHT BETWEEN CKT 120 AND GROUND ON CHASSIS. APPLY FUSED 12V TO FUEL PUMP TEST TERMINAL.

TEST LIGHT "ON"

CONNECT TEST LIGHT GROUND TO CKT 450.

TEST LIGHT "ON"

REPAIR FUEL PUMP.

TEST LIGHT "OFF"

REPAIR OPEN IN CKT 120.

TEST LIGHT "OFF"

REPAIR OPEN IN CKT 450.

YES

IF NO FUEL MODULE, NO TROUBLE FOUND. IN RELAY CIRCUIT WITH FUEL MODULE: IGNITION "OFF," CONNECT MODULE AND WAIT 10 SECONDS. IGNITION "ON," FUEL PUMP SHOULD RUN FOR ABOUT 20 SECONDS. DOES IT?

NO

REFER TO FUEL MODULE CHECK PROCEDURE.

YES

NO TROUBLE FOUND.

NO

OPEN OR SHORT TO GROUND IN CKT 465 OR FAULTY ECM.

NO

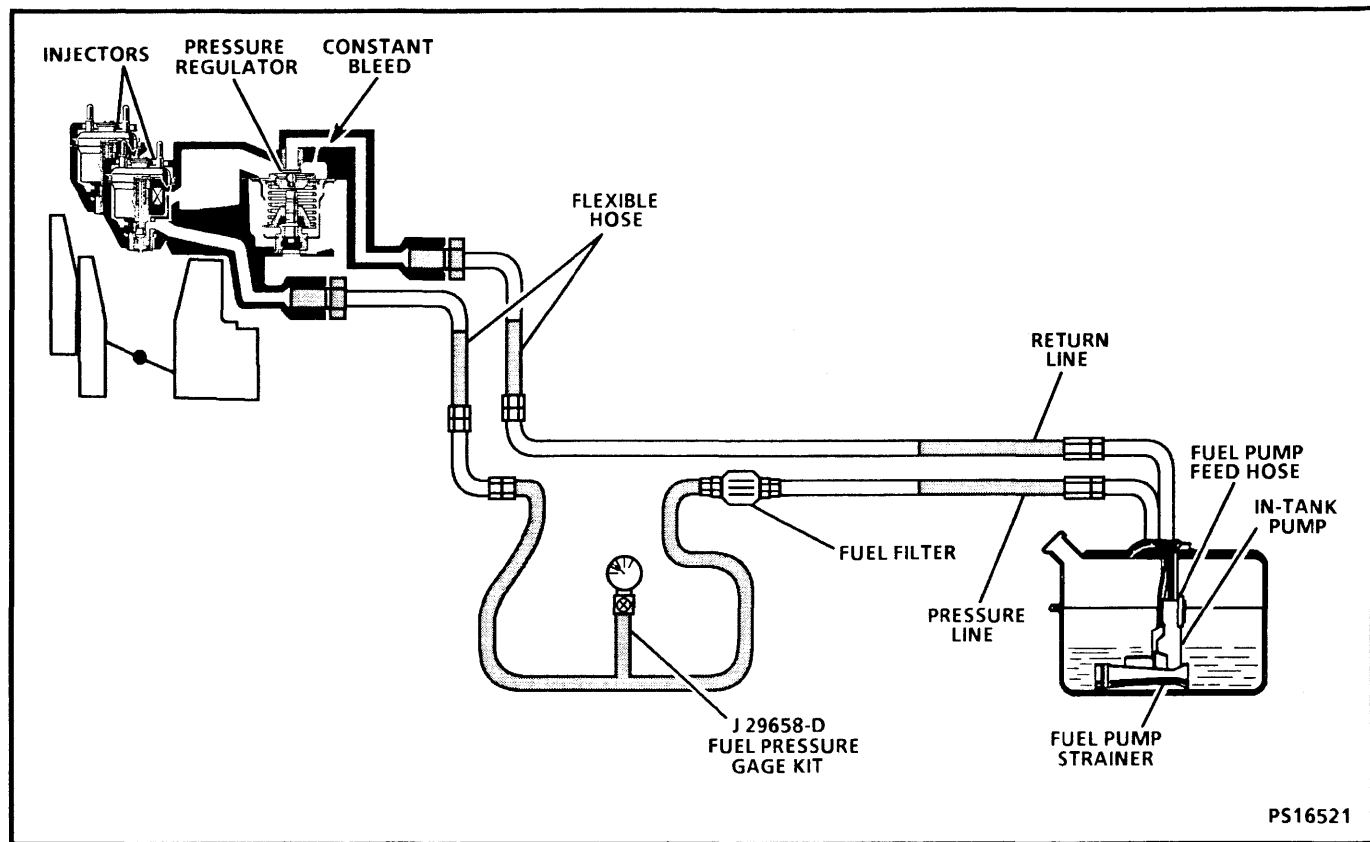
OPEN IN CKT 440 OR 120 TO THE OIL PRESSURE SWITCH OR FAULTY OIL PRESSURE SWITCH.

TEST LIGHT

FAULTY OIL PRESSURE SWITCH.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

3-27-93  
PS 17219



**CHART A-6**  
**FUEL SYSTEM DIAGNOSIS**

### Circuit Description:

When the fuel pump is running, fuel is delivered to the injector(s) and then to the regulator where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank. Fuel module is used on all 7.4, 5.7 over 8500 GVW.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Pressure, but less than 62 kPa (9 psi) falls into two areas:

- Regulated pressure but less than 62 kPa (9 psi) - Amount of fuel to injector OK but pressure is too low. System will be lean running and may set DTC 44. Also, hard starting cold and poor overall performance.
- Restricted flow causing pressure drop - Normally, a vehicle with a fuel pressure of less than 62 kPa (9 psi) at idle will not be drivable. However, if the pressure drop occurs only while driving, the engine could surge and stop when pressure is too low.
- If pressure builds slowly or vehicle is hard starting when cold, the fuel could be draining back into fuel tank. The check valve is diagnosed in this step.

2. Restricting the outlet side of the gage allows the pump to develop its maximum pressure (dead head pressure). With battery voltage applied to the pump "test" terminal, fuel pressure should rise to 90 to 103 kPa (13 to 15 psi) as the pressure gage outlet hose is gradually pinched.
3. This test determines if the high fuel pressure is due to a restricted fuel return line or a throttle body pressure regulator problem.

### Diagnostic Aids:

- If the vehicle is equipped with a fuel module, the module must be disconnected before performing the fuel system pressure test. Refer to SECTION 4.
- Fuel system is under pressure. To avoid fuel spillage, refer to procedures in SECTION 4 for testing or making repairs requiring disassembly of fuel lines or fittings.
- On TBI engines, the fuel pressure drops to almost zero psi after pump shuts "OFF."

# CHART A-6 FUEL SYSTEM DIAGNOSIS

- IGNITION "OFF" FOR TEN SECONDS.
- IGNITION "ON." LISTEN FOR IN-TANK FUEL PUMP. WITH IGNITION "ON," PUMP SHOULD RUN FOR 2 SECONDS.

YES

NO

SEE FUEL PUMP RELAY  
CIRCUIT CHART A-5.

- IGNITION "OFF."
- CHECK FOR ADEQUATE FUEL LEVEL IN-TANK.
- RELIEVE FUEL PRESSURE.
- INSTALL PRESSURE GAGE AS OUTLINED IN SECTION 4 (AN OUTLET OF FUEL FILTER).
- INSTALL FUSED 12 VOLTS TO FUEL PUMP "TEST" TERMINAL, NOTE PRESSURE WITHIN 2 SECONDS.

FUEL PRESSURE IS BELOW 62 kPa (9 psi) OR  
ABOVE 89 kPa (13 psi) WITHIN 2 SECONDS.

FUEL PRESSURE IS  
62-90 kPa (9-13 psi)

NO PROBLEM FOUND

1 LESS THAN 62 kPa (9 psi)

FUEL PRESSURE WITHIN  
SPEC. BUT, LONG CRANK  
TIMES BEFORE STARTING.

ABOVE 89 kPa (13 psi)

- INSTALL PRESSURE GAGE ON INLET SIDE OF FUEL FILTER AND REINSTALL FILTER OUTLET LINE.
- APPLY FUSED 12 VOLTS TO TEST TERMINAL. NOTE PRESSURE.

- IGNITION "OFF."
- APPLY FUSED 12 VOLTS TO TEST TERMINAL AND WAIT FOR PRESSURE TO BUILD.
- DISCONNECT JUMPER AND PINCH OFF FUEL RETURN LINE. SOME PRESSURE SHOULD HOLD FOR AT LEAST 30 SECONDS. DOES IT?

- 3
- DISCONNECT INJECTOR CONNECTOR.
  - DISCONNECT FUEL RETURN LINE FLEXIBLE HOSE.
  - ATTACH 5/16 I.D. FLEX HOSE TO THROTTLE BODY SIDE OF RETURN LINE. INSERT THE OTHER END IN AN APPROVED GASOLINE CONTAINER.
  - NOTE FUEL PRESSURE WITHIN 2 SECONDS AFTER IGNITION "ON."

LESS THAN 62 kPa (9 psi)

ABOVE 62 kPa (9 psi)

- 2
- IGNITION "OFF."
  - DISCONNECT INJECTOR.
  - APPLY FUSED 12 VOLTS TO FUEL PUMP TEST CONNECTOR.
  - GRADUALLY PINCH PRESSURE GAGE OUTLET HOSE AND NOTE PRESSURE.

REPLACE FILTER  
AND RECHECK.

YES

NO

NO TROUBLE  
FOUND.  
REFER TO  
SECTION 2.

CHECK FOR  
LEAKING  
FUEL PUMP  
FEED HOSE.

IF OK

FUEL PUMP IS  
FAULTY.  
(LEAKING,  
CHECK VALVE  
INSIDE PUMP).

ABOVE 89  
kPa (13 psi)

62-89 kPa  
(9-13 psi)

CHECK FOR  
RESTRICTED  
FUEL LINE  
BETWEEN  
GAGE AND  
RETURN LINE  
FLEXIBLE  
HOSE.

LOCATE AND  
CORRECT  
RESTRICTED  
FUEL  
RETURN LINE  
TO TANK.

IF LINE OK, REPLACE  
PRESSURE REGULATOR  
ASSY.

ABOVE 89 kPa (13 psi)

REPLACE PRESSURE  
REGULATOR ASSY.

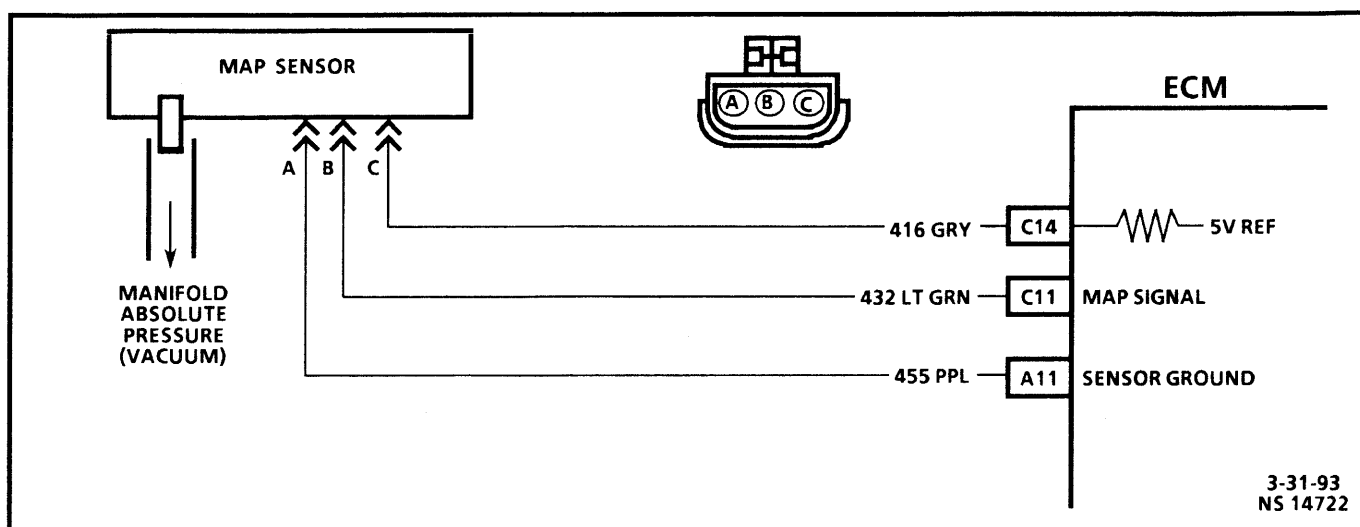
PRESSURE, BUT LESS  
THAN 62 kPa (9 psi)

CHECK FOR  
RESTRICTED FUEL  
LINE FROM FUEL  
TANK TO  
GAGE OR FAULTY  
IN-TANK

- FUEL PUMP.
- COUPLING HOSE.
- PUMP INLET FILTER.
- WRONG FUEL PUMP.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

3-24-93  
75 3807



## MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor measures the pressure changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and RPM changes; and converts these into a voltage output. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the ECM knows the manifold pressure. At lower pressure output the voltage will be about 1 to 2 volts at idle. While at higher pressure or at Wide Open Throttle (WOT) output the voltage will be about 4 to 4.8 volts. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the ECM to make adjustments for different altitudes. The ECM uses the MAP sensor to control fuel delivery and ignition timing.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

### Important

- Be sure to use the same Diagnostic Test Equipment for all measurements.

- Checks MAP sensor output voltage to the ECM. This voltage, without engine running, represents a barometer reading to the ECM.
  - When comparing scan tool readings to a known good vehicle, it is important to compare vehicles that use a MAP sensor having the same color insert or having the same "Hot Stamped" number. Refer to figures on facing page.
- Applying 34 kPa (10" Hg) vacuum to the MAP sensor should cause the voltage to change. Subtract second reading from the first. Voltage value should be greater than 1.5 volts. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.

- Check vacuum hose to sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

**NOTICE:** Make sure electrical connector remains securely fastened.

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connection. Output changes greater than .1 volt indicate a bad connector or connection. If OK, replace sensor.

# MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

**NOTICE:** THIS CHART ONLY APPLIES TO MAP SENSORS HAVING GREEN OR BLACK COLOR KEY INSERT (SEE BELOW).

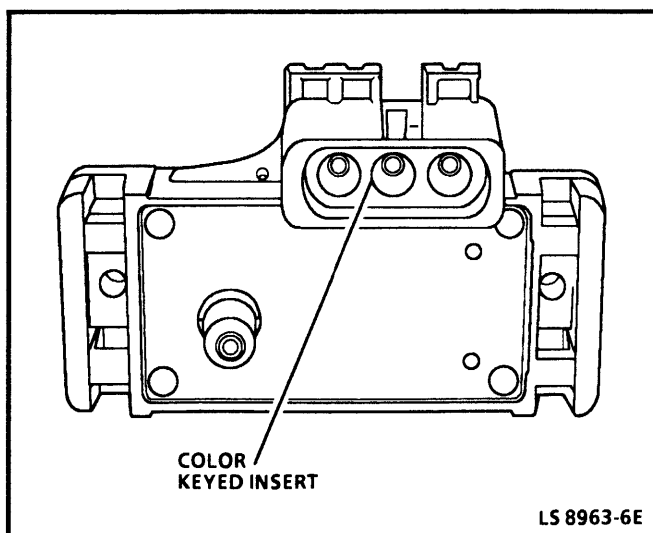
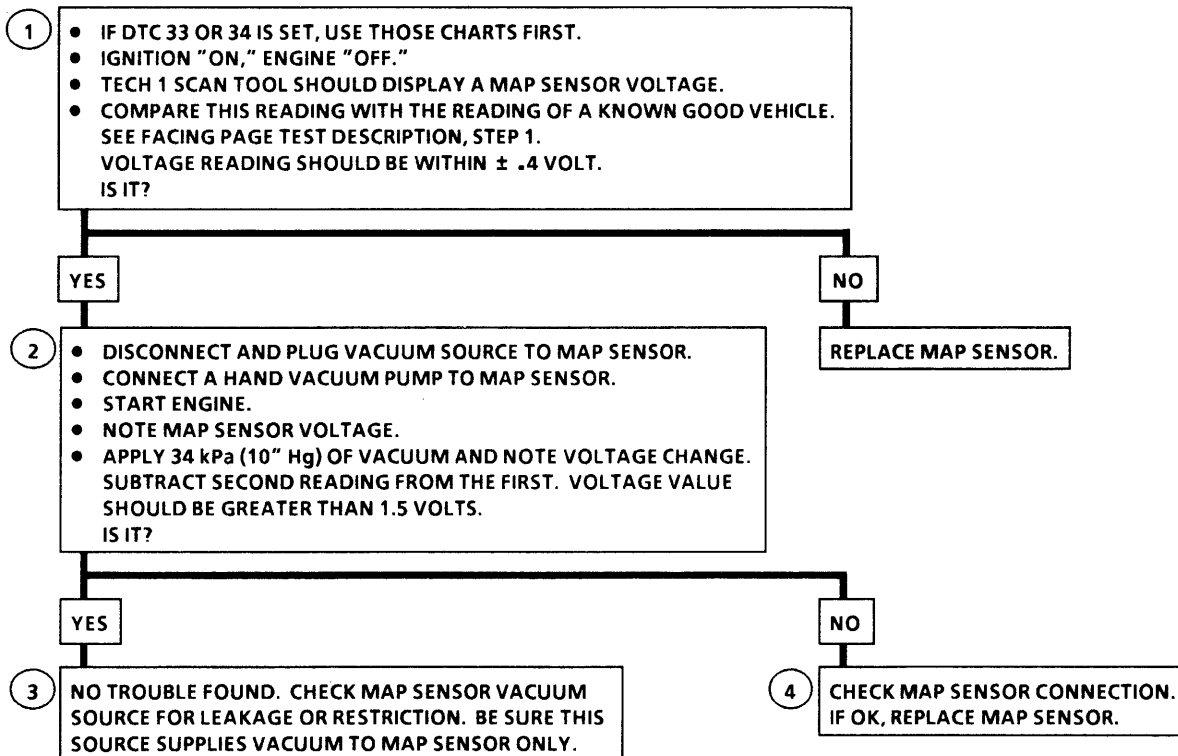


Figure 1 - Color Key Insert

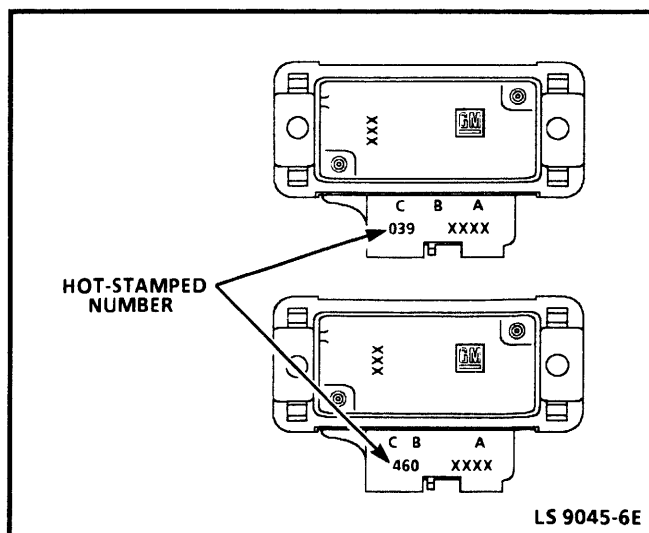
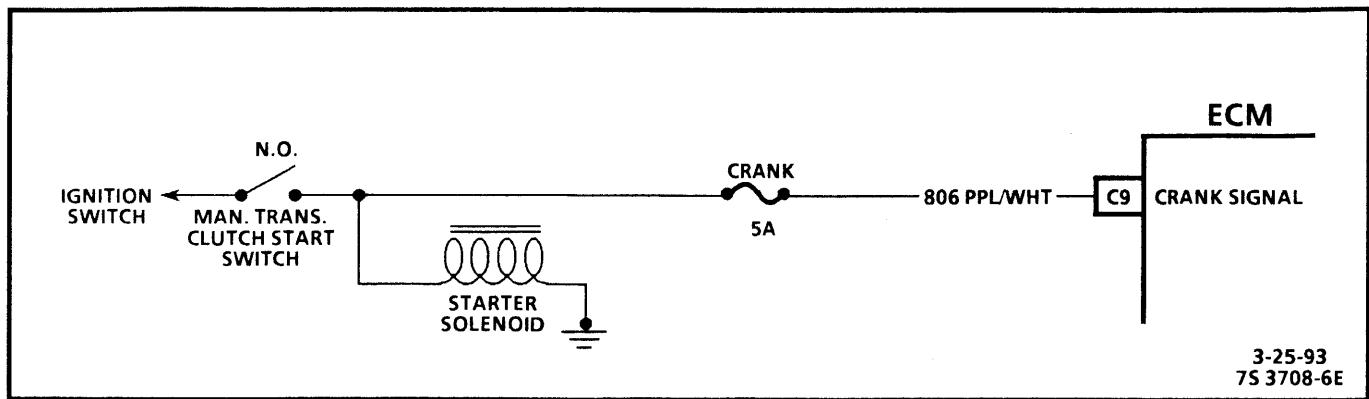


Figure 2 - Hot Stamped Number

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

5-1-92  
NS 13990





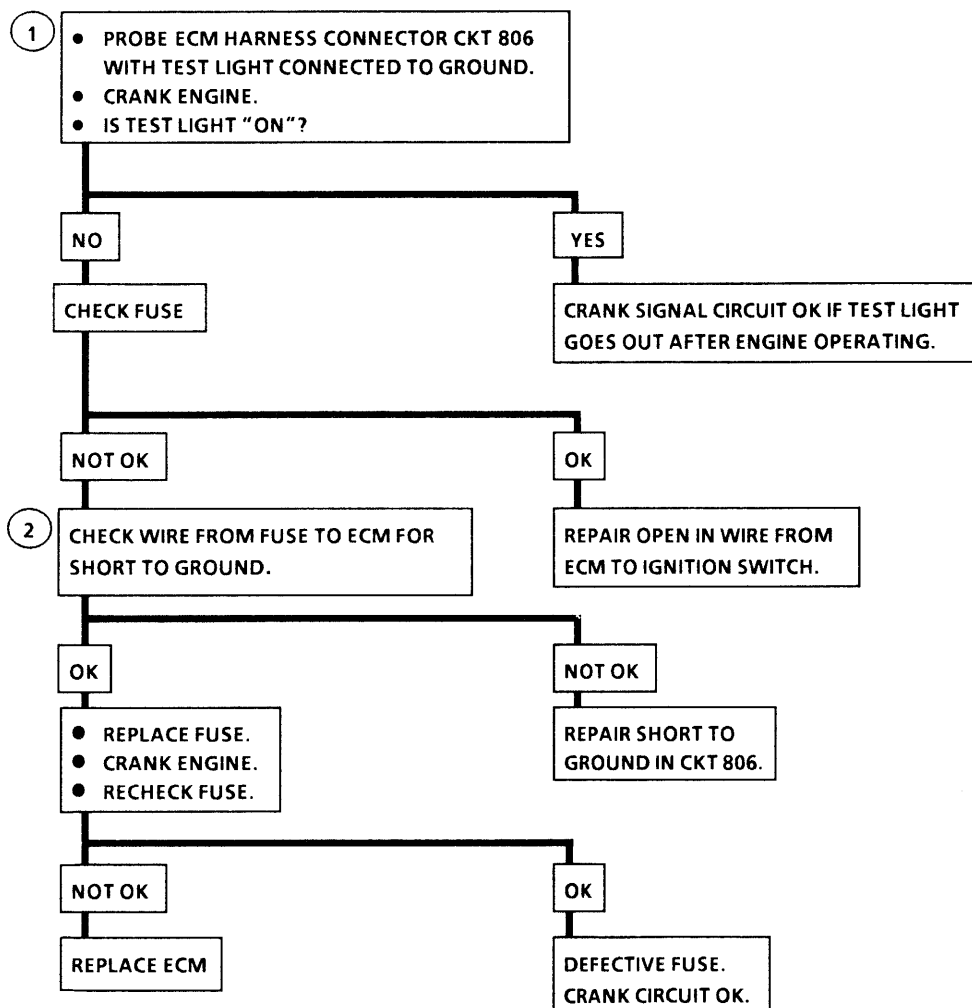
## CRANK SIGNAL DIAGNOSIS

### Circuit Description:

Crank signal is an ignition voltage signal to the ECM during cranking to allow enrichment and cancel diagnostics until engine is operating with 12 volts no longer on the circuit.

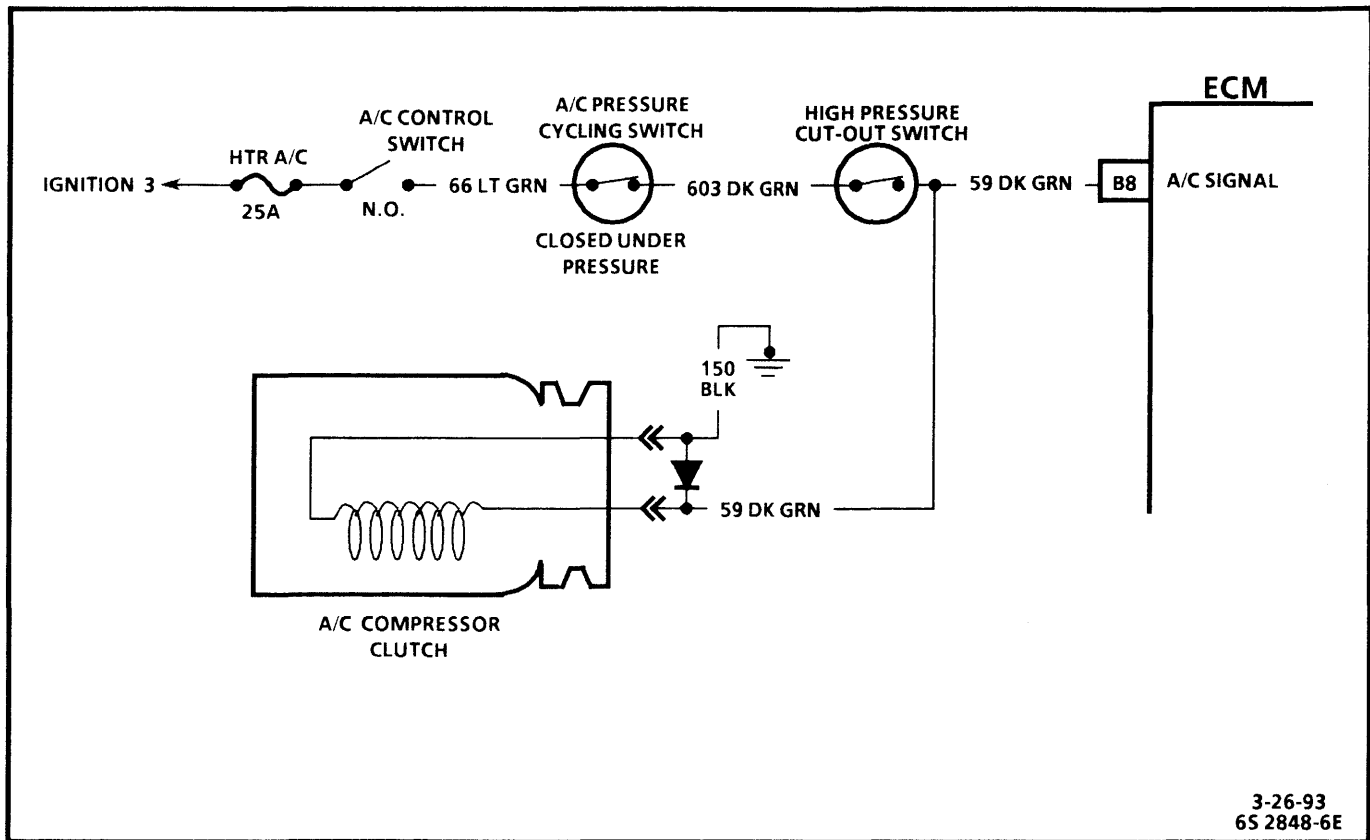
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for normal (cranking) voltage to terminal "C9" of ECM. Test light should be "ON" during cranking and then go "OFF" when engine is operating.
2. Checks to determine if source of open fuse or fuse link was a faulty ECM.

**CRANK SIGNAL DIAGNOSIS**

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-2-92  
7S 3709-6E



## A/C SIGNAL DIAGNOSIS

### Circuit And Chart Test Description:

Turning "ON" the air conditioning supplies CKT 59 battery voltage to the A/C compressor clutch and to terminal "B8" of the ECM connector to increase and maintain idle speed.

The ECM does not control the A/C compressor clutch, therefore, if A/C does not function, refer to the A/C section of the service manual for diagnosis of the system.

If A/C is operating properly and idle speed dips too low when the A/C compressor turns "ON" or flares too high when the A/C compressor turns "OFF," check for an open CKT 59 to the ECM. If circuits are OK, it is a faulty ECM connector terminal "B8" or ECM.

## RESTRICTED EXHAUST SYSTEM CHECK

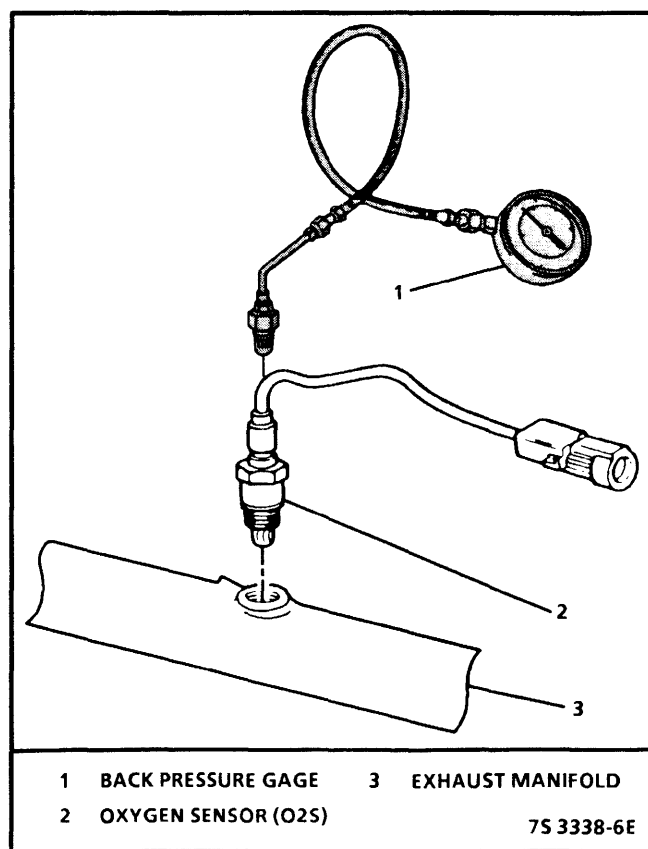
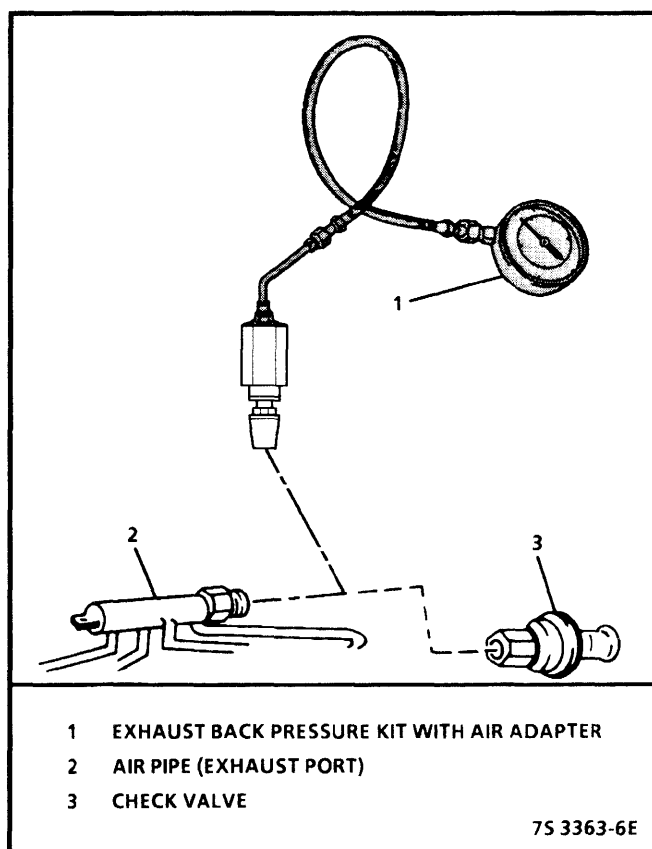
Proper diagnosis for a restricted exhaust system is essential before any components are replaced. Either of the following procedures may be used for diagnosis, depending upon engine or tool used:

### CHECK AT AIR PIPE:

1. Remove the rubber hose at the exhaust manifold AIR pipe check valve. Remove check valve.
2. Connect exhaust backpressure kit (with air adapter) J 35314-A.
3. Insert the adapter into the exhaust manifold AIR pipe.

### OR CHECK AT OXYGEN SENSOR (O2S):

1. Carefully remove oxygen sensor.
2. Install exhaust backpressure gage J 35314-A in place of oxygen sensor (refer to illustration).
3. After completing test described below, coat threads of oxygen sensor with anti-seize compound P/N 5613695 or equivalent prior to re-installation.



### DIAGNOSIS:

1. With the engine idling at normal operating temperature, observe the exhaust system backpressure reading on the gage. Reading should not exceed 8.6 kPa (1.25 psi).
2. Increase engine speed to 2000 RPM and observe gage. Reading should not exceed 20.7 kPa (3 psi).
3. If the backpressure at either speed exceeds specification, a restricted exhaust system is indicated.
4. Inspect the entire exhaust system for a collapsed pipe, heat distress, or possible internal muffler failure.
5. If there are no obvious reasons for the excessive backpressure, the catalytic converter is suspected to be restricted and should be replaced using current recommended procedures.

4-30-92  
●75 3340-6E

Figure 3B-3 - Exhaust System Check

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

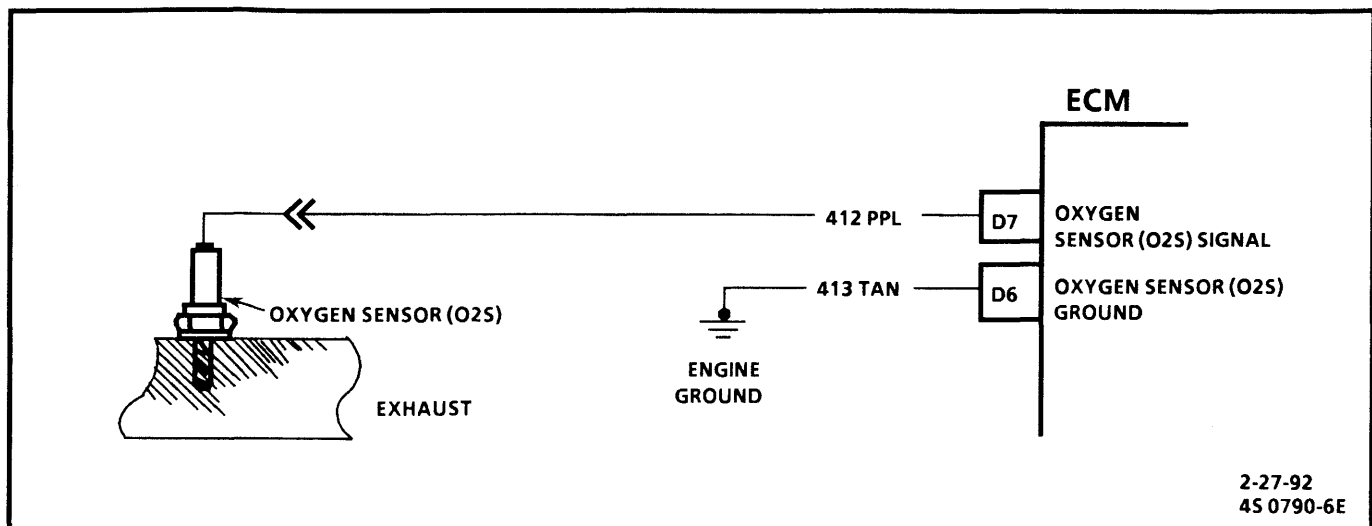
The malfunction indicator lamp will only be "ON" if the malfunction exists under the conditions listed below. If the malfunction clears, the lamp will go out and the DTC will be stored in the ECM. Any DTCs stored will be erased if no problem reoccurs within 50 engine starts.

| DTC AND CIRCUIT                                                                           | PROBABLE CAUSE                                                                                                                                                                                            | DTC AND CIRCUIT                                                                                 | PROBABLE CAUSE                                                                                                    |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| DTC 13 - Oxygen O2S Sensor Circuit (Open Circuit)                                         | Indicates that the oxygen sensor circuit or sensor was open for one minute while off idle.                                                                                                                | DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit High (Signal Voltage High- Low Vacuum) | MAP sensor output high for 5 seconds or an open signal circuit.                                                   |
| DTC 14 - Engine Coolant Temperature Sensor (ECT) Circuit Low (High Temperature Indicated) | Sets if the sensor or signal line becomes grounded for 3 seconds.                                                                                                                                         | DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit Low (Signal Voltage Low-High Vacuum)   | Low or no output from sensor with engine running.<br><br>ECM has seen an open or grounded IC or bypass circuit.   |
| DTC 15 - Engine/Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | Sets if the sensor, connections, or wires open for 3 seconds.                                                                                                                                             | DTC 42 - Ignition Control (IC) Error                                                            | Signal to the ECM has remained low for too long or the system has failed a functional check.                      |
| DTC 21 - Throttle Position (TP) Sensor Circuit High (Signal Voltage High)                 | TP voltage greater than 2.5 volts for 3 seconds with less than 1200 RPM.                                                                                                                                  | DTC 43 - Knock Sensor (KS) Circuit                                                              |                                                                                                                   |
| DTC 22 - Throttle Position (TP) Sensor Circuit Low (Signal Voltage Low)                   | A short to ground or open signal circuit will set DTC in 3 seconds.                                                                                                                                       | DTC 44 - Lean Exhaust                                                                           | Sets if oxygen sensor voltage remains below .2 volt for about 20 seconds.                                         |
| DTC 24 - Vehicle Speed Sensor (VSS) Circuit Low                                           | No vehicle speed present during a road load decel.                                                                                                                                                        | DTC 45 - Rich Exhaust                                                                           |                                                                                                                   |
| DTC 32 - Exhaust Gas Recirculation (EGR) Error                                            | Vacuum switch shorted to ground on start up<br>OR<br>Switch not closed after the ECM has commanded EGR for a specified period of time.<br>OR<br>EGR solenoid circuit open for a specified period of time. | DTC 51 - Faulty PROM Problem                                                                    | Sets if oxygen sensor voltage remains above .7 volt for about 1 minute.                                           |
|                                                                                           |                                                                                                                                                                                                           | DTC 53 - System Over Voltage                                                                    | Faulty PROM or ECM.                                                                                               |
|                                                                                           |                                                                                                                                                                                                           | DTC 54 - Fuel Pump Relay (Low Voltage)                                                          | System overvoltage. Indicates a basic generator problem.                                                          |
|                                                                                           |                                                                                                                                                                                                           | DTC 55 - Faulty ECM                                                                             | Sets when the fuel pump voltage is less than 2 volts when reference pulses are being received.<br><br>Faulty ECM. |

4-5-93  
NS 14144

Figure 3B-4 - ECM DTC System

**BLANK**



## DTC 13

### OXYGEN SENSOR (O2S) CIRCUIT (OPEN CIRCUIT)

#### Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen Sensor (O2S) varies the voltage from a range of approximately 1 volt if the exhaust is rich, to approximately .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below approximately 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

#### DTC 13 Will Set When:

- Engine temperature greater than 70°C (158°F).
- Two minutes engine time after start.
- O2S signal voltage steady between .35 and .55 volt.
- Throttle Position (TP) sensor signal above idle.
- All conditions must be met for about 60 seconds.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate, and the system will go "Open Loop."

**DTC 13 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

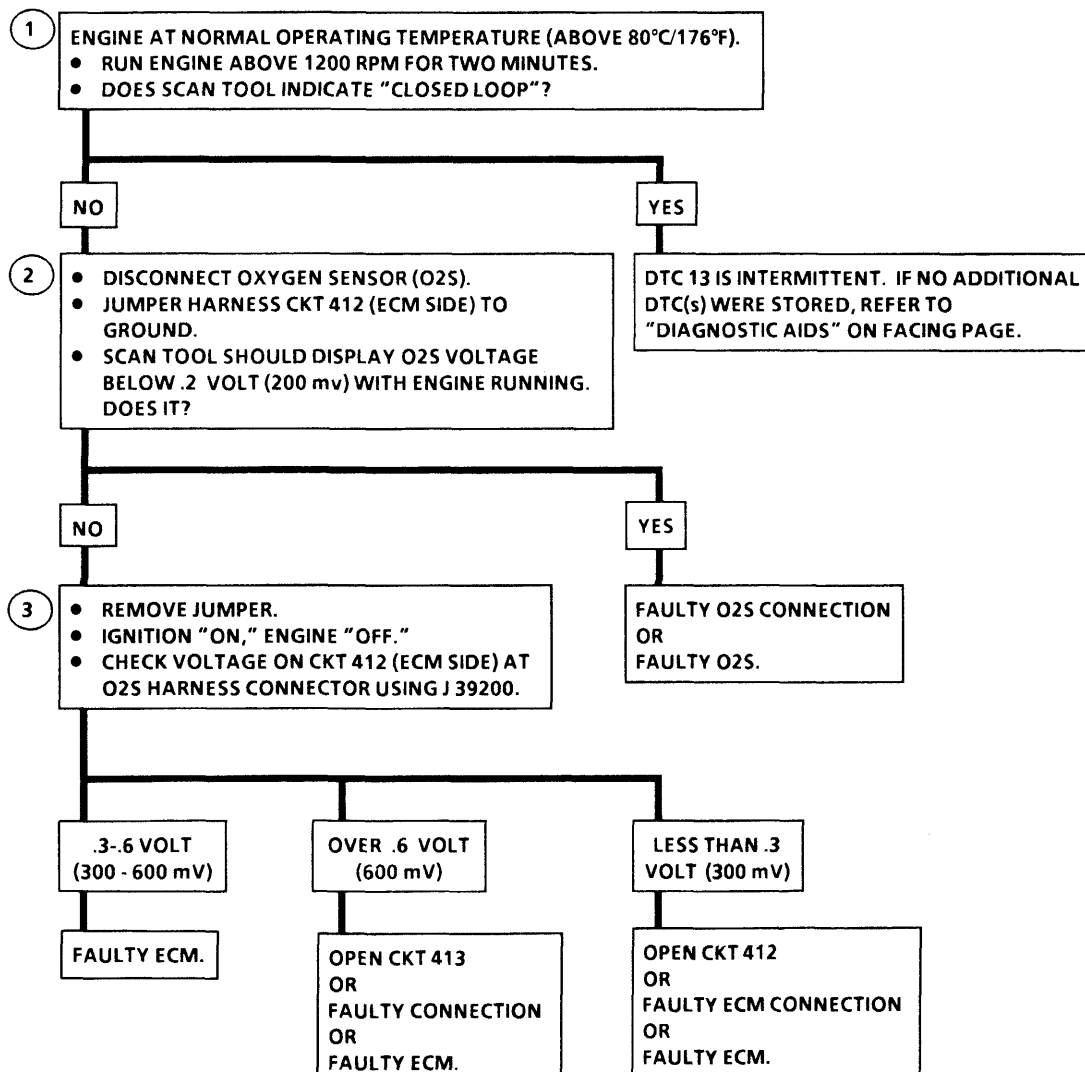
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Verifies DTC criteria.
2. This will determine if the sensor is at fault or the wiring or ECM is the cause of DTC 13.
3. In doing this test, use only a high impedance digital volt ohmmeter. This test checks the continuity of CKTs 412 and 413, because if CKT 413 is open, the ECM voltage on CKT 412 will be over .6 volt (600 mV).

**Diagnostic Aids:** Normal scan tool voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." DTC 13 sets in one minute if voltage remains between .35 and .55 volt; but the system will go "Open Loop" in about 15 seconds. Verify a clean tight ground connection for CKT 413. Open CKT 412 or CKT 413 will result in a DTC 13.

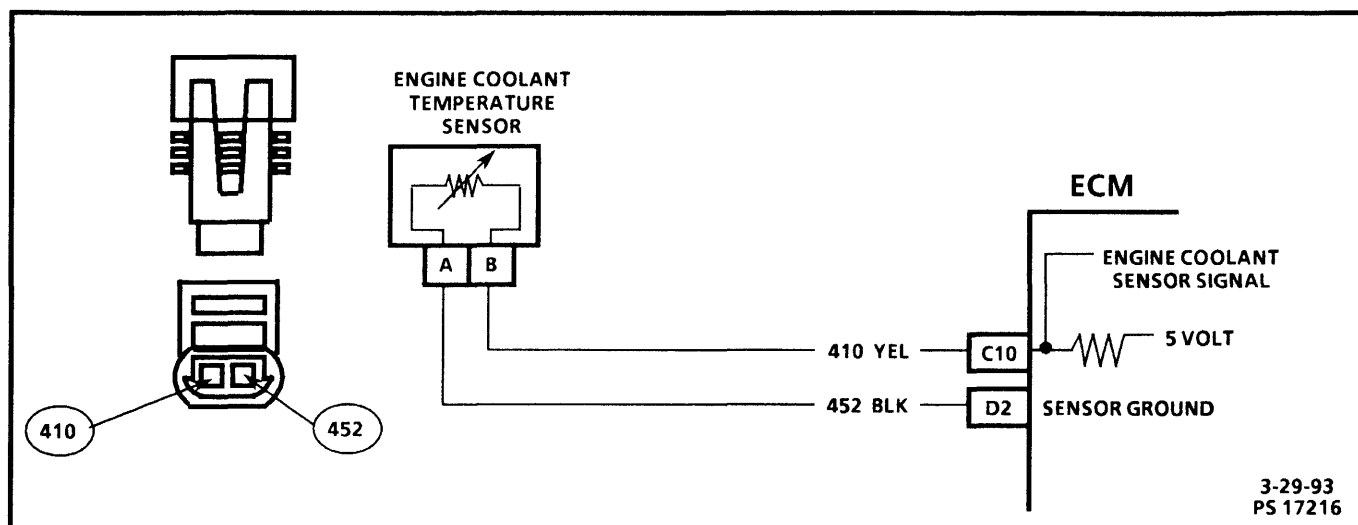
## DTC 13

### OXYGEN SENSOR (O2S) CIRCUIT (OPEN CIRCUIT)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.





## DTC 14

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor which controls the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high; therefore the ECM will see a high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

**DTC 14 Will Set When:** Signal voltage indicates a coolant temperature above 135°C (270°F) for 6 seconds.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 14 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

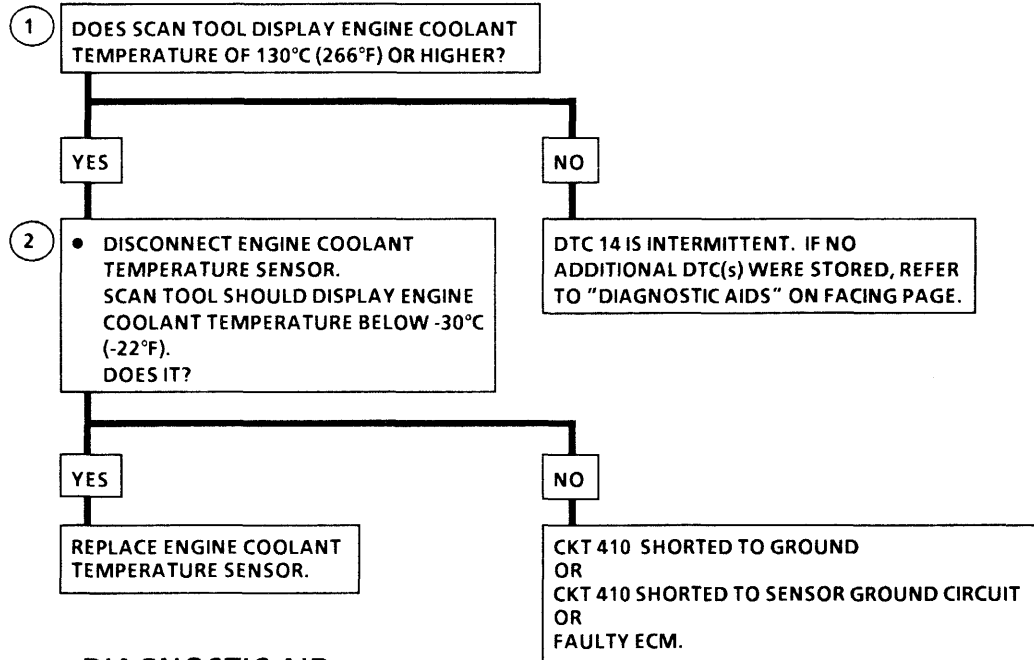
- Checks to see if DTC was set as result of a hard failure or intermittent condition.
- This test simulates conditions for DTC 15. If the ECM recognizes the open circuit (high voltage) and displays a low temperature, the ECM and wiring are OK.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 410.

Tech 1 scan tool displays engine coolant temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens. A faulty connection or an open in CKTs 410 and 452 will result in a DTC 14.

Refer to "Intermittents" in SECTION 2.

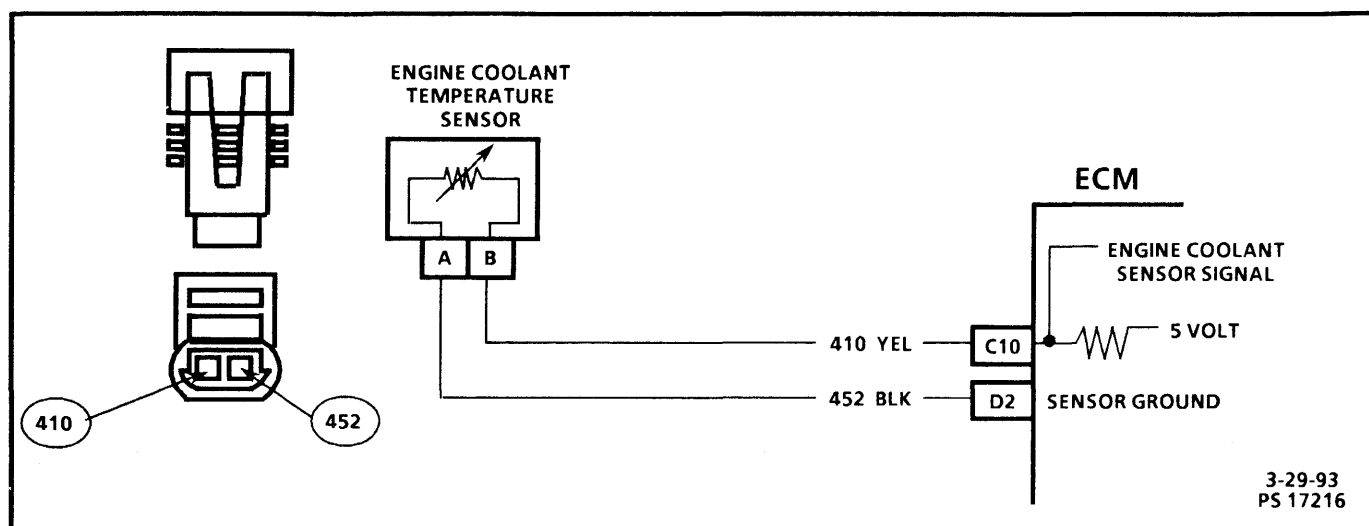
The "Temperature to Resistance Value" scale at the right may be used to test the engine coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

**DTC 14****ENGINE COOLANT TEMPERATURE  
(ECT) SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| ENGINE COOLANT TEMPERATURE SENSOR                  |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

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## DTC 15

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor which controls the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high; therefore the ECM will see a high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

**DTC 15 Will Set When:** Signal voltage indicates a coolant temperature less than -35°C (-31°F) for 30 seconds.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 15 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Check to see if DTC was set as result of a hard failure or intermittent condition.
2. This test simulates a DTC 14. If the ECM recognizes the low signal voltage (high temperature), and the Tech 1 scan reads 130°C (266°F) or above, the ECM and wiring are OK.
3. This test will determine if CKT 410 is open. There should be 5 volts present at sensor connector if measured with J 39200 voltmeter. This will determine if there is a wiring problem or a faulty ECM.

**Diagnostic Aids:** A scan tool reads engine coolant temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

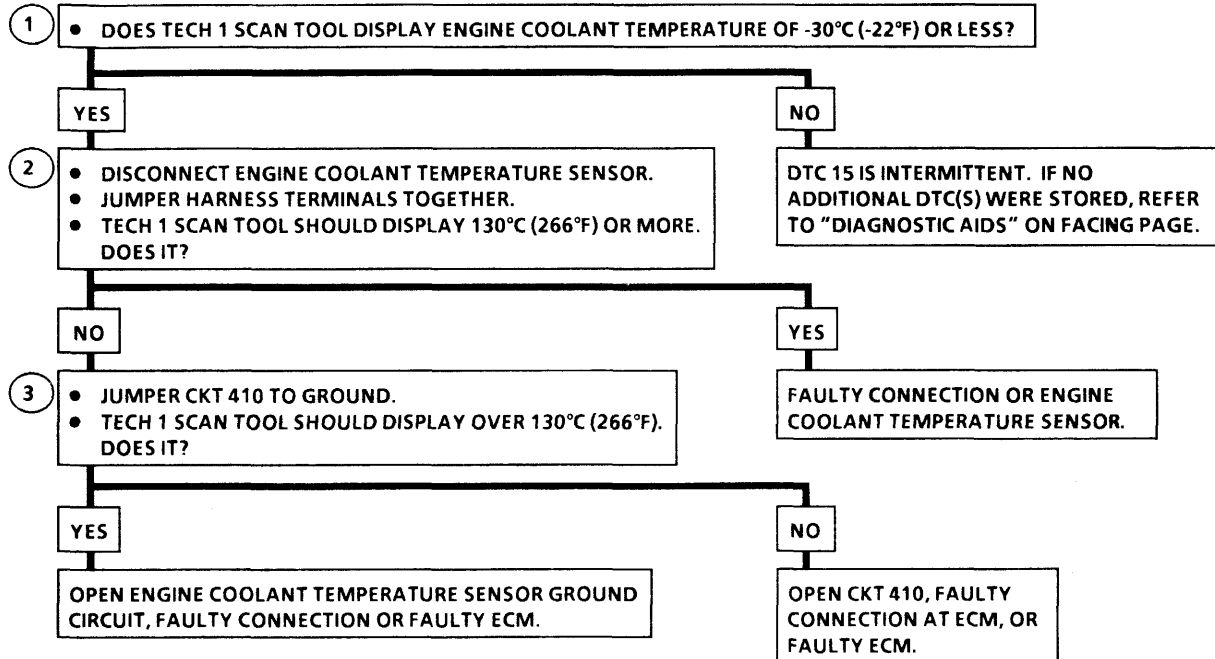
A faulty connection, or an open in CKTs 410 or 452 will result in a DTC 15.

Refer to DTCs in SECTION 2.

The "Temperature To Resistance Value" scale at the right may be used to test the engine coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

## DTC 15

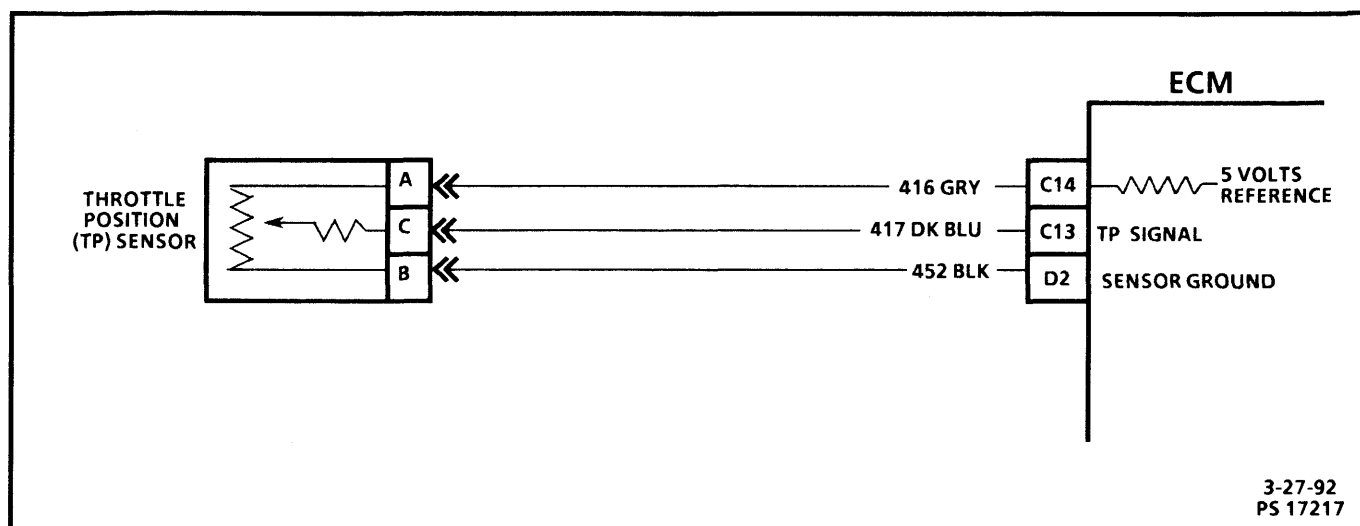
### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)



### DIAGNOSTIC AID

| ENGINE COOLANT TEMPERATURE SENSOR |     |        |
|-----------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES |     |        |
| (APPROXIMATE)                     |     |        |
| °C                                | °F  | OHMS   |
| 100                               | 212 | 177    |
| 90                                | 194 | 241    |
| 80                                | 176 | 332    |
| 70                                | 158 | 467    |
| 60                                | 140 | 667    |
| 50                                | 122 | 973    |
| 45                                | 113 | 1188   |
| 40                                | 104 | 1459   |
| 35                                | 95  | 1802   |
| 30                                | 86  | 2238   |
| 25                                | 77  | 2796   |
| 20                                | 68  | 3520   |
| 15                                | 59  | 4450   |
| 10                                | 50  | 5670   |
| 5                                 | 41  | 7280   |
| 0                                 | 32  | 9420   |
| -5                                | 23  | 12300  |
| -10                               | 14  | 16180  |
| -15                               | 5   | 21450  |
| -20                               | -4  | 28680  |
| -30                               | -22 | 52700  |
| -40                               | -40 | 100700 |

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.



## DTC 21

### THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH)

#### Circuit Description:

The Throttle Position (TP) sensor provides a voltage signal which changes relative to the throttle blade angle. Signal voltage will vary from about .5 volt at idle to about 4.0 volts at Wide Open Throttle (WOT).

The TP signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

On nonadjustable TP switches, each time voltage drops below 1.25 volts and stops, the ECM assumes this value is 0 throttle angle and measures percent throttle from this point on.

#### DTC 21 Will Set When:

- Engine running.
- TP signal voltage is greater than 2.5 volts.
- All conditions met for eight seconds. With throttle closed, the TP signal should read less than 1.25 volts. Refer to "Diagnostic Aids."

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 21 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step checks to see if DTC 21 is the result of hard failure or an intermittent condition.
2. With the TP sensor disconnected, the TP signal voltage should go low if the ECM and wiring is OK.
3. Probing CKT 452 with a test light checks the 5 volt return circuit. This step isolates a faulty sensor ECM or an open CKT 452.

**Diagnostic Aids:** A scan tool reads throttle position in volts. Should read about .45 to .95 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also, some scan tools will read throttle angle 0% = closed throttle 100% = WOT.

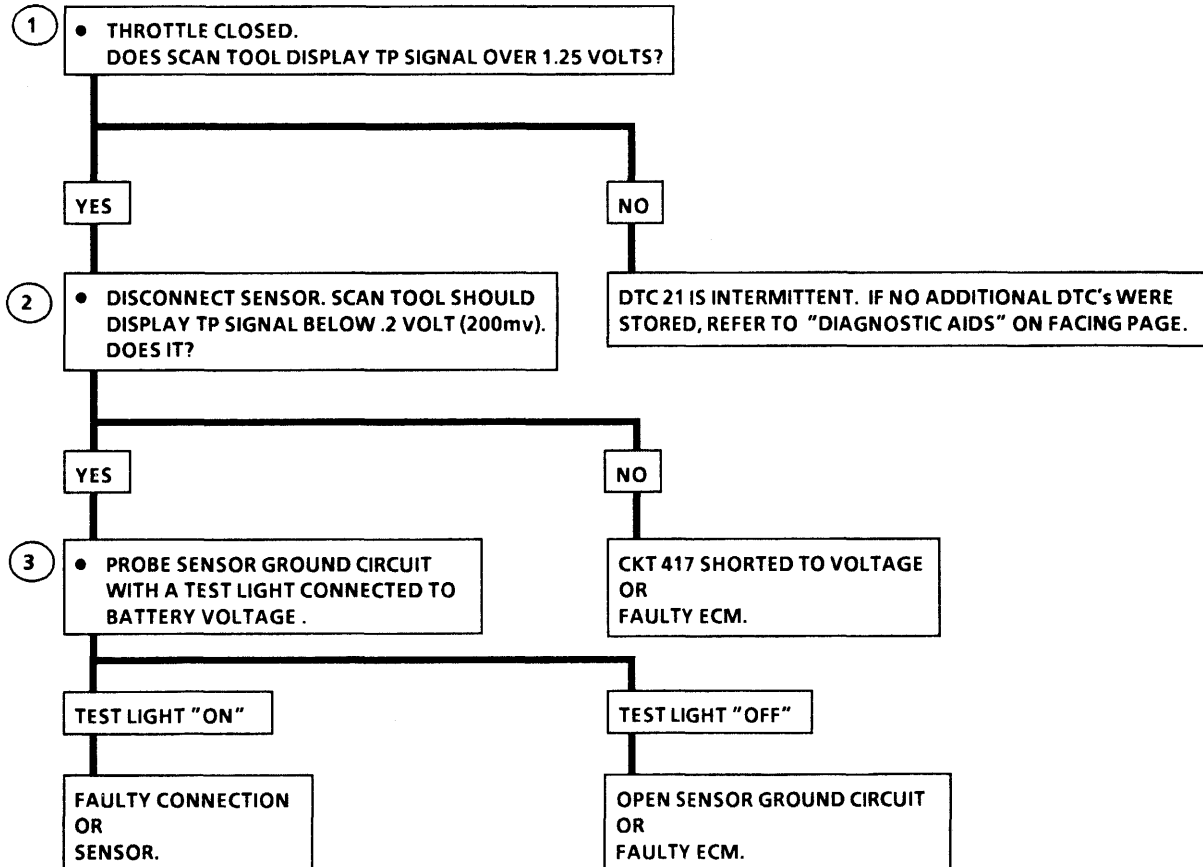
Scan TP signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed to over 4.5 volts (4500 mV) when throttle is held at Wide Open Throttle (WOT) position.

A DTC 21 will result if CKT 452 is open or CKT 417 is shorted to voltage.

Refer to "Intermittents" in SECTION 2.

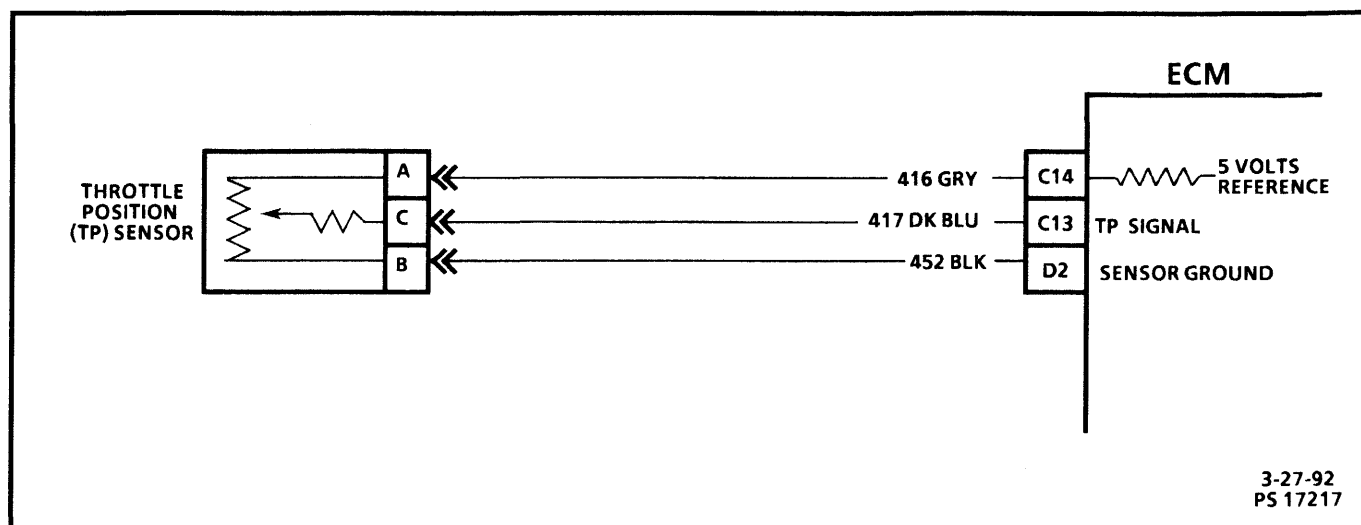
## DTC 21

### THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

5-1-92  
95 8024-6E



## DTC 22

### THROTTLE POSITION (TP) SENSOR CIRCUIT LOW (SIGNAL VOLTAGE LOW)

#### Circuit Description:

The Throttle Position (TP) sensor provides a voltage signal which changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to about 4.0 volts at Wide Open Throttle (WOT).

The TP signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

On non-adjustable TP switches, each time voltage drops below 1.25 volts and stops, the ECM assumes this value is 0 throttle angle and measures percent throttle from this point on.

#### DTC 22 Will Set When:

- Engine running.
- TP signal voltage is less than .2 volt for two seconds.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 22 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

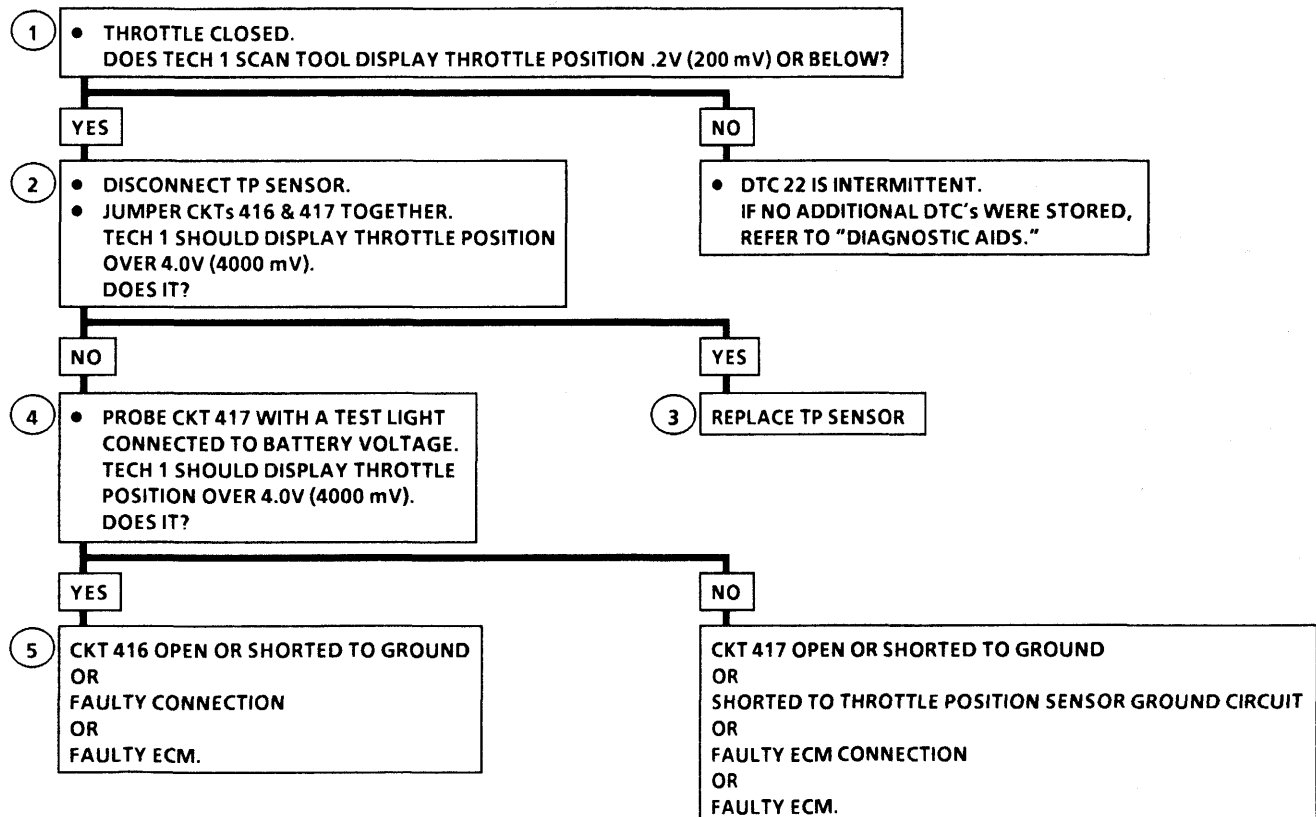
1. This step checks to see if DTC 22 is the result of a hard failure or an intermittent condition.
2. Simulates DTC 21: (high voltage) - If the ECM recognizes the high signal voltage, the ECM and wiring are OK.
3. The ECM recognizes the voltage as over 4 volts, indicating that CKT 417 and the ECM are OK.
4. This simulates a high signal voltage to check for an open in CKT 417.
5. If CKT 416 is shorted to ground, there may also be a stored DTC 34.

**Diagnostic Aids:** A scan tool reads throttle position in volts. Should read about .45 to .85 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

An open or short to ground in CKTs 416 or 417 will result in a DTC 22.

Refer to SECTION 2 for "ECM Intermittent DTC(s) or Performance."

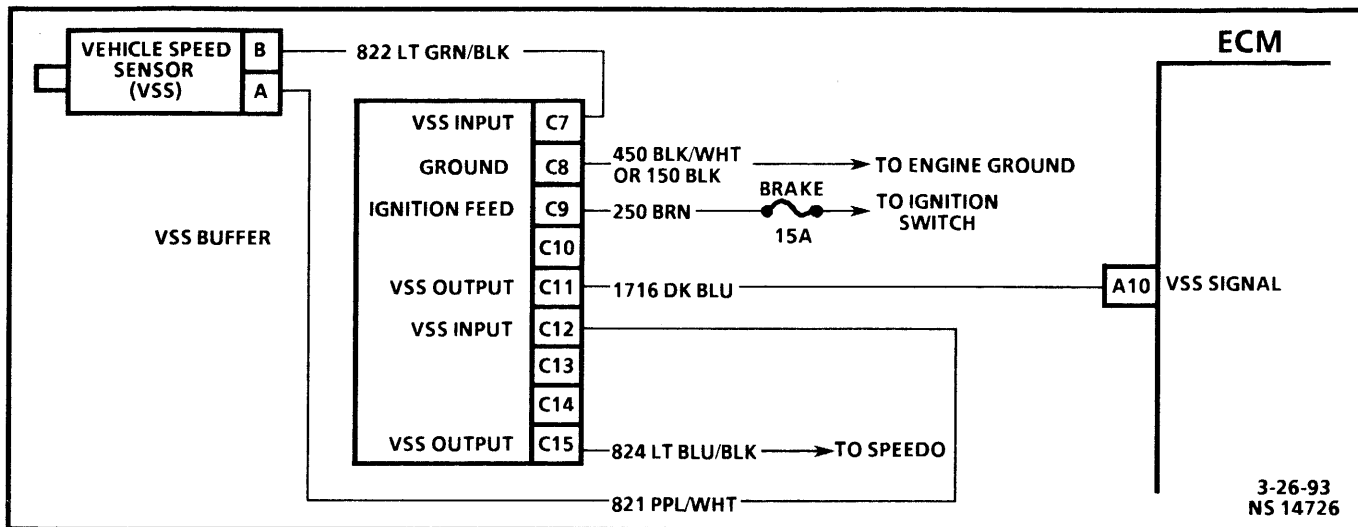
Scan TP signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed to over 4.5 volts (4500 mV) when throttle is held at Wide Open Throttle (WOT) position.

**DTC 22****THROTTLE POSITION (TP) SENSOR CIRCUIT LOW  
(SIGNAL VOLTAGE LOW)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

5-1-92  
MS 9565-6E





## DTC 24

## VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW

### Circuit Description:

The ECM applies and monitors 12 volts on CKT 1716. CKT 1716 connects to the Vehicle Speed Sensor (VSS) buffer which alternately grounds CKT 1716, when receiving voltage pulses from Vehicle Speed Sensor (VSS) while drive wheels are turning. This pulsing action takes place about 2000 times per mile and the ECM will calculate vehicle speed based on the time between "pulses."

A scan tool reading should closely match the speedometer reading with drive wheels turning.

### DTC 24 Will Set When:

- Automatic transmission in drive.
- Coolant temperature above 65°C (149°F).
- Throttle position below 2%.
- MAP limit 20 kPa.
- All conditions must be met for five seconds.
- CKT 1716 voltage is constant.
- Engine speed between 1300 - 1400 RPM.
- Vehicle speed signal indicates less than two mph (three km/h) on Tech 1 scan tool.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 24 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

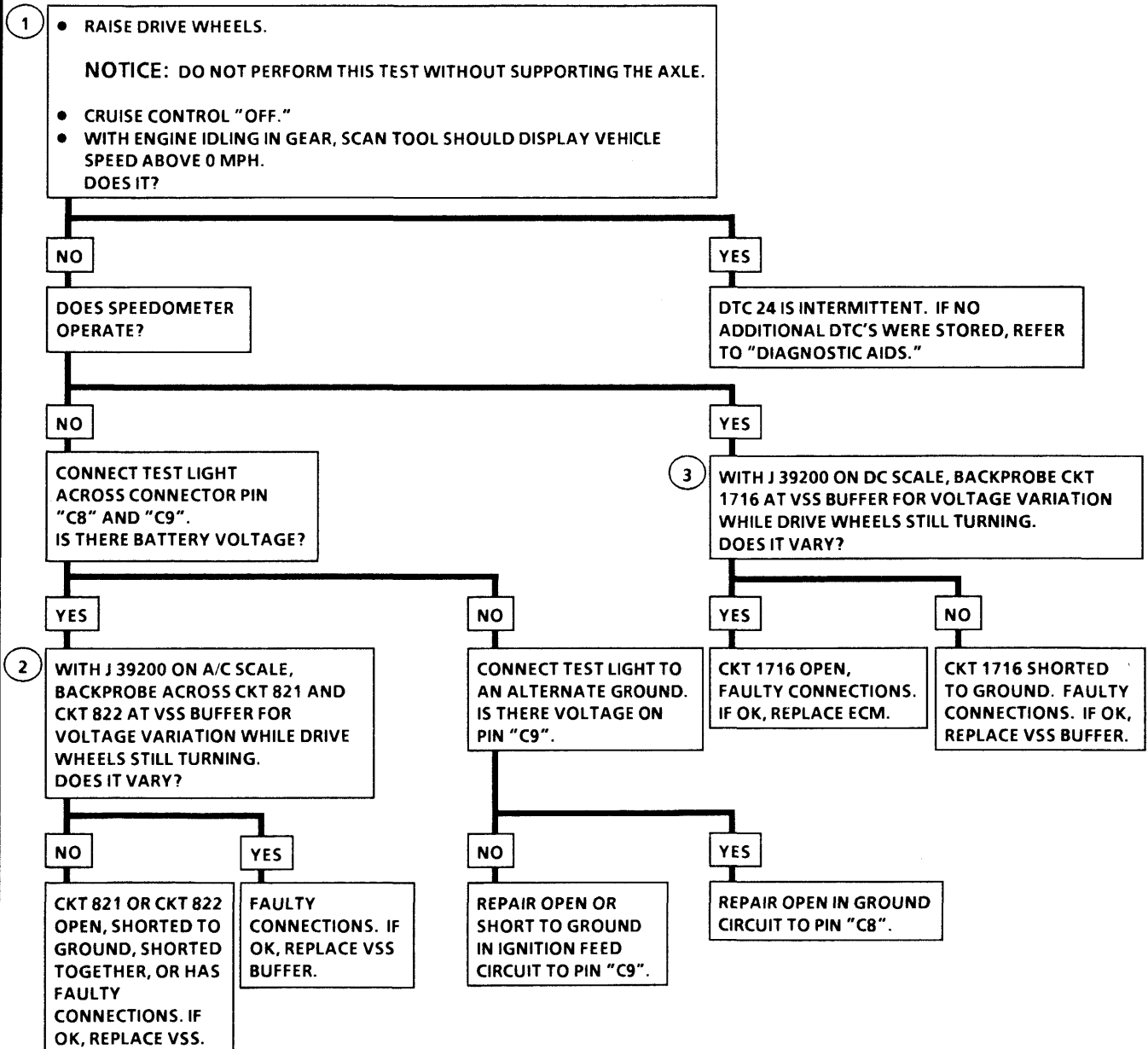
1. Checks to see if DTC was set as result of a hard failure or intermittent condition.
2. This test determines if the VSS buffer is receiving the A/C signal from the VSS.
3. This test monitors the VSS buffer voltage on CKT 437. With the wheels turning, the pulsing action will result in a varying voltage. The variation will be greater at low wheel speeds to an average of 4-6 volts at about 20 mph (32 km/h).

### Diagnostic Aids:

1. Scan tool reading should closely match speedometer readings with drive wheels turning.
2. Refer to "ECM Intermittent DTC(s) or Performance" in SECTION 2.

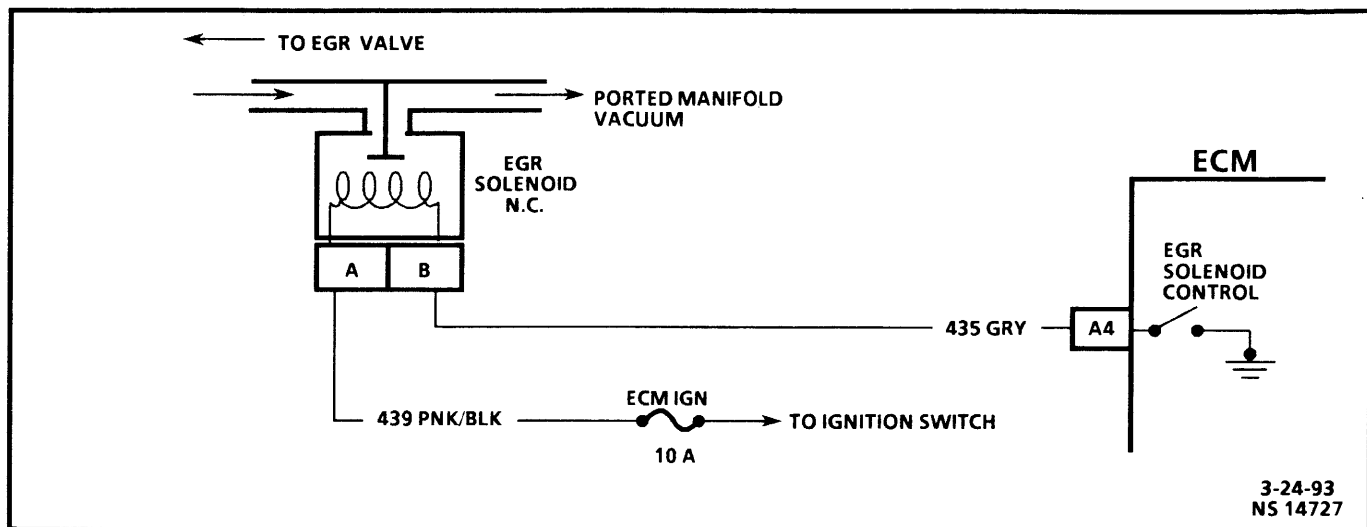
## DTC 24

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

3-24-93  
MS 9231-6E



## DTC 32

### EXHAUST GAS RECIRCULATION (EGR) ERROR

#### Circuit Description:

The ECM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid which then allows vacuum to pass to the EGR valve.

**DTC 32 Will Set When:** The ECM monitors EGR effectiveness by de-energizing the EGR control solenoid; thereby, shutting "OFF" vacuum to the EGR valve diaphragm. With the EGR valve closed, and O<sub>2</sub>S fluctuating normally, short term fuel trim counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a DTC 32 will be set.

The ECM will check EGR operation when:

- Vehicle speed is above 45 mph.
- Engine vacuum is between 15 and 60 kPa.
- Throttle angle between 6 and 30%.
- No change in throttle position while test is being run, max 4%.
- EGR on threshold 98%.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 32 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. By grounding the diagnostic terminal, the EGR solenoid should be energized and allow vacuum to be applied to the EGR valve, and the vacuum should hold.
2. The MIL should also flash while the diagnostic terminal is grounded. If the light does not flash, this may indicate that the "quad-driver" has been damaged by low resistance in TCC circuit.
3. When the diagnostic terminal is ungrounded, the vacuum to the EGR valve should bleed off through a vent in the solenoid and the valve should close. The gage may or may not bleed off but this does not indicate a problem.
4. This test will determine if the electrical control part of the system is at fault, or if the connector or solenoid is at fault.

5. This system uses a negative backpressure valve which should hold vacuum with engine "OFF."
6. When engine is started, exhaust backpressure should cause vacuum to bleed off and valve should fully close.

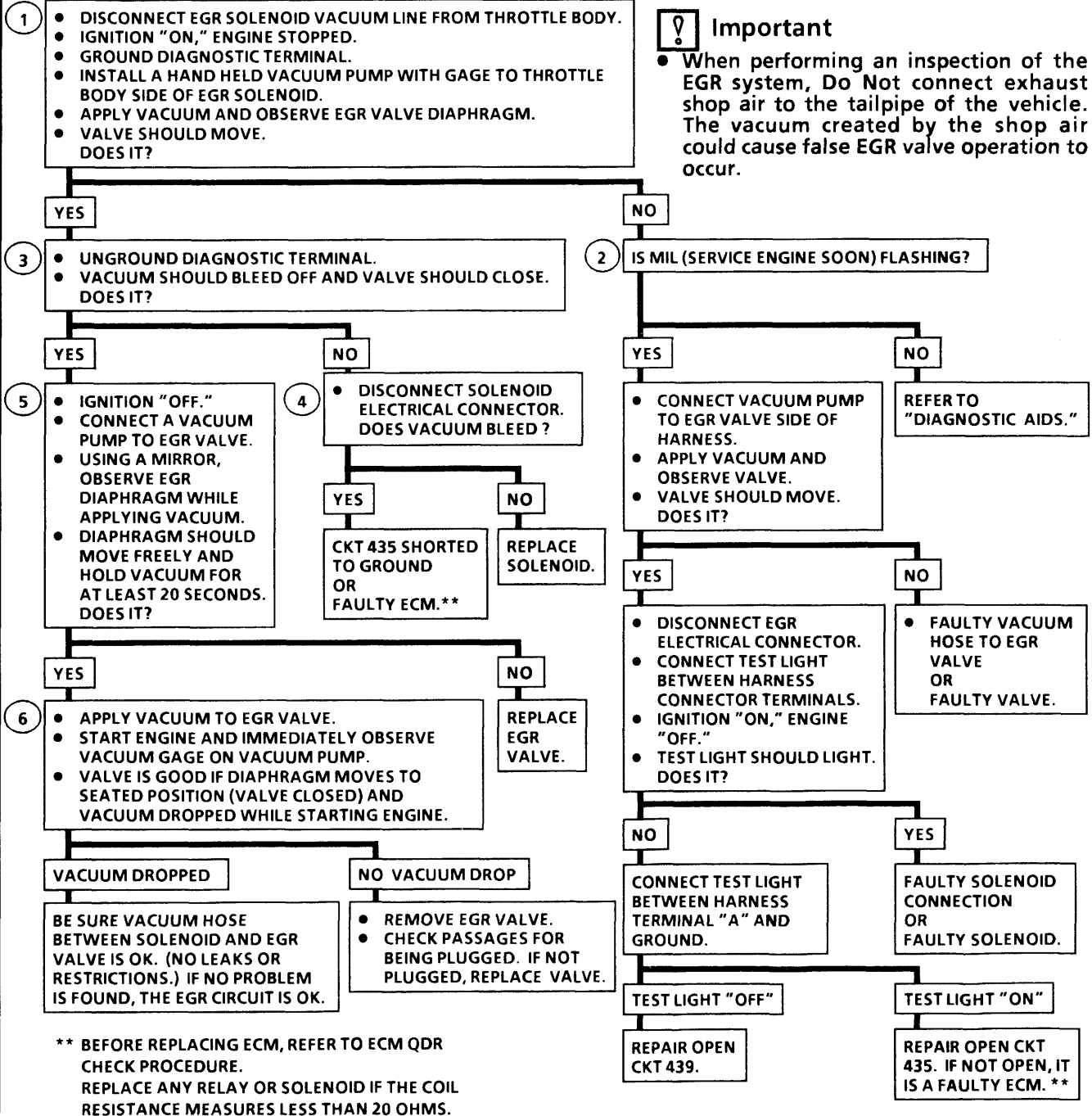
#### Diagnostic Aids:

- Before replacing ECM, use an ohmmeter and check the resistance of each ECM controlled relay and solenoid coil. For example: TCC, etc., refer to "ECM QDR Check Procedure." Refer to "ECM Wiring Diagram" for coil terminal ID of solenoid(s) and relay(s) to be checked. Replace any solenoid where resistance measures less than 20 ohms.

**DTC 32****EXHAUST GAS RECIRCULATION (EGR) ERROR**

BEFORE USING THIS CHART, CHECK VACUUM SOURCE TO EGR SOLENOID. ALSO, CHECK HOSES FOR LEAKS OR RESTRICTIONS. SHOULD BE AT LEAST (7") HG VACUUM AT 2000 RPM.

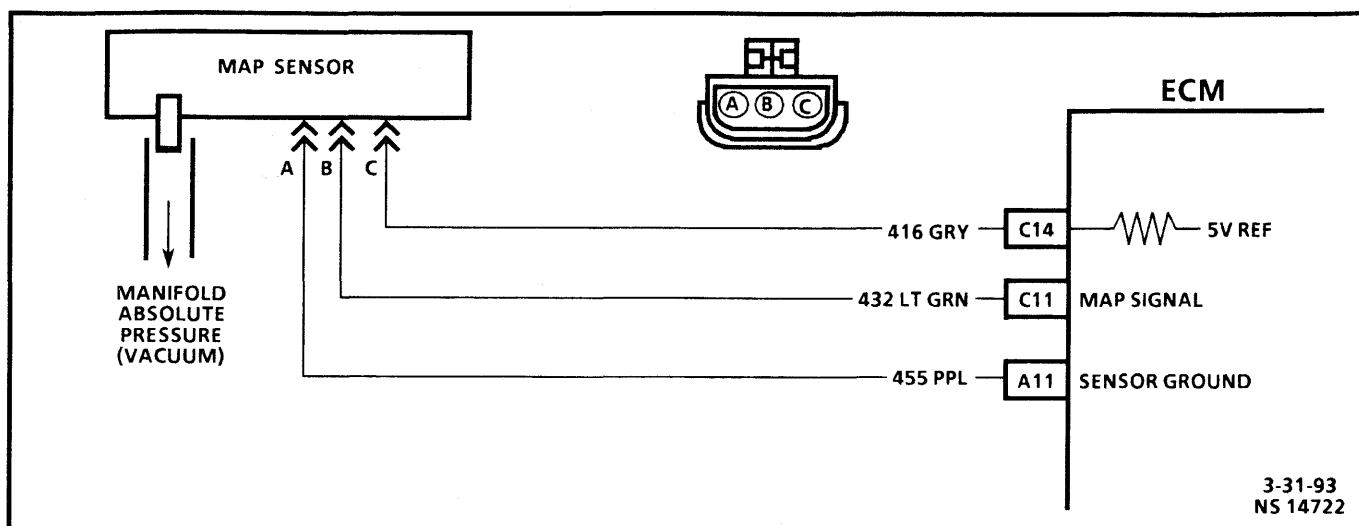
**NOTICE:** DISCONNECT TECH 1 SCAN TOOL WHEN USING THIS CHART.



**! Important**

- When performing an inspection of the EGR system, Do Not connect exhaust shop air to the tailpipe of the vehicle. The vacuum created by the shop air could cause false EGR valve operation to occur.

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.



## DTC 33

### MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH - LOW VACUUM)

#### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1-1.5 volts at closed throttle (idle) to 4-4.6 volts at Wide Open Throttle (WOT) (low vacuum).

#### DTC 33 Will Set When:

- MAP signal voltage is too high (low vacuum) 68 kPa.
- TP signal less than 2%.
- These conditions exist longer than 5 seconds.
- Engine misfire or a low unstable idle may set DTC 33.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate and the ECM will substitute a fixed MAP value and use the Throttle Position (TP) sensor and RPM to control fuel delivery.

**DTC 33 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 33 is the result of a hard failure or an intermittent condition.
2. This step simulates conditions for a DTC 34. If the ECM recognizes the change, the ECM and CKT 416 and CKT 432 are OK. If CKT 455 is open, there may also be a stored DTC 23.

If DTC 33 is intermittent, refer to "Driveability Symptoms," SECTION 2.

- Check all connections.
- Disconnect sensor from bracket and twist sensor connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

**NOTICE:** Make sure electrical connector remains securely fastened.

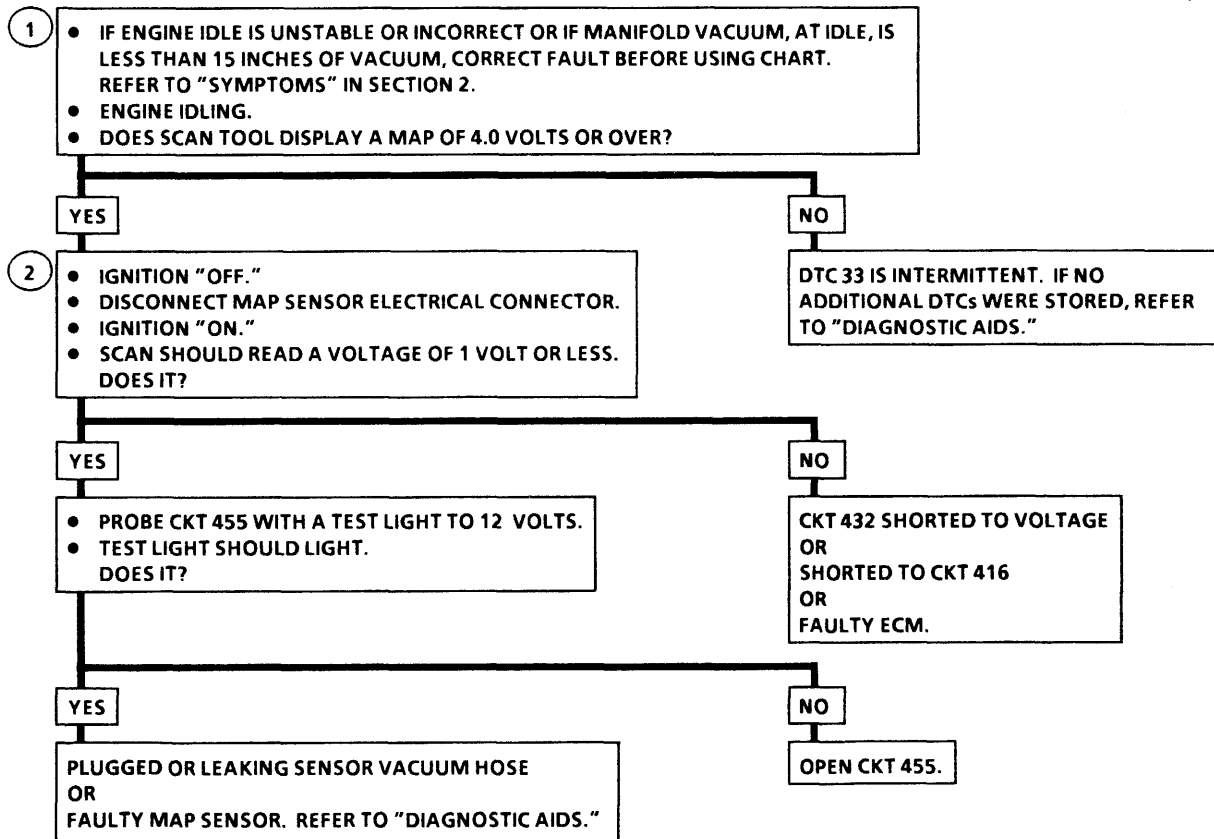
- Refer to "MAP Output Check" in "SECTION 3 for further diagnosis.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

A DTC 33 will result if CKT 455 is open or if CKT 432 is shorted to voltage or to CKT 416.

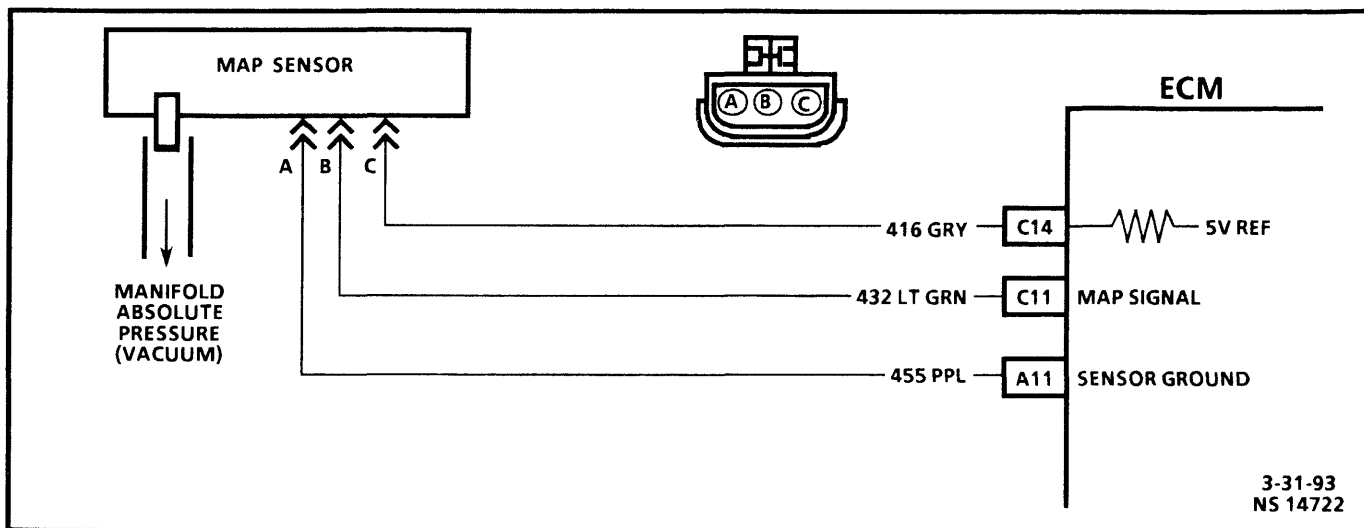
## DTC 33

### MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH (SIGNAL VOLTAGE HIGH - LOW VACUUM)



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

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NS 14728



## DTC 34

### MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW (SIGNAL VOLTAGE LOW - HIGH VACUUM)

#### Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1-1.5 volts at idle to 4-4.6 volts at Wide Open Throttle (WOT).

#### DTC 34 Will Set When:

- Engine is less than 1200 RPM.
- Manifold pressure reading is less than 12 kPa for one second.
- Engine speed is greater than 1200 RPM.
- Throttle angle over 8%.
- Manifold pressure less than 12 kPa for one second.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate if the MAP sensor fails, then the ECM will substitute a fixed MAP value and use the Throttle Position (TP) sensor and RPM to control fuel delivery.

**DTC 34 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 34 is the result of a hard failure or an intermittent condition.
2. Jumpering harness terminals "B" to "C" (5 volts to signal circuit) will determine if the sensor is at fault, or if there is a problem with the ECM or wiring.
3. The scan tool may not display 5 volts. The important thing is that the ECM recognized the voltage as more than 4 volts, indicating that the ECM and CKT 432 are OK.

**Diagnostic Aids:** An intermittent open in CKT 432 or CKT 416 will result in a DTC 34.

With the ignition "ON" and the engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude.

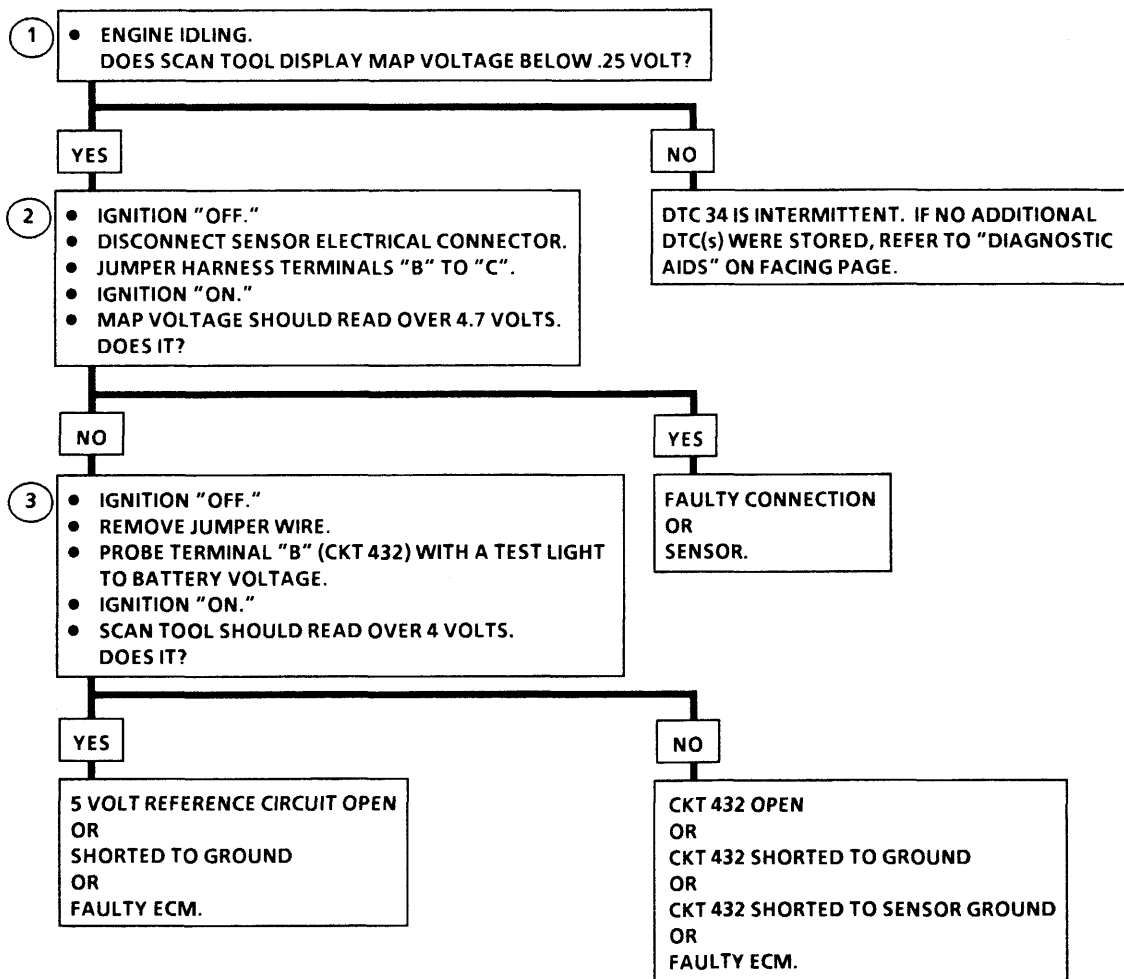
Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Reading should be the same  $\pm .4$  volt. Also, MAP output check in "Control Module System," SECTION 3 can be used to test the MAP sensor.

Refer to "Intermittents," in SECTION 2.

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

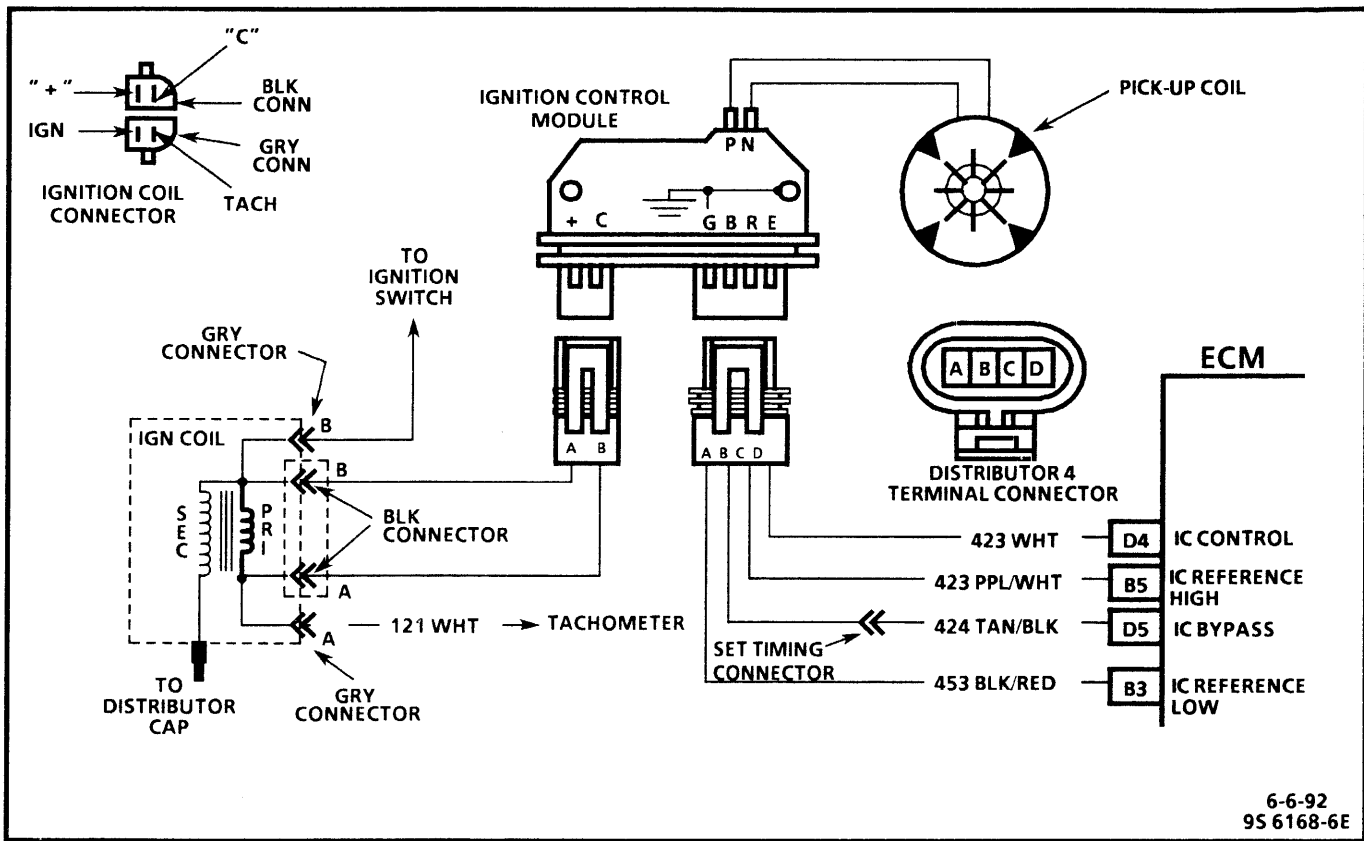
**NOTICE:** Make sure electrical connector remains securely fastened.

Refer to "MAP Output Check" for further diagnosis.

**DTC 34****MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW  
(SIGNAL VOLTAGE LOW - HIGH VACUUM)**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.





## DTC 42

### IGNITION CONTROL (IC) ERROR

#### Circuit Description:

When the system is running on the ignition module, that is, no voltage on the bypass line, the ignition module grounds the IC signal. The PCM expects to see no voltage on the IC line during this condition. If it sees a voltage, it sets DTC 42 and will not go into the IC mode.

When the RPM for IC is reached (about 450 RPM), and bypass voltage is applied, the IC should no longer be grounded in the ignition module so the IC voltage should be varying.

**DTC 42 Will Set When:** If the bypass line is open or grounded, the ignition module will not switch to IC mode so the IC voltage will be low and DTC 42 will be set.

If the IC line is grounded, the ignition module will switch to IC, but because the line is grounded there will be no IC signal. A DTC 42 will be set.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 42 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. DTC 42 means the ECM has seen an open or short to ground in the IC or bypass circuits. This test confirms DTC 42 and that the fault causing the DTC is present.
2. Checks for a normal IC ground path through the ignition module. An IC CKT 423 shorted to ground will also read less than 500 ohms; however, this will be checked later.
3. As the test light voltage touches CKT 424, the module should switch causing the ohmmeter to "overrange" if the meter is in the 100-200 ohm position.

Selecting the 10-20,000 ohms position will indicate above 5000 ohms. The important thing is that the module "switched."

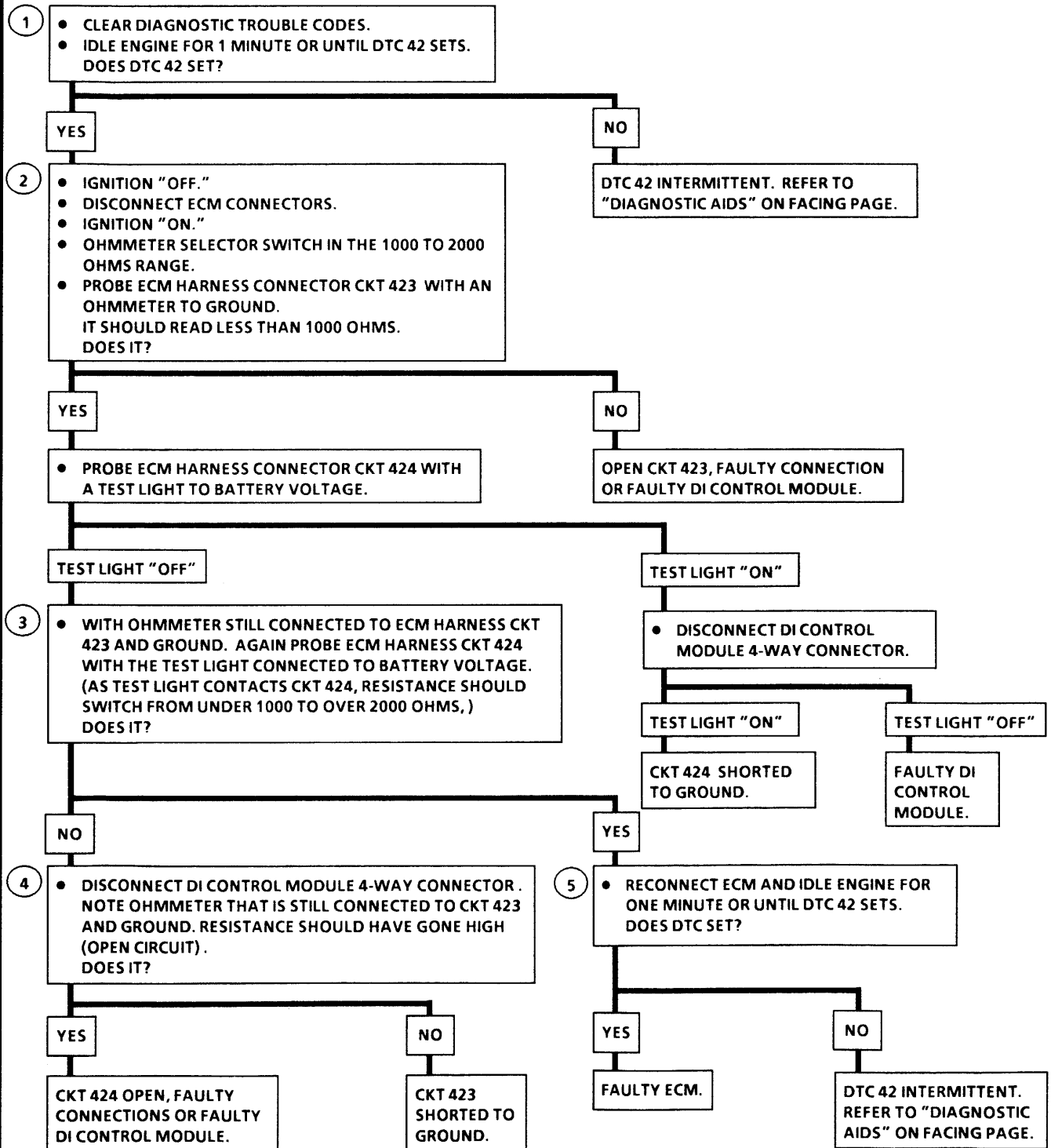
4. The module did not switch and this step checks for:
  - IC CKT 423 shorted to ground.
  - Bypass CKT 424 open.
  - Faulty ignition module connection or module.
5. Confirms that DTC 42 is a faulty ECM and not an intermittent in CKTs 423 or 424.

**Diagnostic Aids:** The scan tool does not have any ability to help diagnose a DTC 42 problem.

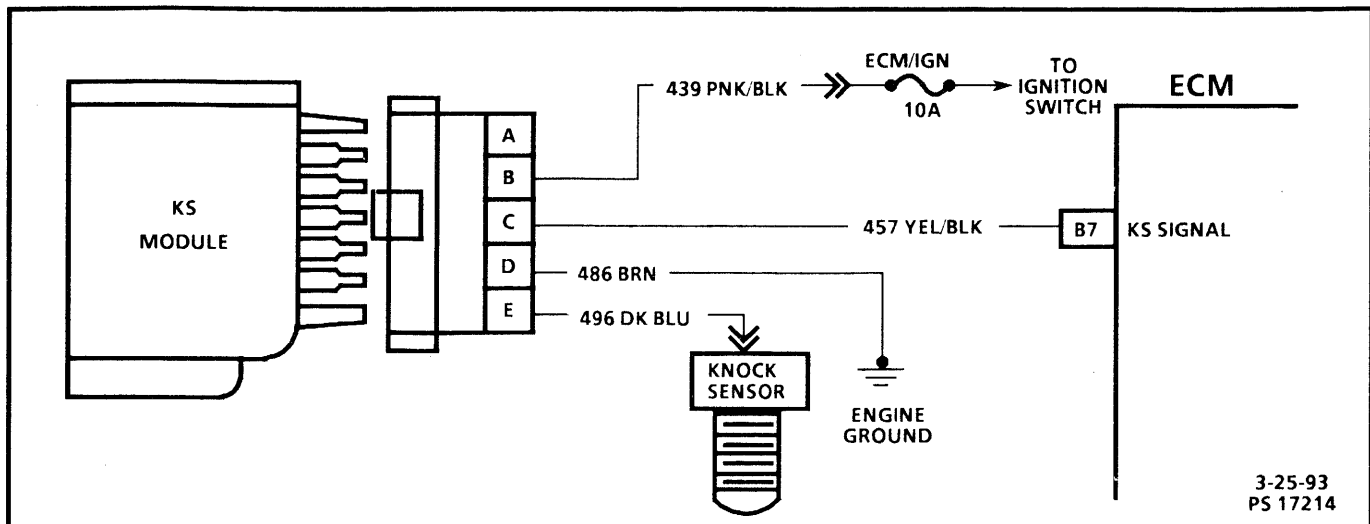
Refer to SECTION 2 for "Intermittent's DTC."

## DTC 42

### IGNITION CONTROL (IC) ERROR



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.



## DTC 43

### KNOCK SENSOR (KS) CIRCUIT

#### Circuit Description:

Knock Sensor (KS) system is accomplished with a module which sends a voltage signal to the ECM. As the KS detects engine knock, the voltage from the KS module to the KS drops, which in turn signals the ECM to retard timing. The ECM will retard the timing when knock is detected and RPM is above 900 RPM but less than 3800 RPM.

**DTC 43 Will Set When:** DTC 43 means the ECM has seen a low voltage on CKT 457 terminal "B7" for longer than 5 seconds with the engine running, or the system has failed the functional check.

The ECM continually monitors voltage on CKT 457 terminal "B7" if a knock signal (low voltage) is detected; but less than one second, the KS system is considered operational and DTC 43 will not set. If however, low voltage is detected for more than one second or signal voltage remains high, a functional check will be performed. To perform check, the ECM will advance the spark timing when coolant temperature is between 86°C -105°C (186°F -224°F) and the engine is under heavy load (near WOT). The ECM then checks the signal voltage at "B7" to see if a knock is detected. If no knock is detected, the MIL will remain "ON" until the ignition is turned "OFF" or until a knock signal is detected. The functional check will only be performed once per startup.

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 43 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. If the conditions for a DTC 43 are present, the Tech 1 scan tool will always display "YES." There should not be a knock at idle unless an internal engine problem, or a system problem exists.
2. This test will determine if the system is functioning at this time. Usually a knock signal can be generated by tapping on the right exhaust manifold. If no knock signal is generated, try tapping on block close to the area of the sensor.
3. Because DTC 43 sets when the signal voltage on CKT 457 remains low, this test should cause the signal on CKT 457 to go high. The 12 volts signal should be seen by the ECM as "no knock" if the ECM and wiring are OK.
4. This test will determine if the knock signal is being detected on CKT 496 or if the KS module is at fault.

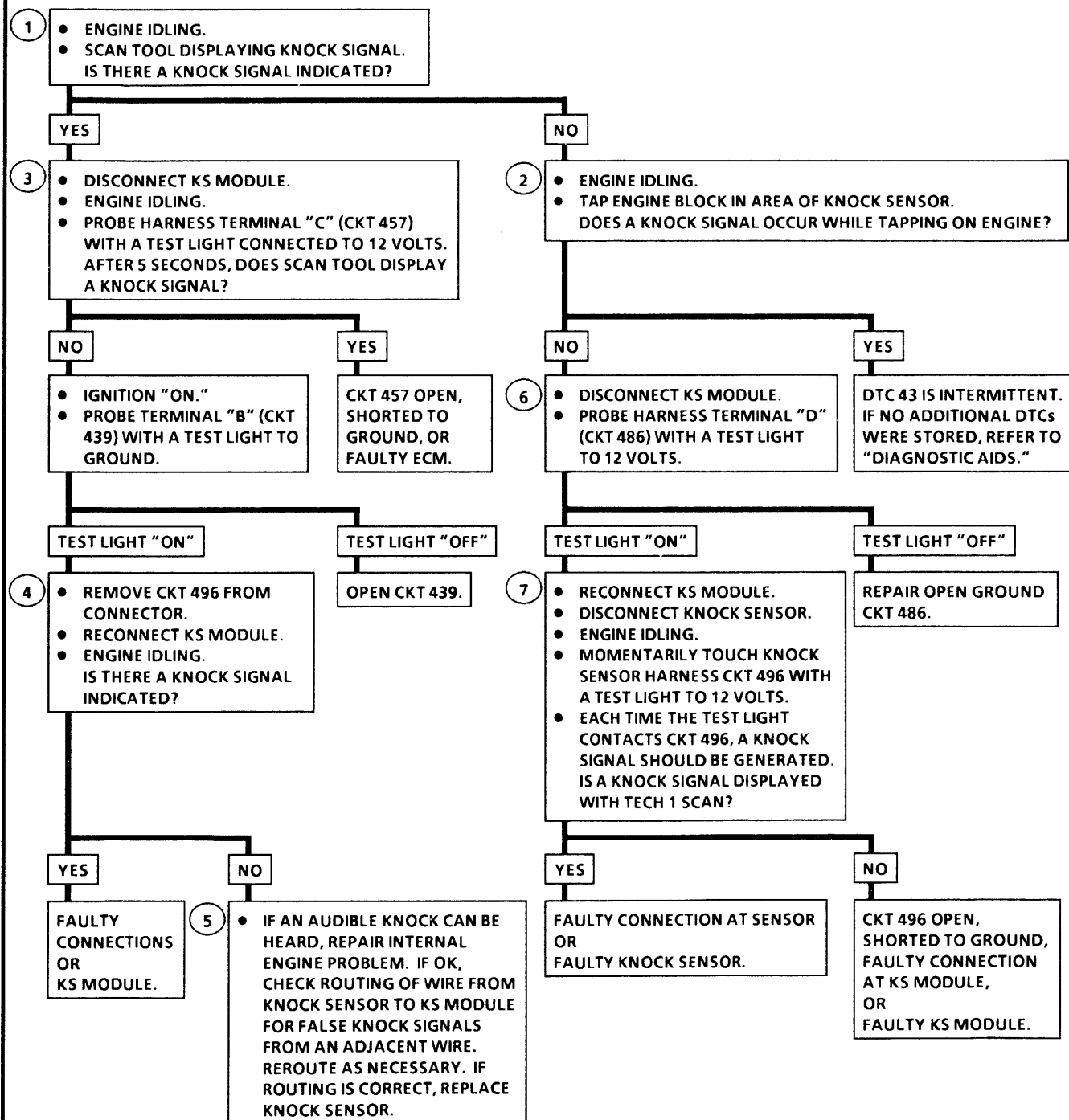
5. If CKT 496 is routed too close to secondary ignition wires, the KS module may see the interference as a knock signal.
6. This checks the ground circuit to the module. An open ground will cause the voltage on CKT 457 to be about 12 volts which would cause the DTC 43 functional test to fail.
7. Connecting CKT 496 with a test light to 12 volts should generate a knock signal. This will determine if the KS module is operating correctly.

**Diagnostic Aids:** DTC 43 can be caused by a faulty connection at the knock sensor at the KS module or at the ECM. Also check CKT 457 for possible open or short to ground.

Refer to SECTION 2 for "Intermittents."

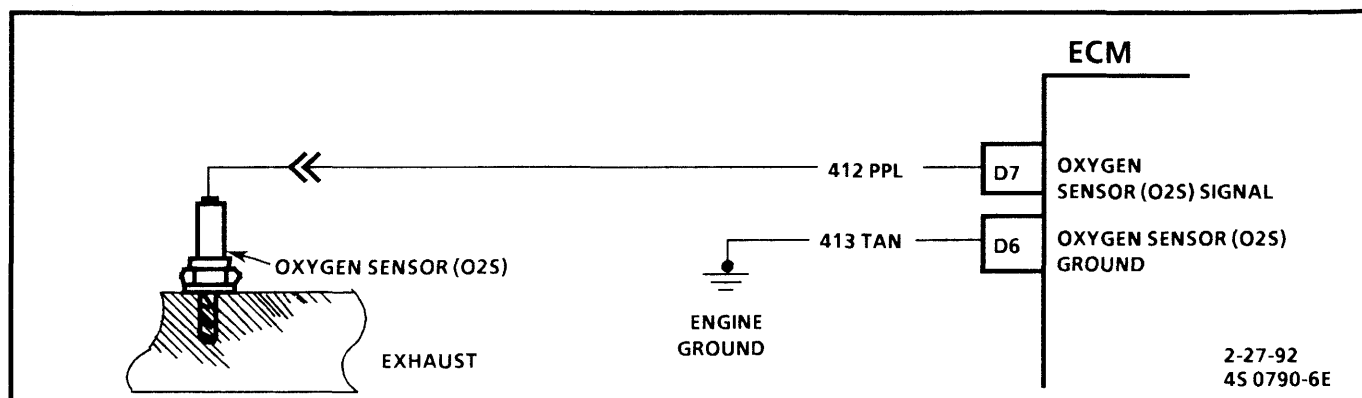
## DTC 43

### KNOCK SENSOR (KS) CIRCUIT



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

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PS 17215



## DTC 44

### LEAN EXHAUST

#### Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, to about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

**DTC 44 Will Set When:** The Oxygen Sensor (O2S) signal voltage on CKT 412:

- Remains below .2 volt from 20 seconds to 225 seconds.
- With the system operating in "Closed Loop."

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 44 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

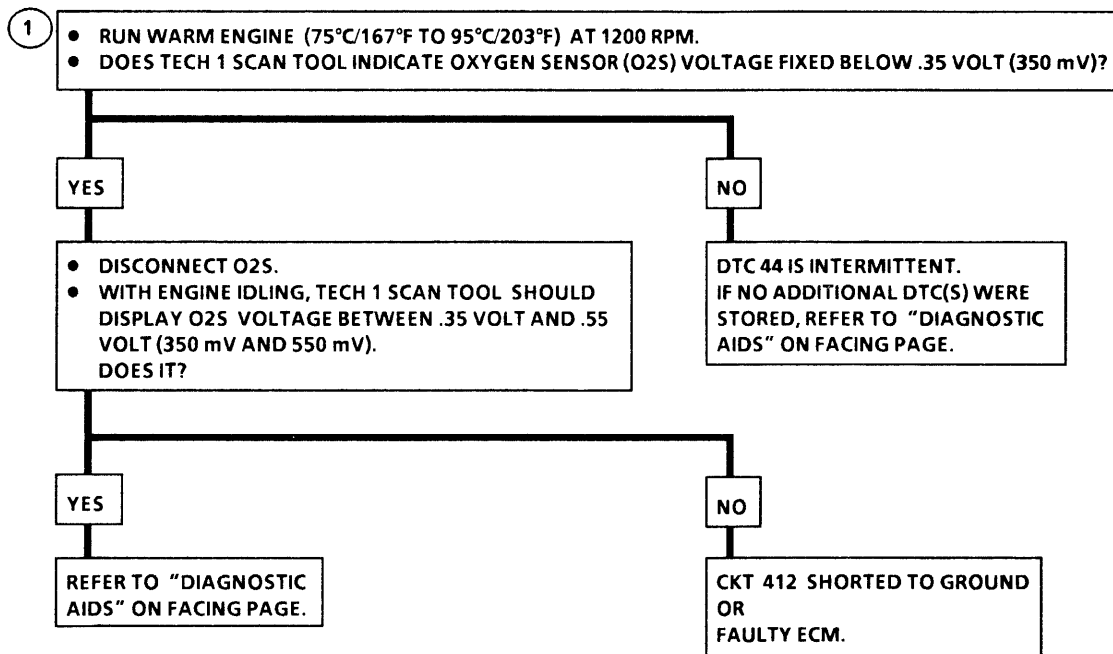
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if DTC was set as result of a hard failure or intermittent condition. The next check is of the wiring and ECM.

**Diagnostic Aids:** Using a scan tool, observe the long term fuel trim values at different RPM and air flow conditions. The scan tool also displays the block cells, so the long term fuel trim values can be checked in each of the cells to determine when the DTC 44 may have been set. If the conditions for DTC 44 exists, the long term fuel trim values will be around 150.

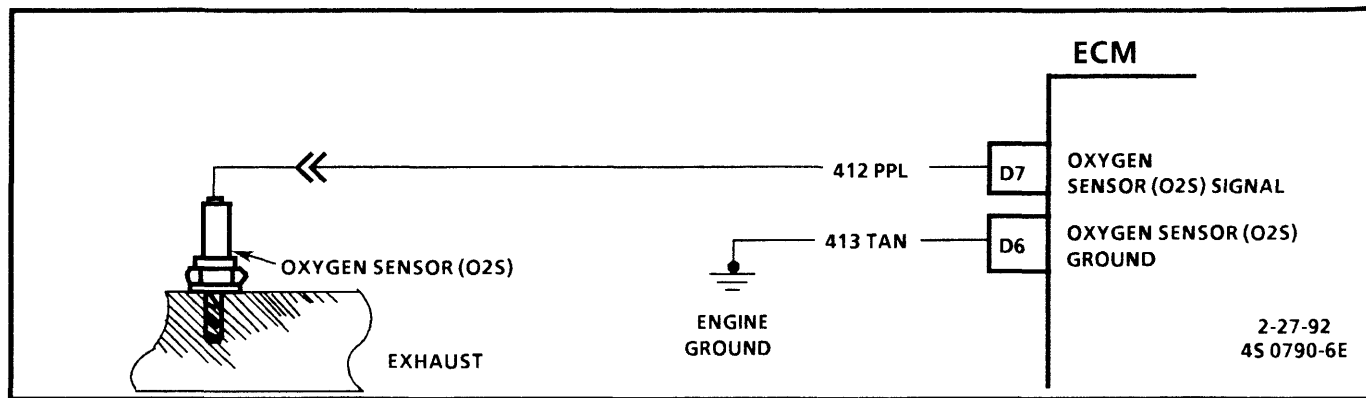
- Oxygen Sensor (O2S) Wire - Sensor pigtail may be mispositioned and in contact with the exhaust manifold.
- Check for intermittent ground in wire between connector and sensor.
- Fuel Contamination - Water, even in small amounts near the in-tank fuel pump inlet, can be delivered to the injectors. Water intrusion causes a lean exhaust and can set a DTC 44.

- Fuel Pressure - System will be lean if pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. Refer to "Fuel System Diagnosis," CHART A-6.
- Exhaust Leaks - If there is an exhaust leak, the engine can cause outside air to be pulled into the exhaust and past the sensor. Vacuum or crankcase leaks can cause a lean condition.
- AIR System - Be sure air is not being directed to the exhaust ports while in "Closed Loop." If the long term fuel trim value goes down while squeezing air hose on left side of exhaust ports, refer to SECTION 8.
- CKT 413 - If CKT 413 is open, the voltage at terminal "D7" will be about .45 volt. This may also cause DTC 13 to set.
- If all checks OK, the Oxygen Sensor (O2S) is faulty.

**DTC 44**  
**LEAN EXHAUST**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

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● 75 3191-6E



## DTC 45

### RICH EXHAUST

#### Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, to about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

**DTC 45 Will Set When:** The Oxygen Sensor (O2S) signal voltage or CKT 412:

- Remains above .7 volt for 60 seconds, while in "Closed Loop."
- Engine time after start is one minute or more.
- Throttle angle greater than 5% (about .2 volt above idle voltage).

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 45 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if DTC was set as result of a hard failure or intermittent condition. Also checks wiring and ECM.

**Diagnostic Aids:** Using the Tech 1 scan tool, observe the long term fuel trim values at different RPM and air flow conditions to determine when the DTC 45 may have been set. If the conditions for DTC 45 exist, the long term fuel trim values will be around 115. The MIL will remain "ON" until the ignition is turned "OFF," due to possible high fuel pressure.

An oxygen supply inside the O2S is necessary for proper O2S operation. This supply of oxygen is routed through the O2S wires. All O2S wires and connections should be inspected for breaks or contamination which could prevent reference oxygen from reaching the O2S.

- **Fuel Pressure** - System will go rich if pressure is too high. The ECM can compensate for some increase. However, if it gets too high, a DTC 45 may be set.

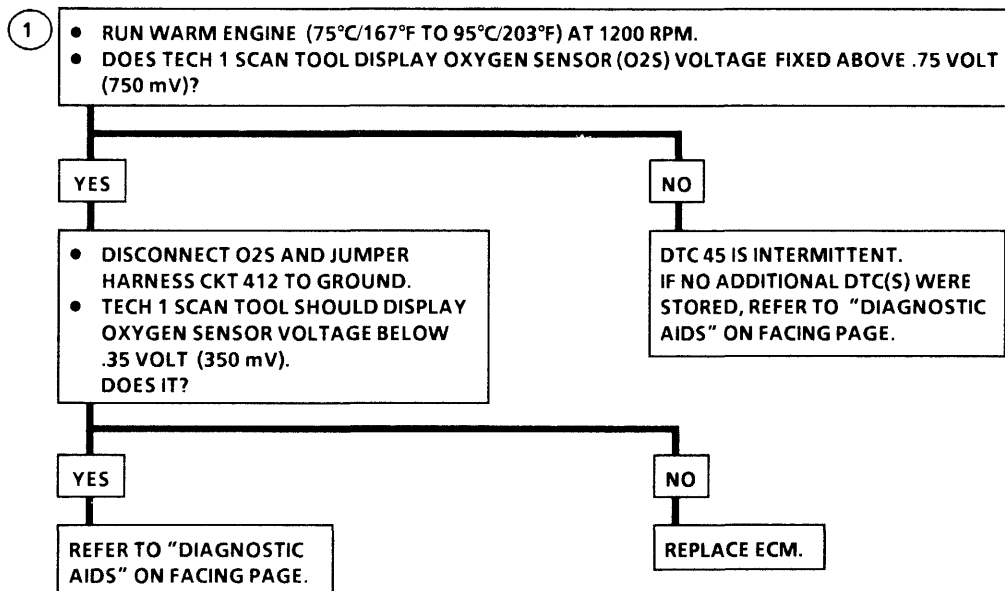
Refer to "Fuel System Diagnosis" chart.

- Check for fuel contaminated oil. Refer to "Fuel System Diagnosis" chart.

- **DI Shielding** - An open ground CKT 453 (ignition system reference low) may result in EMI, or induced electrical "noise." The ECM looks at this "noise" as reference pulses.

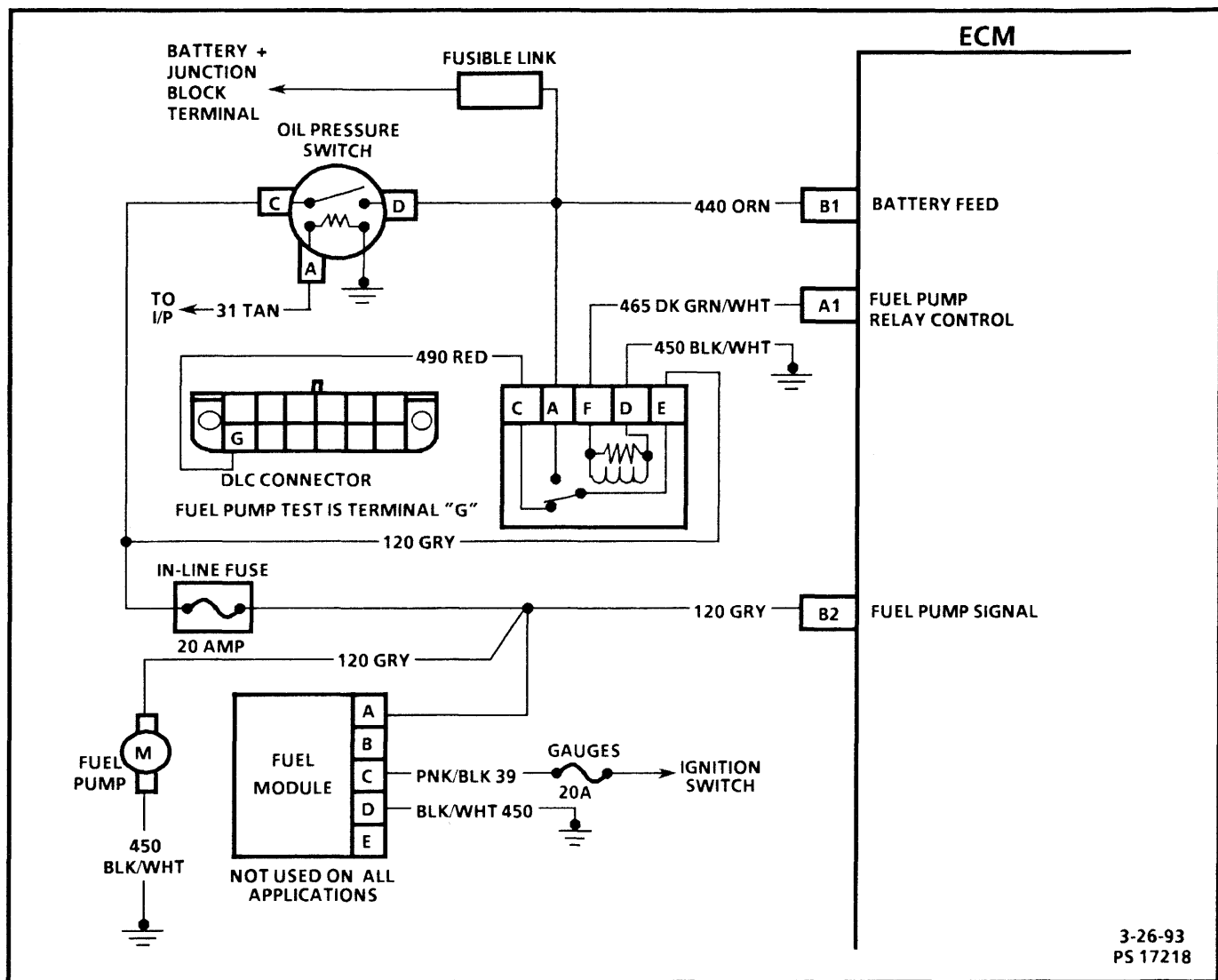
The additional pulses result in a higher than actual engine speed signal. The ECM then delivers too much fuel, causing system to go rich. Engine tachometer will also show higher than actual engine speed which can help in diagnosing this problem.

- **Canister Purge** - Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to SECTION 5.
- **MAP Sensor** - An output which causes the ECM to read higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone.
- **Pressure Regulator** - Check for leaking fuel pressure regulator diaphragm by checking for presence of liquid fuel.
- **TP Signal** - An intermittent TP signal output will cause the system to go rich, due to a false indication of the engine accelerating.
- **ECT** - Check for a skewed sensor which could cause a rich exhaust and set a DTC 15. Refer to chart for DTC 15.

**DTC 45**  
**RICH EXHAUST**

"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.





## DTC 54

### FUEL PUMP RELAY (LOW VOLTAGE)

#### Circuit Description:

The status of the fuel pump CKT 120 is monitored by the ECM at terminal "B2" and is used to compensate fuel delivery based on system voltage. This signal is also used to store a DTC if the fuel pump relay is defective or fuel pump voltage is lost while the engine is running. There should be about 12 volts on CKT 120 for at least two seconds after the ignition is turned "ON," or any time reference pulses are being received by the ECM.

**DTC 54 Will Set When:** The voltage at terminal "B2" is less than two volts for one second since the last reference pulse was received. This DTC is designed to detect a faulty relay, causing extended crank time and the DTC will help the diagnosis of an engine that "Cranks But Will Not Run."

**Action Taken (ECM will default to):** The Malfunction Indicator Lamp (MIL) will illuminate.

**DTC 54 Will Clear When:** Conditions for fault are no longer present and Tech 1 "Clear DTCs" function is used or 50 ignition switch keycycles have passed with no further faults or ignition switch is turned "OFF" and ECM B fuse is removed for 10 seconds.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if DTC was set as result of a hard failure or intermittent condition.

2. Checks relay, relay power feed and ground circuits.

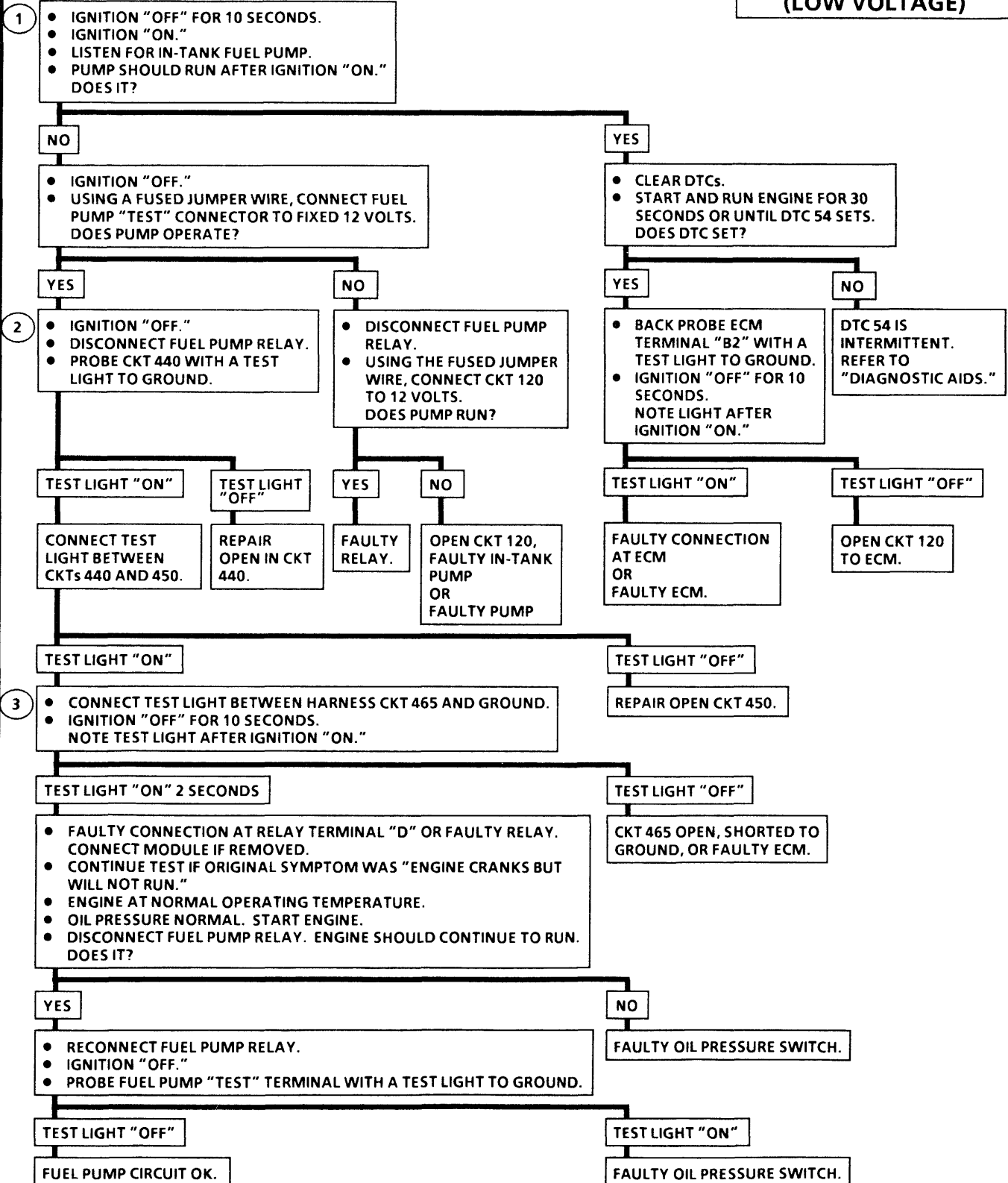
3. Checks ECM and oil pressure switch.

#### Diagnostic Aids:

- Refer to "Intermittents" in SECTION 2.

## DTC 54 FUEL PUMP RELAY (LOW VOLTAGE)

DISCONNECT FUEL MODULE IF EQUIPPED.



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-5-93  
75 3794-6E

**DTC 51  
DTC 52  
DTC 55**

**DTC 51  
PROM PROBLEM**

CHECK THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET. IF OK, REPLACE PROM, (CAL-PAK)  
CLEAR MEMORY, AND RECHECK. IF DTC 51 REAPPEARS, REPLACE ECM.

**DTC 52  
PROM (CAL-PAK) MISSING**

CHECK FOR MISSING PROM (CAL-PAK) AND THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET.  
IF OK, REPLACE ECM. NOTE: ON SOME VEHICLES THE PROM (CAL-PAK) IS SOLDERED IN.

**DTC 55  
FAULTY ECM  
ALL ENGINES**

BE SURE ECM GROUNDS ARE OK AND THAT PROM (CAL-PAK) IS  
PROPERLY LATCHED. IF OK, REPLACE ECM.

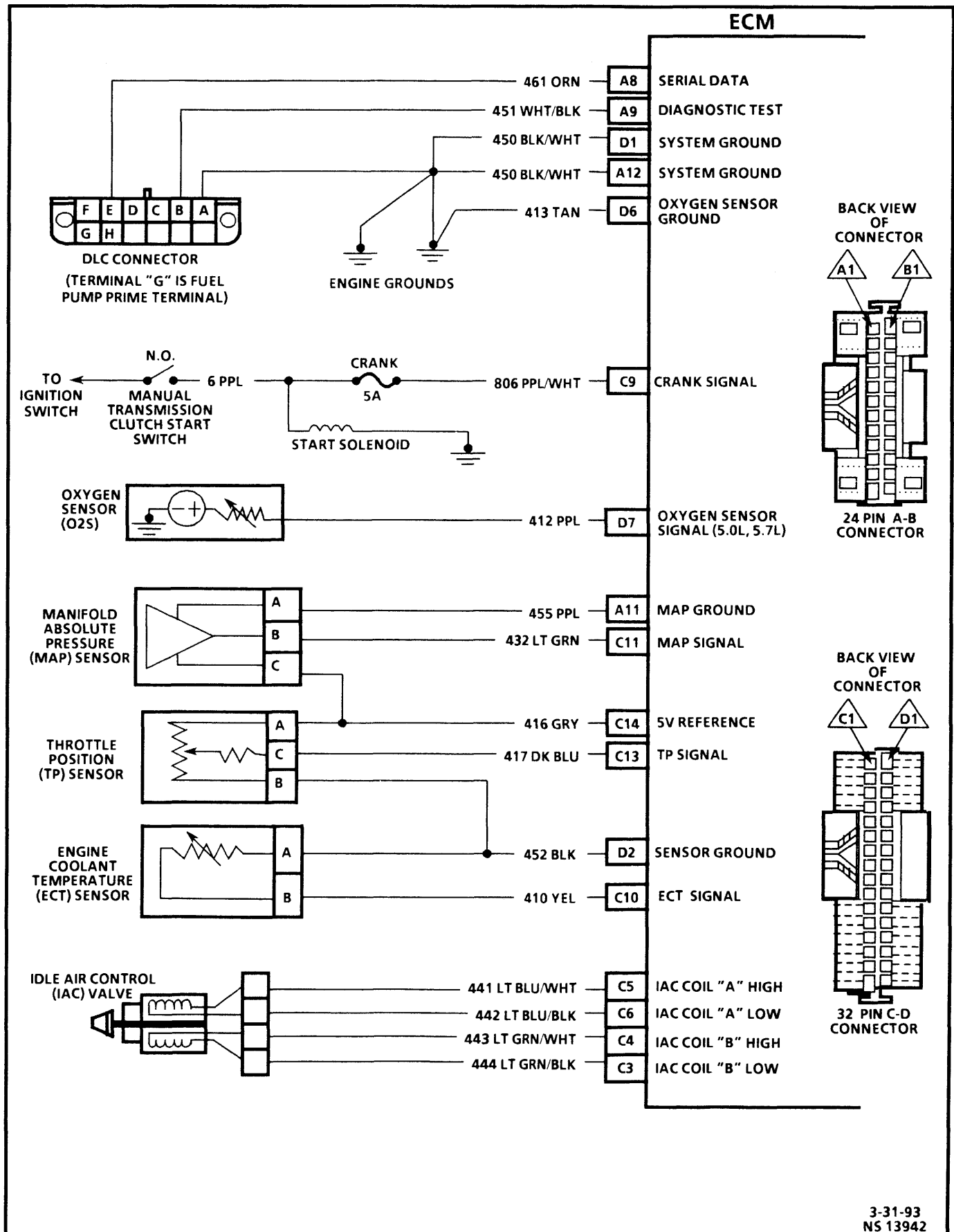


Figure 3B-5 - ECM Wiring Diagram 5.0L, 5.7L (C/K) Manual Transmission (1 of 4)

# 3B-64 DRIVEABILITY AND EMISSIONS (GASOLINE)

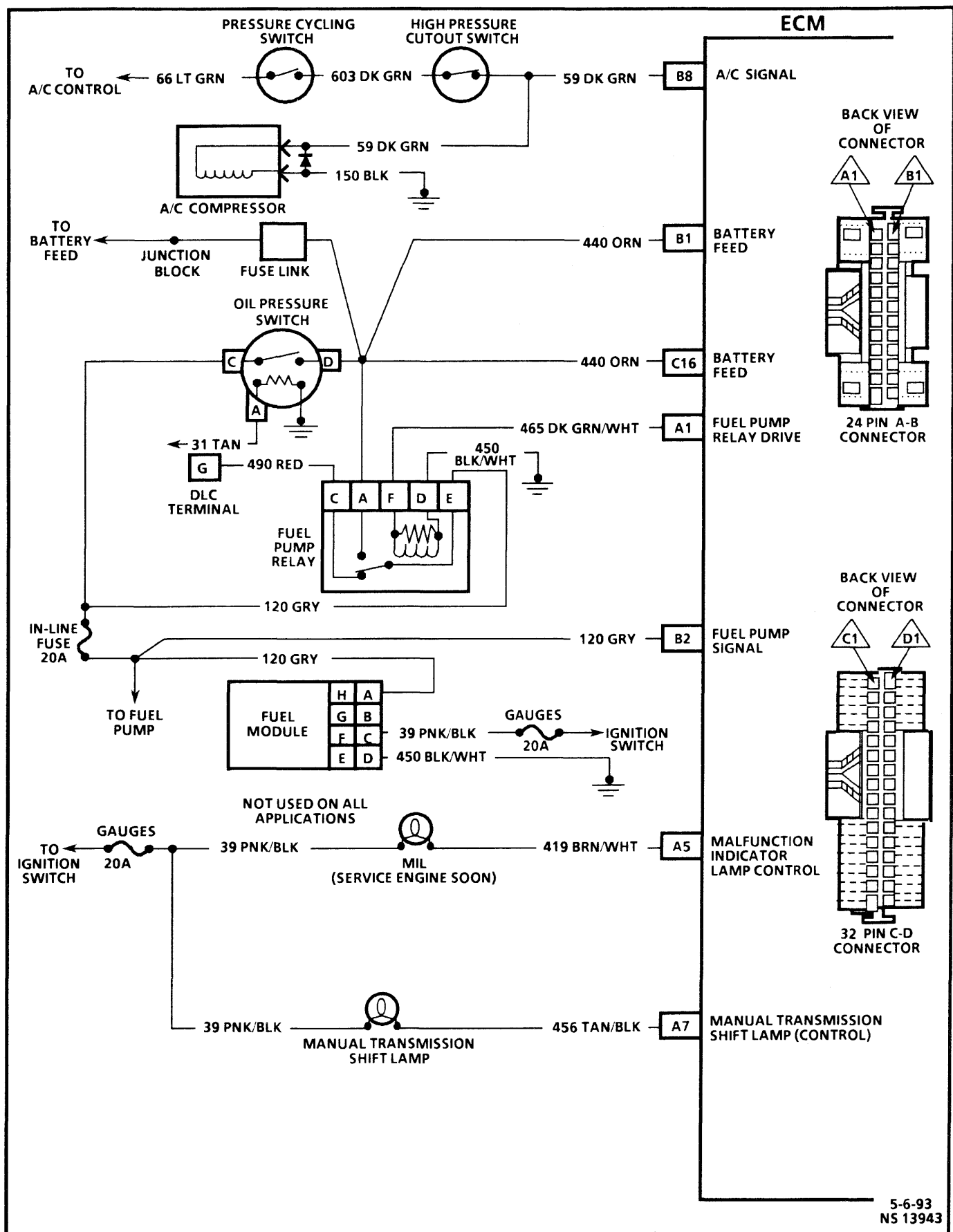


Figure 3B-6 - ECM Wiring Diagram 5.0L, 5.7L (C/K) Manual Transmission (2 of 4)

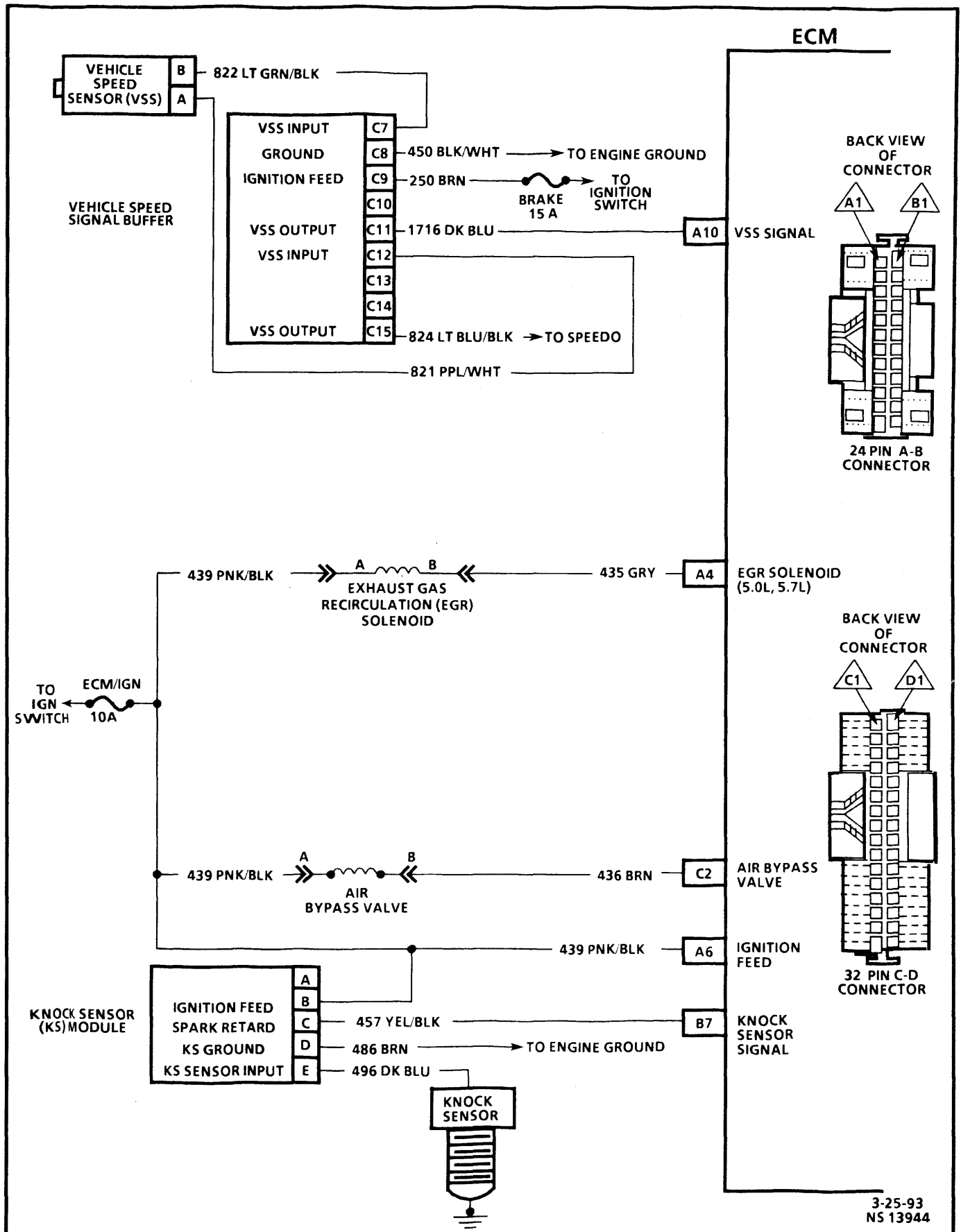


Figure 3B-7 - ECM Wiring Diagram 5.0L, 5.7L (C/K) Manual Transmission (3 of 4)

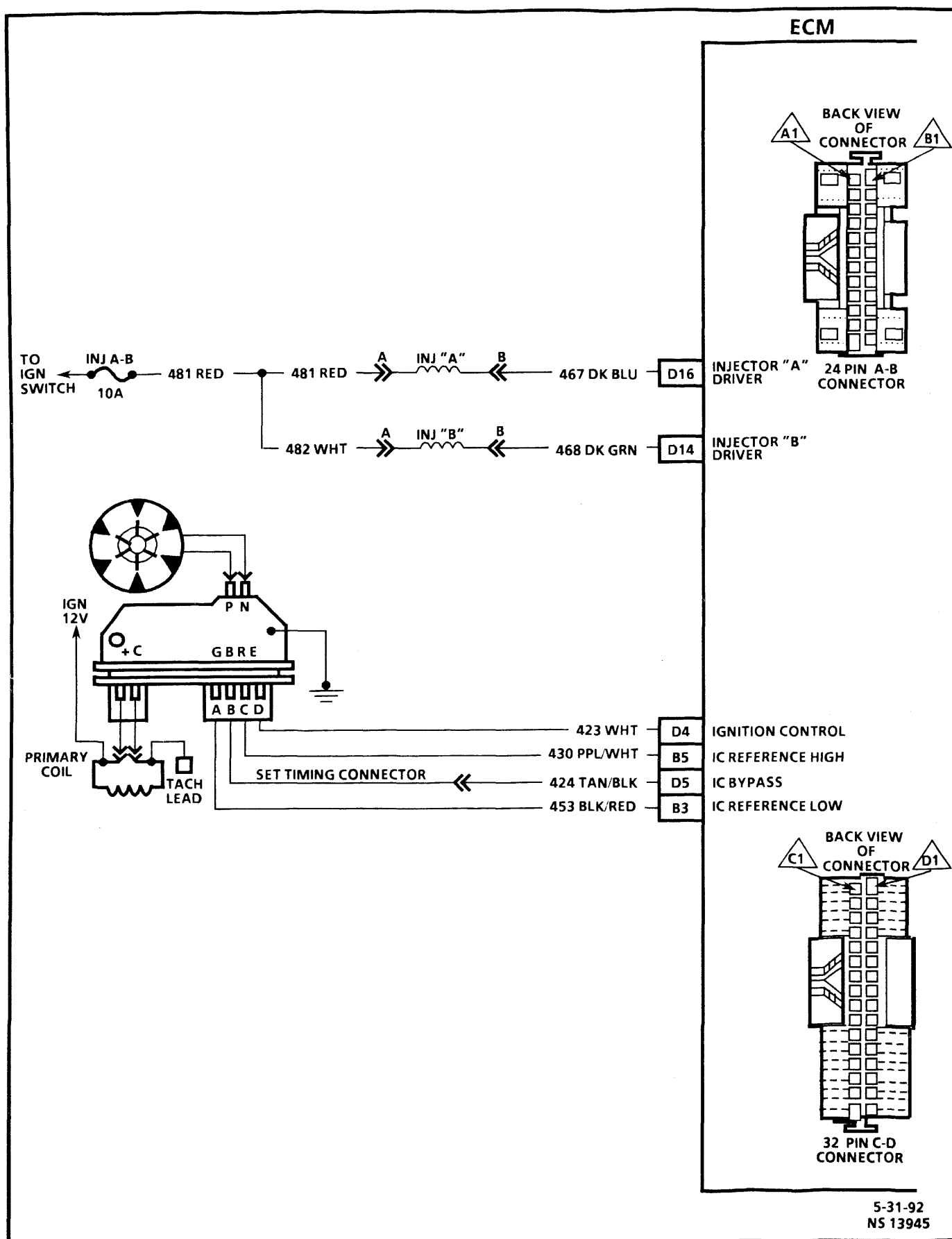


Figure 3B-8 - ECM Wiring Diagram 5.0L, 5.7L (C/K) Manual Transmission (4 of 4)

### ECM Connector and Driveability Symptoms Identification

This ECM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

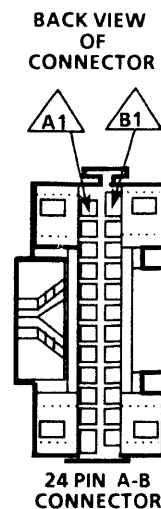
The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION                                | CKT # | WIRE COLOR  | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                       |
|-----|---------------------------------------------|-------|-------------|---------------------|----------------|------------------|-----------------|-----------------------------------------|
|     |                                             |       |             |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                         |
| A1  | FUEL PUMP RELAY DRIVE                       | 465   | DK GRN/ WHT | FUEL PUMP RELAY     | (1)            | B +              | 54              | LONG CRANK TIME BEFORE ENGINE STARTS    |
| A2  | NOT USED                                    | -     | -           | -                   | -              | -                | -               | -                                       |
| A3  | NOT USED                                    | -     | -           | -                   | -              | -                | -               | -                                       |
| A4  | EGR CONTROL                                 | 435   | GRY         | EGR                 | B +            | B +              | 32              | DETONATION                              |
| A5  | MALFUNCTIONING INDICATOR LAMP (MIL) CONTROL | 419   | BRN         | INSTRUMENT PANEL    | 0*             | B +              | NONE            | MIL INOP, OR MIL FLASHING               |
| A6  | IGNITION FEED                               | 439   | PNK/BLK     | SPLICE              | B +            | B +              | NONE            | NO START, MIL INOP                      |
| A7  | SHIFT LAMP                                  | 456   | TAN/BLK     | SHIFT LAMP          | B +            | B +              | NONE            | SHIFT LAMP INOP, SHIFT LAMP "ON" ALWAYS |
| A8  | SERIAL DATA                                 | 461   | ORN         | DATA LINK CONNECTOR | (2)            | (2)              | NONE            | NO SERIAL DATA                          |
| A9  | DIAGNOSTIC TEST TERMINAL                    | 451   | WHT/BLK     | DATA LINK CONNECTOR | 5 V            | 5 V              | NONE            | MIL FLASHING                            |
| A10 | VEHICLE SPEED SENSOR SIGNAL                 | 1716  | DK BLU      | VSS BUFFER          | (3)            | (3)              | 24              | SHIFT LAMP INOP                         |
| A11 | MAP SENSOR GROUND                           | 455   | PPL         | MAP SENSOR          | 0*             | 0*               | 33, 45          | SURGE POOR FUEL ECONOMY                 |
| A12 | SYSTEM GROUND                               | 450   | BLK/WHT     | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                               |

- (1) BATTERY VOLTAGE FIRST 2 SECONDS.  
 (2) VARIES FROM 2 TO 5 VOLTS.  
 (3) VARIES FROM .01 TO BATTERY VOLTAGE DEPENDING ON POSITION OF DRIVE WHEELS.  
 \* LESS THAN .5 VOLT (500 mV).



3-24-93  
MS 9910

Figure 3B-9 - ECM Connector Terminal End View 5.0L, 5.7L (C/K) (Manual Transmission) (1 of 4)



### ECM Connector and Driveability Symptoms Identification

This ECM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

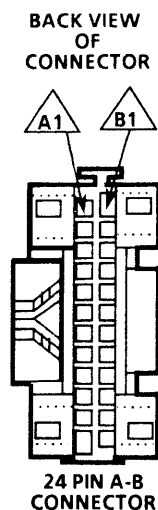
- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION      | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                          |
|-----|-------------------|-------|------------|---------------------|----------------|------------------|-----------------|--------------------------------------------|
|     |                   |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                            |
| B1  | BATTERY FEED      | 440   | ORN        | SPLICE              | B +            | B +              | NONE            | NO CHANGE                                  |
| B2  | FUEL PUMP SIGNAL  | 120   | GRY        | FUEL PUMP RELAY     | (1)            | B +              | NONE            | NO CHANGE                                  |
| B3  | IC REFERENCE LOW  | 453   | BLK/RED    | DISTRIBUTOR MODULE  | 0*             | 0*               | NONE            | NO CHANGE                                  |
| B4  | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |
| B5  | IC REFERENCE HIGH | 430   | PPL/WHT    | DISTRIBUTOR MODULE  | 0*             | 1.6V             | NONE            | NO RESTART                                 |
| B6  | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |
| B7  | KNOCK SIGNAL      | 457   | YEL/BLK    | KNOCK SENSOR        | 9V             | 9V               | 43              | POOR ECONOMY, POOR PERFORMANCE, DETONATION |
| B8  | A/C SIGNAL        | 59    | DK GRN     | A/C SWITCH          | (2)            | (2)              | NONE            | INCORRECT IDLE                             |
| B9  | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |
| B10 | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |
| B11 | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |
| B12 | NOT USED          | -     | -          | -                   | -              | -                | -               | -                                          |

(1) BATTERY VOLTAGE FIRST 20 SECONDS.

(2) 0 VOLTS A/C "OFF," BATTERY VOLTAGE A/C "ON."

\* LESS THAN .5 VOLT (500 mV).



3-24-93  
MS 13726

Figure 3B-10 - ECM Connector Terminal End View 5.0L, 5.7L (C/K) (Manual Transmission) (2 of 4)

### ECM Connector and Driveability Symptoms Identification

This ECM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

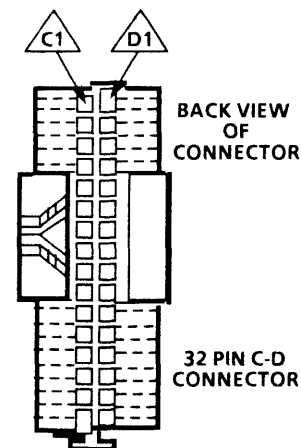
The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • Closed Loop • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION         | CKT # | WIRE COLOR  | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                          |
|-----|----------------------|-------|-------------|---------------------|----------------|------------------|-----------------|--------------------------------------------|
|     |                      |       |             |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                            |
| C1  | NOT USED             | -     | -           | -                   | -              | -                | -               | -                                          |
| C2  | AIR BYPASS VALVE     | 436   | BRN         | AIR BYPASS VALVE    | B +            | B +              | NONE            | AIR BYPASS INOP                            |
| C3  | IAC "B" LOW          | 444   | LT GRN/ BLK | IAC VALVE           | NOT            | USABLE           | NONE            | STALLING ROUGH UNSTABLE OR INCORRECT IDLE  |
| C4  | IAC "B" HIGH         | 443   | LT GRN/ WHT | IAC VALVE           | NOT            | USABLE           | NONE            | STALLING ROUGH UNSTABLE OR INCORRECT IDLE  |
| C5  | IAC "A" HIGH         | 441   | LT BLU/ WHT | IAC VALVE           | NOT            | USABLE           | NONE            | STALLING ROUGH UNSTABLE OR INCORRECT IDLE  |
| C6  | IAC "A" LOW          | 442   | LT BLU/ BLK | IAC VALVE           | NOT            | USABLE           | NONE            | STALLING ROUGH UNSTABLE OR INCORRECT IDLE  |
| C7  | NOT USED             | -     | -           | -                   | -              | -                | -               | -                                          |
| C8  | NOT USED             | -     | -           | -                   | -              | -                | -               | -                                          |
| C9  | CRANK SIGNAL         | 806   | PPL/WHT     | STARTER             | (1)            | 0*               | NONE            | MAY SET FALSE DTC ON START UP              |
| C10 | ECT SIGNAL           | 410   | YEL         | ECT SENSOR          | (2)            | (2)              | 14, 15          | POOR PERFORMANCE, EXHAUST ODOR, ROUGH IDLE |
| C11 | MAP SIGNAL           | 432   | LT GRN      | MAP SENSOR          | 4.8V           | 1.0†V            | 34, 45          | POOR PERFORMANCE, SURGE, POOR FUEL ECONOMY |
| C12 | NOT USED             | -     | -           | -                   | -              | -                | -               | -                                          |
| C13 | TP SIGNAL            | 417   | DK BLU      | TP SENSOR           | (3)            | .6V              | 22              | POOR PERFORMANCE, INCORRECT IDLE           |
| C14 | MAP & TP REF. SIGNAL | 416   | GRY         | TP AND MAP SENSOR   | 5V             | 5V               | 22, 34          | LACK OF POWER, IDLE SURGE                  |
| C15 | NOT USED             | -     | -           | -                   | -              | -                | -               | -                                          |
| C16 | BATTERY FEED         | 440   | ORN         | SPLICE              | B +            | B +              | NONE            | NO CHANGE                                  |

- (1) BATTERY VOLTAGE WHEN CRANKING.
  - (2) ABOUT 1.0 VOLT, VARIES WITH TEMPERATURE.
  - (3) .6 VOLT TO ABOUT 4.8 VOLTS AT WIDE OPEN THROTTLE (WOT).
- \* LESS THAN .5 VOLT (500 mV).  
† VARIES WITH MANIFOLD PRESSURE.



6-2-92  
MS 9911

Figure 3B-11 - ECM Connector Terminal End View 5.0L, 5.7L (C/K) (Manual Transmission) (3 of 4)

### 3B-70 DRIVEABILITY AND EMISSIONS (GASOLINE)

#### ECM Connector and Driveability Symptoms Identification

This voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

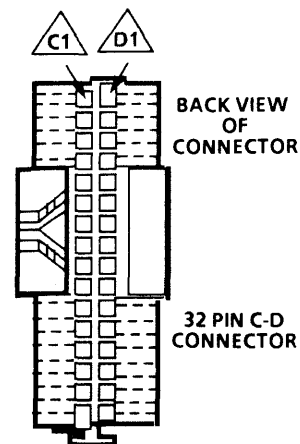
- Engine at operating temperature • "Closed Loop" • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

| PIN | PIN FUNCTION           | CKT # | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                                   |
|-----|------------------------|-------|------------|---------------------|----------------|------------------|-----------------|-----------------------------------------------------|
|     |                        |       |            |                     | IGNITION "ON"  | ENGINE OPERATING |                 |                                                     |
| D1  | SYSTEM GROUND          | 450   | BLK/WHT    | ENGINE BLOCK        | 0*             | 0*               | NONE            | NO CHANGE                                           |
| D2  | TP & ECT SENSOR GROUND | 452   | BLK        | TP AND ECT SENSOR   | 0*             | 0*               | 15, 21          | HIGH IDLE, ROUGH IDLE, HARD START, POOR PERFORMANCE |
| D3  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D4  | IC CONTROL             | 423   | WHT        | DISTRIBUTOR MODULE  | 0*             | 1.0V             | 42              | STALL, WILL RESTART IN BYPASS MODE, LACK OF POWER   |
| D5  | IC BYPASS              | 424   | TAN/BLK    | DISTRIBUTOR MODULE  | 0*             | 4.75V            | 42              | FIXED TIMING                                        |
| D6  | OXYGEN SENSOR GROUND   | 413   | TAN        | ENGINE BLOCK        | 0*             | 0*               | 13, 44          | LEAN EXHAUST, FIXED O2S, POOR PERFORMANCE           |
| D7  | OXYGEN SENSOR SIGNAL   | 412   | PPL        | OXYGEN SENSOR       | (1)            | (2)              | 13, 44          | EXHAUST ODOR, POOR PERFORMANCE                      |
| D8  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D9  | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D10 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D11 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D12 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D13 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D14 | INJECTOR "2" CONTROL   | 468   | DK GRN     | INJECTOR            | B +            | B +              | NONE            | ROUGH IDLE, LACK OF POWER, STALL                    |
| D15 | NOT USED               | -     | -          | -                   | -              | -                | -               | -                                                   |
| D16 | INJECTOR "1" CONTROL   | 467   | DK BLU     | INJECTOR            | B +            | B +              | NONE            | ROUGH IDLE, LACK OF POWER, STALL                    |

(1) NON-HEATED O2S .26 TO .46 VOLT.

(2) VARIES FROM .1 VOLT TO .9 VOLT.

\* LESS THAN .5 VOLT (500 mV).



3-24-93  
MS 13727

Figure 3B-12 - ECM Connector Terminal End View 5.0L, 5.7L (C/K) (Manual Transmission) (4 of 4)

## ON-VEHICLE SERVICE

## ELECTRONIC CONTROL MODULE (ECM)

Replacement of the Electronic Control Module (ECM) consists of a service controller, without a PROM (CAL-PAK).

If the diagnostic procedures require the ECM to be replaced, the ECM, PROM (CAL-PAK) should be checked for the correct part number. If they are correct, remove the PROM (CAL-PAK) and install them in the service controller. The service controller will not contain a PROM (CAL-PAK).

### ! Important

- When replacing a production ECM with a service controller, transfer the broadcast DTC and production ECM part number to the controller label. Do not record information on the access cover.

**NOTICE:** The ignition must be "OFF," when disconnecting or reconnecting the ECM connector, to prevent internal damage to the ECM.

**NOTICE:** To prevent possible Electrostatic Discharge damage to the ECM, Do Not touch the connector pins or soldered components on the circuit board.

### ECM Replacement - With PROM (CAL-PAK) Figure 3B-13 and 3B-14

#### ↔ Remove or Disconnect

- Negative battery cable.
- Glove box panel.
- Mounting brackets and/or retainers.
- PCM from tray.

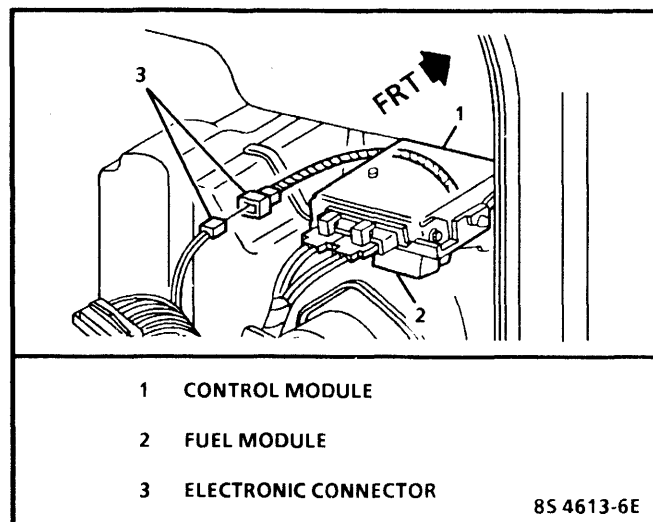


Figure 3B-13 - Electronic Control Module (ECM) (C/K)

- PCM harness connectors.
- Access cover and PROM (CAL-PAK). Refer to PROM (CAL-PAK) service.

#### → Install or Connect

- PROM (CAL-PAK) and access cover on new PCM.
- Mounting brackets and module(s).
- PCM into tray until clips lock.
- PCM harness connectors.
- Glove box panel.
- Negative battery cable.
- Perform functional check.

## PROM (CAL-PAK)

Refer to Figure 3B-14, for removal and installation of a PROM (CAL-PAK).

**NOTICE:** To prevent possible Electrostatic Discharge damage to the PROM (CAL-PAK), Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR Figure 3B-15

**NOTICE:** Care must be taken, when handling ECT sensor. Damage to ECT sensor will affect proper operation of the fuel control system.

#### ↔ Remove or Disconnect

- Negative battery cable.
- Drain cooling system below level of sensor.
- Electrical connector releasing locking tab.
- Coolant sensor.

#### → Install or Connect

- Sensor in engine.
- Electrical connector.
- Refill coolant system.
- Negative battery cable.

### MAP SENSOR Figure 3B-16

Other than checking for loose hoses and electrical connections, the only service possible is unit replacement, if diagnosis shows sensor to be faulty.

#### ↔ Remove or Disconnect

- Negative battery cable.
- Vacuum harness assembly.

## Remove or Disconnect, (Figure 1)

1. ECM access cover screws.

## Important

2. Access cover.

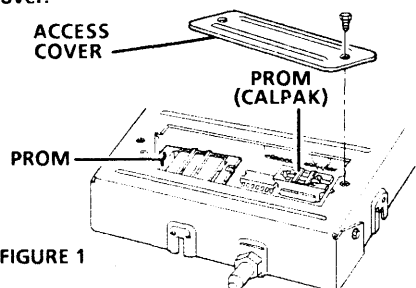


FIGURE 1

## Remove or Disconnect, (Figures 2 & 3)

3. PROM using the rocker-type PROM removal tool shown. Grasp the carrier by the narrow ends only in Figure 2. Engage one end of the PROM carrier with the hook end of the tool. Press on the vertical bar end of the tool and rock the engaged end of the PROM carrier up as far as possible. Engage the opposite end of the PROM carrier in the same manner and rock this end up as far as possible. Repeat this process until the PROM carrier and PROM are free of the PROM socket. The PROM carrier with PROM in it should lift off of the PROM socket easily.
4. PROM (CALPAK) (if used) using removal tool shown in figure 3. Grasp the carrier by the narrow ends only. Gently rock the carrier from end to end while applying a firm upward force.

## Important

- The PROM carrier(s) with PROM(s) in it should lift off of the PROM socket easily.

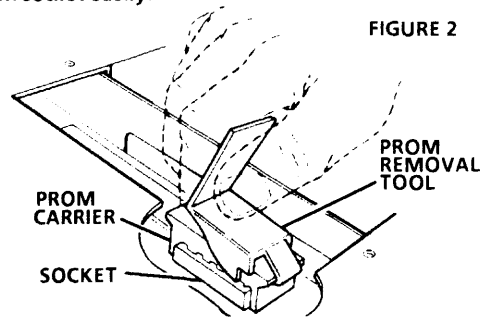


FIGURE 2

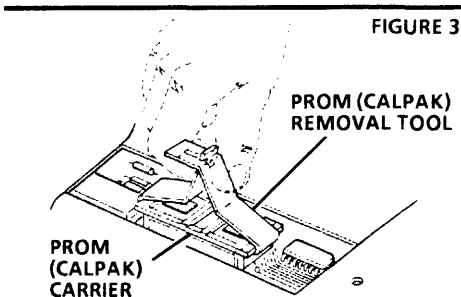


FIGURE 3

## Inspect, (Figure 4)

- Inspect reference notch on the PROM carrier(s) and carefully set aside.

**NOTICE:** To prevent possible Electrostatic Discharge damage to the ECM, DO NOT touch the connector pins or soldered components on the circuit board.

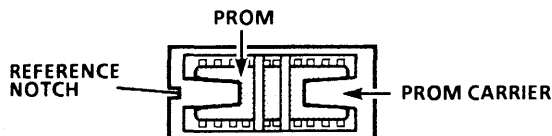


FIGURE 4

## Inspect

- New PROM for same part number as old or updated number per service bulletin.

## Install or Connect

- PROM and carrier on PROM socket.

**NOTICE:** Any time the PROM is installed backward and the ignition switch turned "ON," the PROM is destroyed.

## Important

- Small notch in carrier should be aligned with small notch in socket. Press on PROM carrier until it is firmly seated in the socket. Do not press on PROM; only the carrier.

## Important

- When replacing the production ECM with a service ECM, it is important to transfer the Broadcast Code and production ECM number to the service ECM label. Please do not record on ECM access cover. This will allow positive identification of ECM parts throughout the service life of the vehicle.

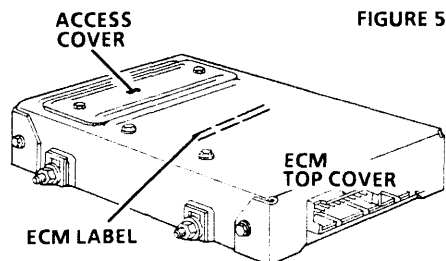


FIGURE 5

## Install or Connect

1. Access cover on ECM.
2. ECM to mounting bracket in correct location and perform "On-board Diagnostic System Check" to confirm proper installation.

2-3-92  
6S 2511-6E

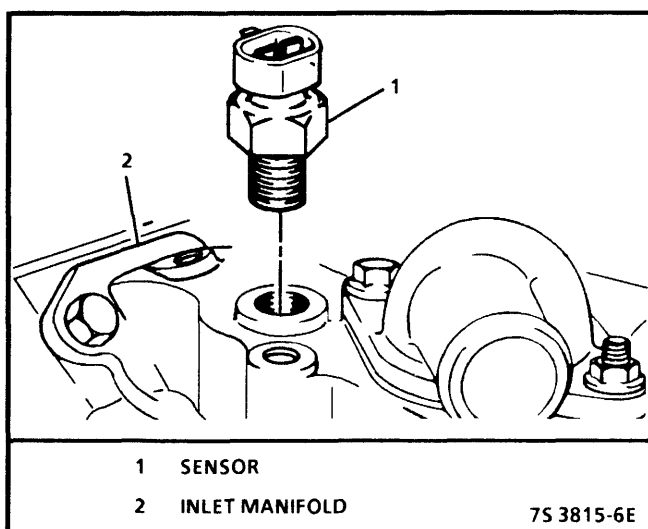


Figure 3B-15 - Engine Coolant Sensor

3. Electrical connector releasing locking tab.
4. Bolts or release lock tabs and remove sensor.

#### Install or Connect

1. Bolts or snap sensor on bracket.
2. Electrical connector.
3. Vacuum harness.
4. Negative battery cable.

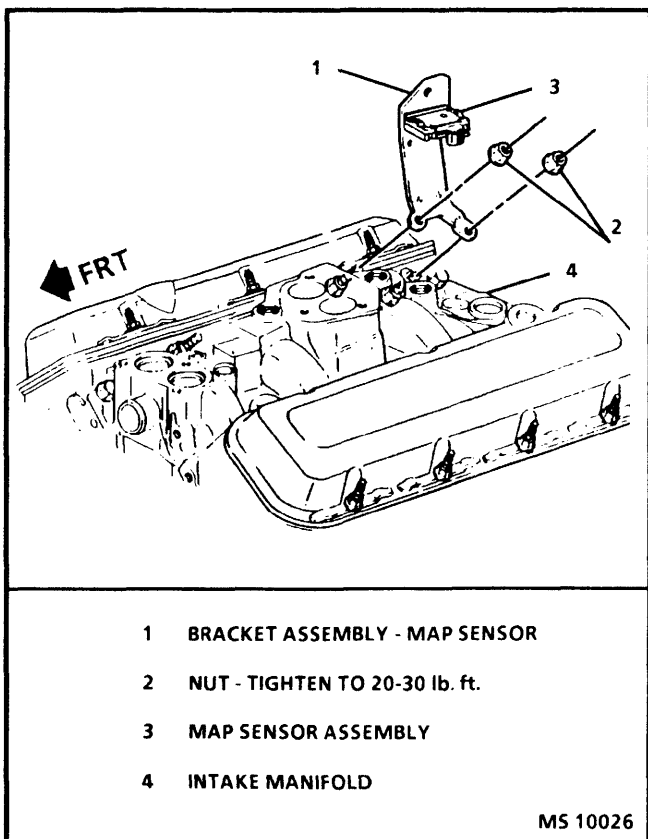


Figure 3B-16 - MAP Sensor

## OXYGEN SENSOR (O2S)

Figure 3B-17

**NOTICE:** The O2S uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2S. Damage or removal of the pigtail or connector could affect proper operation of the oxygen sensor.

Take care when handling the O2S. The in-line electrical connector and louvered end must be kept free of grease, dirt, or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the O2S.

#### Remove or Disconnect

- The O2S may be difficult to remove, when engine temperature is below 48°C (120°F). Excessive force may damage threads in exhaust manifold or exhaust pipe.
- 1. Negative battery cable.
- 2. Electrical connector releasing locking tab.
- 3. Carefully back out O2S.

#### Install or Connect

#### Important

- A special anti-seize compound is used on the O2S threads. The compound consists of liquid graphite and glass beads. The graphite will tend to burn away, but the glass beads will remain, making the sensor easier to remove.

New, or service replacement sensors will already have the compound applied to the threads. If a sensor is removed from an engine, and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of O2S with anti-seize compound (GM P/N 5613695 or equivalent), if necessary.
2. Sensor, and torque to 41 N·m (30 lb. ft.).
3. Electrical connector.
4. Negative battery cable.

## THROTTLE POSITION (TP) SENSOR REPLACEMENT

Figure 3B-18

#### Remove or Disconnect

1. Air cleaner, adapter, and gaskets. Discard gaskets.
2. Electrical connector releasing locking tab.
3. Two TP sensor attaching screw assemblies.
4. TP sensor from throttle body assembly.
5. TP sensor seal.

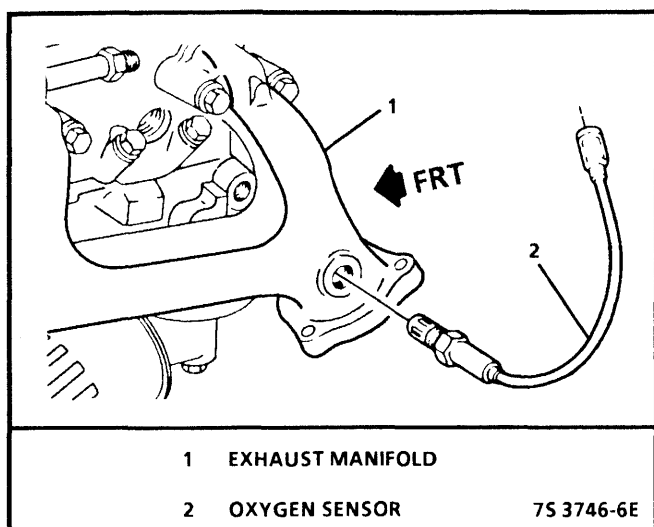


Figure 3B-17 - Oxygen Sensor (O2S)

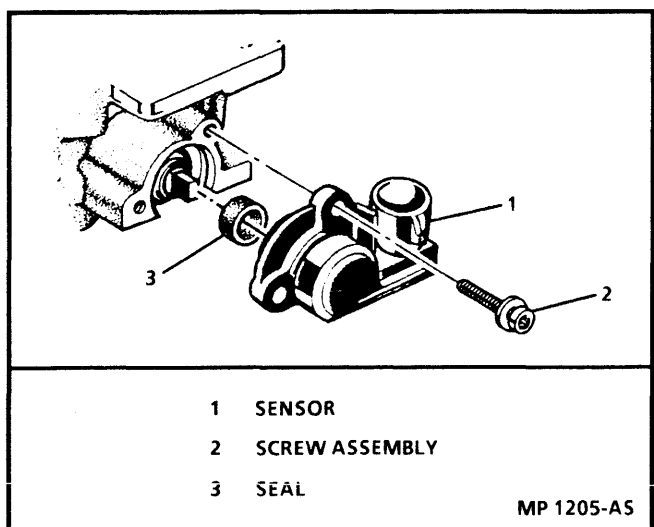


Figure 3B-18 - TP Sensor Configurations - TBI 220

**NOTICE:** The TP sensor is an electrical component and must not be soaked in any liquid cleaner, or solvent, as damage may result.

### Install or Connect

1. TP sensor seal over throttle shaft as shown in Figure 3B-18.
2. With throttle valve closed, install TP sensor on throttle shaft. Rotate counterclockwise to align mounting holes.
3. Two TP sensor attaching screw assemblies.
  - Refer to "Thread-Locking Materials."

### Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in.).
4. Electrical connector.
  5. Air cleaner, adapter, and new gaskets.

## KNOCK SENSOR (KS)

Refer to SECTION 7 for replacement of the knock sensor.

## VEHICLE SPEED SENSOR (VSS)

Figures 3B-19 and 3B-20

Refer to SECTION 8C, in service manual, for Vehicle Speed Sensor (VSS) service, which is located on the transmission.

## VEHICLE SPEED SENSOR (VSS) BUFFER

Figure 3B-21

Refer to SECTION 8C, in the appropriate service manual for Vehicle Speed Sensor (VSS) buffer module.

On the S/T model, it is located on the right hand side of the instrument panel attached to the ECM bracket. On the C/K model the VSS buffer is located in the instrument panel near the ECM.

### Remove or Disconnect

1. Place gear selector in "neutral."
2. Electrical connectors.
3. Spread tangs on housing and pull switch.

### Install and Connect

1. Align actuator on switch, with hole in shift tube.
2. Position rearward portion of the switch (connector side) to fit into cutout in lower jacket.
3. Push down on front of switch to engage the two tangs.
4. Move gear selection to "park" and switch is adjusted.
5. Electrical connectors.

## PARTS INFORMATION

| PART NAME                          | GROUP |
|------------------------------------|-------|
| Controller, ECM                    | 3.670 |
| PROM (CAL-PAK)                     | 3.670 |
| Sensor, Engine Coolant Temp.       | 3.682 |
| Sensor, Exhaust Oxygen             | 3.682 |
| Sensor, MAP                        | 3.682 |
| Sensor, Throttle Position: Part of |       |
| Sensor Kit, Throttle Position      | 3.440 |
| Switch, Neu. St. & Backing LP      | 2.698 |
| Sensor, Knock (KS)                 | 2.383 |
| Sensor, Vehicle Speed (VSS)        | 3.682 |
| Sensor, Throttle Position (TP)     | 3.764 |
| Buffer, Vehicle Speed (VSS)        | 3.682 |

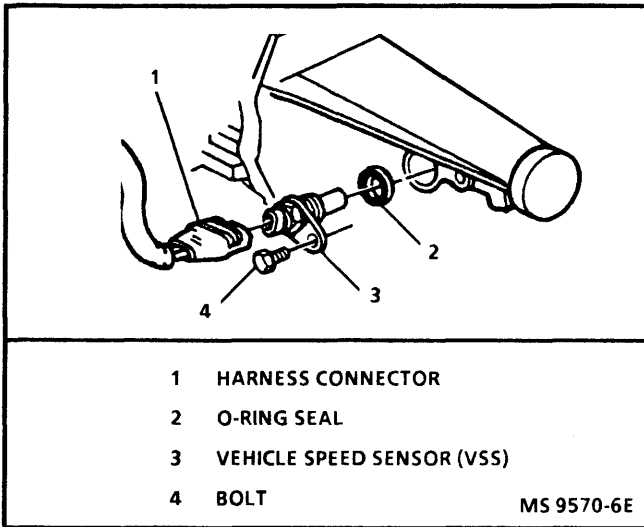


Figure 3B-19 - Vehicle Speed Sensor (VSS) 2WD

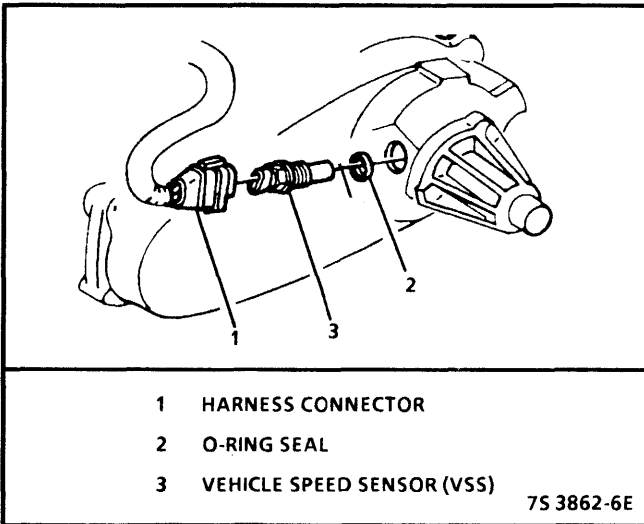


Figure 3B-20 - Vehicle Speed Sensor (VSS) 4WD

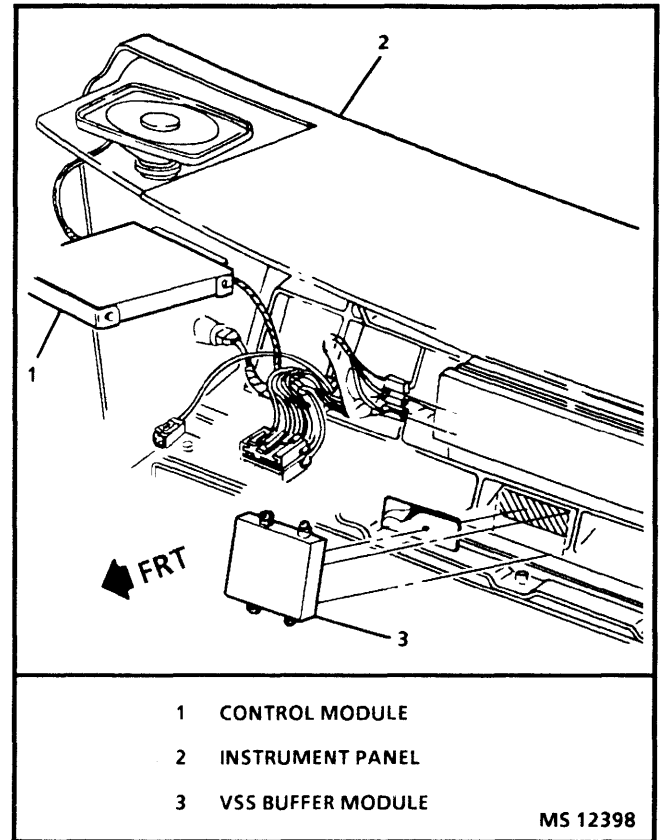


Figure 3B-21 - VSS Buffer



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## SECTION 4

# FUEL SYSTEMS

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## GENERAL DESCRIPTION

The fuel system is controlled by the control module located in the passenger compartment. The control module is the control center of the system. Refer to SECTIONS 3A and 3B.

The basic function of the fuel system is to control fuel delivery to the engine under all operating conditions. Fuel is delivered to the engine by one type of fuel injection (TBI) and the injection is supplied fuel by the fuel supply system.

The main control sensor is the Oxygen Sensor (O2S), which is located in the exhaust manifold. The O2S tells the control module the amount of oxygen in the exhaust gas, and the control module changes the air/fuel ratio to the engine by controlling the fuel injector. A 14.7:1 air/fuel ratio is required for efficient catalytic converter operation. Because the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "Closed Loop" system.

Several other important engine operation parameters include: engine speed, manifold pressure, engine coolant temperature and throttle position. These parameters determine the "mode" of engine operation.

There are two separate classifications of fuel systems with which SECTION 4 will focus on:

- Throttle body fuel injection (TBI 220).
- Fuel supply system.

In addition, engine performance specifications, along with controlled idle speed specifications are included for all engine applications.

### FUEL SYSTEM APPLICATION CHART

There are two types of fuel systems with various applications listed below:

1. SECTION 4A - Throttle Body Injection (TBI 220).
2. SECTION 4E - Fuel Supply System.
  - 4.3L C/K (VIN Z).
  - 5.0L C/K (VIN H)
  - 5.7L C/K (VIN K)
  - 7.4L C/K (VIN N)

### What Sections 4A and 4E Contain

- General description.
- Diagnosis.
- On-vehicle service.
- Parts information.

### MODES OF OPERATION

The control module monitors voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions called "modes." All the modes are controlled by the control module.

### Starting Mode

When the key is first turned "ON," the control module turns "ON" the fuel pump relay for two seconds, and the fuel pump builds up pressure to the TBI unit. The control module checks the Engine Coolant Temperature (ECT) sensor, Throttle Position (TP) sensor, Manifold Absolute Pressure (MAP) sensor, and ignition signal, then determines the proper air/fuel ratio for starting. This ranges from 1.5:1 at -36°C (-33°F) to 14.7:1, at 94°C (201°F) running temperature.

## 4-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

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The control module controls the amount of fuel delivered in the starting mode by changing how long the injector is turned "ON" and "OFF." This is done by "pulsing" the injector for very short times.

### Clear Flood Mode

If the engine floods, clear it by pushing the accelerator pedal down all the way. The control module then pulses the injector at a 16.5:1 air/fuel ratio, and holds this injector rate as long as the throttle stays wide open, and the engine is below 600 RPM. If the throttle position becomes less than 65%, the control module returns to the starting mode.

### Run Mode

The run mode is the mode under which the engine operates most of the time. In this mode, the engine operates in one of two conditions: "Open Loop" and "Closed Loop."

#### "Open Loop"

When the engine is first started, and it is above 400 RPM, the system goes into "Open Loop" operation. In "Open Loop," the control module ignores the signal from the O2S, and calculates the air/fuel ratio based on inputs from the Engine Coolant Temperature (ECT) sensor and Manifold Absolute Pressure (MAP) sensor.

The system stays in "Open Loop" until the following conditions are met on non-heated O2S:

1. The O2S has varying voltage output, showing that it is hot enough to operate properly. (This depends on engine temperature.)
2. The Engine Coolant Temperature (ECT) sensor is above a specified temperature.
3. A specific amount of time has elapsed after starting the engine.

A normal functioning system may go into "Open Loop" at idle if Oxygen Sensor (O2S) temperature drops below the minimum requirement to produce voltage fluctuation.

#### "Closed Loop"

The specific values for the above conditions vary with different engines, and are stored in the Programmable Read Only Memory (PROM). When these conditions are met, the system goes into "Closed Loop" operation. In "Closed Loop," the control module calculates the air/fuel ratio (injector "ON"-time) based on the signal from the O2S. This allows the air/fuel ratio to stay very close to 14.7:1.

### Acceleration Mode

When the control module senses rapid changes in throttle position and manifold pressure, the system enters the acceleration mode and provides the extra fuel needed for smooth acceleration.

### Deceleration Mode

When deceleration occurs, the fuel remaining in the intake manifold can cause excessive emissions and backfiring. When the control module observes a fast reduction in throttle opening and a sharp decrease in manifold pressure, it causes the system to enter the deceleration mode by reducing the amount of fuel delivered to the engine. When deceleration is very fast, the control module cuts off fuel completely for short periods.

### Highway Fuel Mode (Semi-"Closed Loop")

This mode comes into operation at highway speeds and its purpose is to improve fuel economy. For the control module to operate in this mode, it first must sense the correct engine coolant temperature, ignition control, canister purge activity and constant engine speed. During semi-"Closed-Loop" operation, there will be very little long term fuel trim (formerly known as "Block Learn") and short term fuel trim (formerly known as "Integrator"), and the oxygen sensor values will read below 100 millivolts.

### Decel En-Leanment

On deceleration, the control module senses a high MAP vacuum (low voltage or kPa) and leans the fuel spray for emission reasons, but it should be noted that the control module can trigger this condition (decel en-leanment) while the vehicle is not moving.

### Decel En-Leanment Operation

This mode of operation can be misdiagnosed as a lean condition. The control module will run the system lean on decel, or if the MAP sensor senses a low voltage (high engine vacuum), with the vehicle standing still, it will lean out the fuel delivery. If it is noted while testing a control module system (with Tech 1 scan tool), and the transmission is in park, that the O2S reading is low (usually below 100 mV) and the long term and short term fuel trim are both around the 128 counts, lower the engine speed to 1000 RPM. If the oxygen sensor and long term fuel trim numbers respond normally at this RPM, it's possible that the system was fooled into the decel en-leanment mode of operation. If the oxygen sensor and long term fuel trim numbers do not respond at the lower RPM readings, there are other problems with the vehicle.

## Battery Voltage Correction Mode

When battery voltage is low, the control module can compensate for a weak spark delivered to the distributor by:

- Increasing injector "ON" time.
- Increasing the idle RPM.
- Increasing ignition dwell time.

## Fuel Cutoff Mode

No fuel is delivered by the injector when the ignition is "OFF." This prevents dieseling. Also, fuel is not delivered if no reference pulses are seen from the Distributor Ignition (DI) system, which means the engine is not running. Fuel cutoff also occurs at high engine RPM, to protect internal engine components from damage vehicle speed also enables fuel cutoff.

### 1994 CONTROLLED IDLE SPEED

**NOTE:** Engine at operating temperature 92°C to 104°C (196°F to 222°F)

| Engine                                  | Transmission | Gear<br>(Drive/Neutral) | Idle Speed<br>(RPM) | IAC<br>Counts * | Open/Closed<br>Loop ** |
|-----------------------------------------|--------------|-------------------------|---------------------|-----------------|------------------------|
| 4.3L (TBI)<br>UNDER 8500 GVW<br>C/K-TRK | AUTO         | DRIVE                   | 590 ± 25            | 5-30            | CL                     |
|                                         | MANUAL       | NEUTRAL                 | 550 ± 25            | 5-30            |                        |
| 4.3L (TBI) C/K-TRK<br>(OVER 8500 GVW)   | AUTO         | DRIVE                   | 650 ± 25            | 5-30            | CL                     |
|                                         | MANUAL       | NEUTRAL                 | 700 ± 25            | 5-30            | CL                     |
| 5.0L<br>C/K-TRK                         | MAN          | NEUTRAL                 | 650 ± 25            | 5-30            | CL                     |
|                                         | AUTO         | DRIVE                   | 550 ± 25            | 5-30            | CL                     |
| 5.7L C/K<br>(under 8500 GVW)            | MAN          | NEUTRAL                 | 660 ± 25            | 5-30            | CL                     |
|                                         | AUTO         | DRIVE                   | 525 ± 25            | 5-30            | CL                     |
| 5.7L C/K<br>(over 8500 GVW)             | MAN          | NEUTRAL                 | 590 ± 25            | 5-30            | CL                     |
|                                         | AUTO         | DRIVE                   | 550 ± 25            | 5-30            | CL                     |
| 7.4L C/K                                | MAN          | NEUTRAL                 | 750 ± 25            | 5-30            | CL                     |
|                                         | AUTO         | DRIVE                   | 675 ± 25            | 5-30            | CL                     |

\* On manual transmission vehicles the Tech 1 will display RDL in neutral.

\* Add 2 counts for engines with less than 500 miles. Add 2 counts for every 1000 ft. above sea level (4.3L and V8).

\*\* Let engine idle until proper fuel control status ("Open/Closed Loop") is reached.

### MINIMUM IDLE SPEED

| Engine | Transmission | Gear<br>(Drive/Neutral) | Engine Speed<br>(RPM) ** | Open/Closed<br>Loop * |
|--------|--------------|-------------------------|--------------------------|-----------------------|
| 7.4L   | MAN          | NEUTRAL                 | 625 ± 25                 | CL                    |
|        | AUTO         | DRIVE                   | 625 ± 25                 | CL                    |

\* Let engine idle until proper fuel control status ("Open/Closed Loop") is reached.

\*\* If the engine has less than 500 miles or is checked at altitudes above 1500 feet, the idle RPM with a seated IAC valve should be lower than valves above.

**BLANK**

## SECTION 4A

# FUEL SYSTEM

### TBI 220

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## GENERAL DESCRIPTION

### FUEL SYSTEM OPERATION

The fuel system consists of the following components:

- Throttle Body Fuel Injection (TBI) unit.
- Fuel pump.
- Fuel pump relay circuit.
- Fuel tank.
- Accelerator control.
- Fuel lines.
- Fuel filter.
- Evaporative Emission (EVAP) control system.

The fuel system has an electric fuel pump, located in the fuel tank on the gage sending unit. It pumps fuel to the throttle body through an in-line fuel filter and fuel supply line. The pump is designed to provide pressurized fuel at about 125 kPa (18 psi).

On 4.3L, 5.0L and 5.7L a pressure regulator in the TBI keeps fuel available to the injectors at a constant pressure between 62 and 90 kPa (9 to 13 psi). On 7.4L TBI applications the fuel pressure is 179 to 220 kPa (26-32 psi). Fuel in excess of injector needs is returned to the fuel tank by a separate line.

The control module controls the injectors that are located in the fuel meter body assembly of the TBI. The injectors deliver fuel in one of several modes, described in SECTION 4.

In order to properly control the fuel supply, the fuel pump is operated by the control module through the fuel pump relay and oil pressure switch (refer to CHART A-5).

### FUEL SUPPLY SYSTEM

The fuel supply is stored in the fuel tank. An electric fuel pump, located in the fuel tank with the gage sending unit, pumps fuel through an in-line fuel filter to the TBI unit. The pump is designed to provide fuel at a pressure greater than is needed by the injectors. The pressure regulator, part of the TBI assembly, keeps fuel available to the injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate line. See SECTION 4E for repair and replacement procedures covering the fuel tank, fuel pump in-line filter and fuel lines.

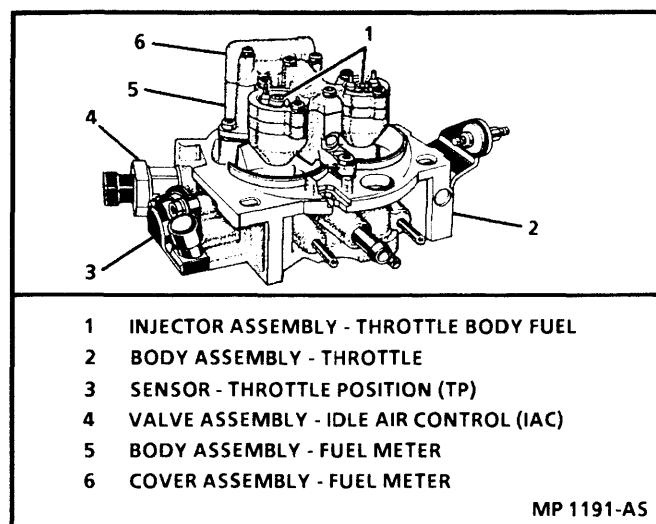


Figure 4A-1 - TBI Unit

### THROTTLE BODY INJECTION (TBI) UNIT Figure 4A-1

The TBI unit consists of three assemblies:

- Fuel meter with:
  - Fuel pressure regulator.
- Fuel meter body with:
  - Fuel injectors.
- Throttle body with:
  - Idle Air Control (IAC) valve assembly.
  - Throttle Position (TP) sensor.

### Vacuum Ports

The throttle body portion of the TBI unit may contain ports located above, or below the throttle valve. These ports generate the vacuum signals for the Exhaust Gas Recirculation (EGR) valve, MAP sensor, and the EVAP canister purge system.

### Fuel Injectors Figure 4A-2

The fuel injector (Figure 4A-2) is a solenoid-operated device, controlled by the control module. The control module turns "ON" the solenoid, which lifts a normally closed ball valve off a seat. Fuel, under pressure, is injected in a conical spray pattern at the walls of the throttle body bore above the throttle valve.

The fuel which is not used by the injectors passes through the pressure regulator before being returned to the fuel tank.

### Fuel Pressure Regulator Figure 4A-2

The pressure regulator is part of the fuel meter assembly, and contains an air chamber and a fuel chamber that are separated by a diaphragm-operated relief valve and a calibrated spring. The regulator's

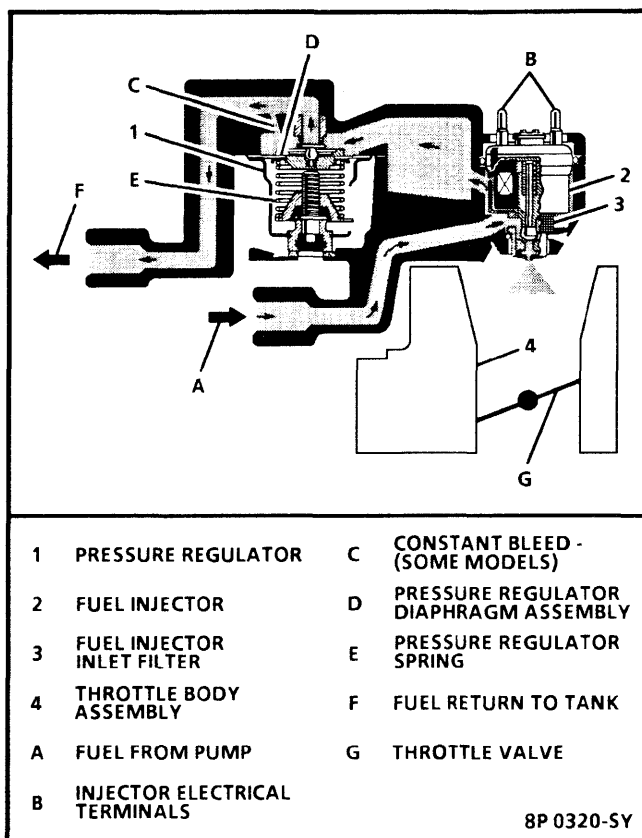


Figure 4A-2 - TBI Unit Operation

function is to maintain a constant fuel pressure drop across the injector at all times. Fuel pressure is regulated by the difference between fuel pump pressure acting on one side of the diaphragm and the force of the calibrated spring (and air cleaner air pressure) acting on the other side. The system operates in an acceptable pressure range of 62 to 90 kPa (9 to 13 psi) on 4.3L, 5.0L and 5.7L engines. The pressure range is 179 to 220 kPa (26 to 32 psi) on 7.4L.

If the fuel pressure is too low, poor performance could result. If the pressure is too high, excess emissions and unpleasant exhaust odor may result.

### Idle Air Control (IAC) System Figure 4A-3

Except for 7.4L engines all engine idle speeds are controlled by the control module through the Idle Air Control (IAC) valve mounted on the throttle body (Figure 4A-3). The control module sends voltage pulses to the IAC motor windings causing the IAC motor shaft and pintle to move "IN" or "OUT" a given distance (number of steps) for each pulse (called counts).

On 7.4L engines a device called an idle speed control actuator is also used to control idle speed when vehicle is cold. It is discussed next in this text.

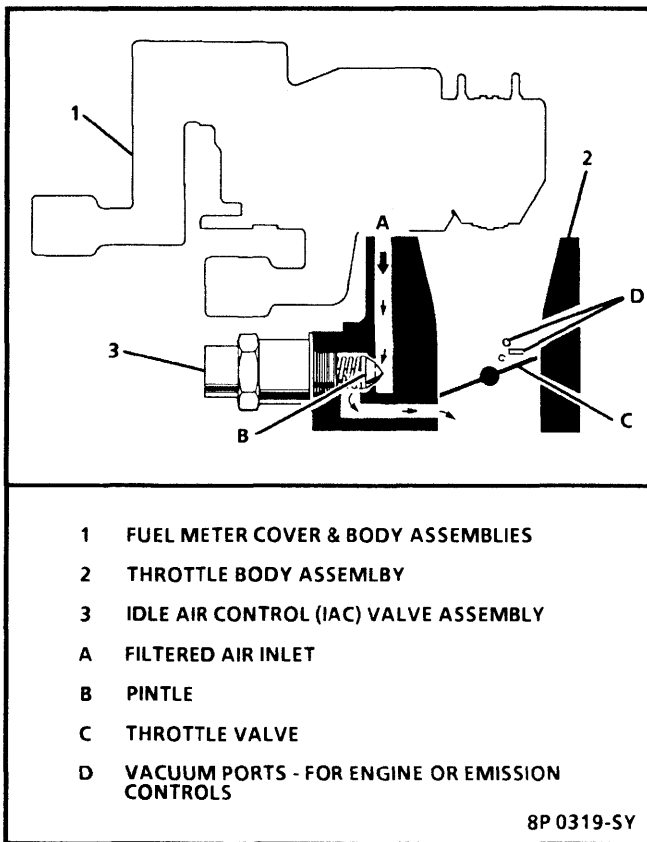


Figure 4A-3 - Idle Air Control (IAC) System

This movement controls airflow around the throttle plate, which in turn, controls engine idle speed, either cold or hot. IAC valve pintle position counts can be seen using a Tech 1 scan tool. Zero (0) counts correspond to a fully closed passage, while 140 counts or more (depending on the application) corresponds to full flow.

- Actual or "controlled" idle speed is obtained by the control module positioning the IAC valve pintle. Resulting idle speed is generated from the total idle air flow (IAC/passage + PCV + throttle valve + vacuum leaks).
- Controlled idle speed is always specified for normal operating conditions. Normal operating condition is engine coolant temperature in operating range, the A/C is "OFF," manual transmission is in neutral or automatic transmission in drive with proper park/neutral position. A high or low engine coolant temperature, or A/C clutch engagement may signal the control module to change the IAC counts.
- The minimum idle speed is set at the factory with a stop screw. This setting allows enough air flow by the throttle valves to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during normal controlled idle operation.

The IAC counts will be higher than normal on an engine with less than 500 miles, or an engine operating at high altitude or an engine with an accessory load such as the alternator, A/C, power steering or hydra-boost brakes activated.

### Idle Speed Control Actuator (7.4L Only)

The idle speed control actuator system assists the idle air control system in controlling the idle speed, primarily at cold temperatures. The idle speed control actuator is a vacuum operated device which opens the throttle slightly (2 to 3 degrees of angle) to increase the cold engine idle speed, to improve the mixing of the air and fuel, and to allow lower warmed up engine idle speeds. The idle speed control actuator is controlled by the idle speed control actuator solenoid, which is controlled by the control module. To increase the idle speed, the solenoid is turned "OFF," and no vacuum is routed to the idle speed control actuator, allowing it to open the throttle slightly. To decrease the idle speed, the solenoid is turned "ON" and vacuum is routed through the solenoid to the idle speed control actuator, allowing the throttle to fully close.

In conjunction with the idle speed control actuator system, the idle air control continuously monitors and controls the engine idle speed to the desired idle speed. A Tech 1 scan tool will read the control module commands to the idle speed control actuator system.

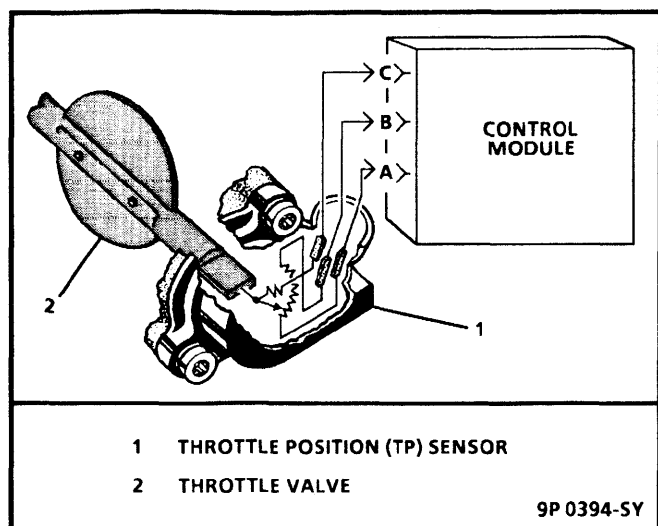
### Throttle Position (TP) Sensor Figure 4A-4

The non-adjustable Throttle Position (TP) sensor, is mounted on the side of the throttle body opposite the throttle lever assembly. Its function is to sense the current throttle valve position and relay that information to the control module (refer to Figure 4A-4). TP sensor information allows the control module to generate the required injector control signals (base pulse).

If the TP sensor senses a Wide Open Throttle (WOT) when the engine is operating, a voltage signal indicating this condition is sent to the control module. The control module then increases the injector base pulse width, permitting increased fuel flow.

As the throttle valve rotates in response to movement of the accelerator pedal, the throttle shaft transfers this rotation movement to the TP sensor. A potentiometer (variable resistor) within the Throttle Position (TP) sensor assembly changes its resistance in proportion to throttle movement.





**Figure 4A-4 - Throttle Position (TP) Sensor**

By applying a reference voltage (5.0 volts) to the TP signal input, a varying voltage (reflecting throttle position) is available at the TP output. For example, approximately 2.5 volts results from a 50% throttle valve opening (depending on TP calibration). The voltage output from the TP assembly is routed to the control module for use in determining throttle position.

### FUEL PUMP CIRCUIT

**Figure 4A-5**

The fuel pump is a turbine type, low pressure electric pump, mounted in the fuel tank. Fuel is pumped at a positive pressure from the fuel pump through the in-line filter to the pressure regulator in the TBI unit (see Figure 4A-5). Excess fuel is returned to the fuel tank through the fuel return line.

The fuel pump is attached to the fuel gage sender assembly. A fuel strainer is attached to the fuel pump inlet line and prevents dirt particles from entering the fuel line and tends to separate water from the fuel.

Vapor lock problems are reduced when using an electric pump because the fuel is pushed from the tank under pressure rather than being pulled under vacuum, a condition that produces vapor.

When the key is first turned "ON" without the engine running, the control module turns a fuel pump relay "ON" for two seconds. This builds up the fuel pressure quickly. If the engine is not started within two seconds, the control module shuts the fuel pump "OFF" and waits for ignition reference pulses. As soon as the engine is cranked, the control module turns the relay "ON" and runs the fuel pump.

When the engine is cranking or operating, the control module receives distributor ignition reference pulses which also energize the injectors.

As a backup system to the fuel pump relay, the fuel pump is also turned "ON" by an oil pressure switch. When the engine oil pressure reaches about 28 kPa (4 psi), through cranking the oil pressure switch will close to complete the circuit to the fuel pump.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn "ON" the fuel pump as soon as oil pressure reaches about 28 kPa (4 psi).

### EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

The system transfers fuel vapors from the fuel tank into a vapor canister and then vapors are purged into the intake manifold air flow and consumed in combustion. Refer to SECTION 5.

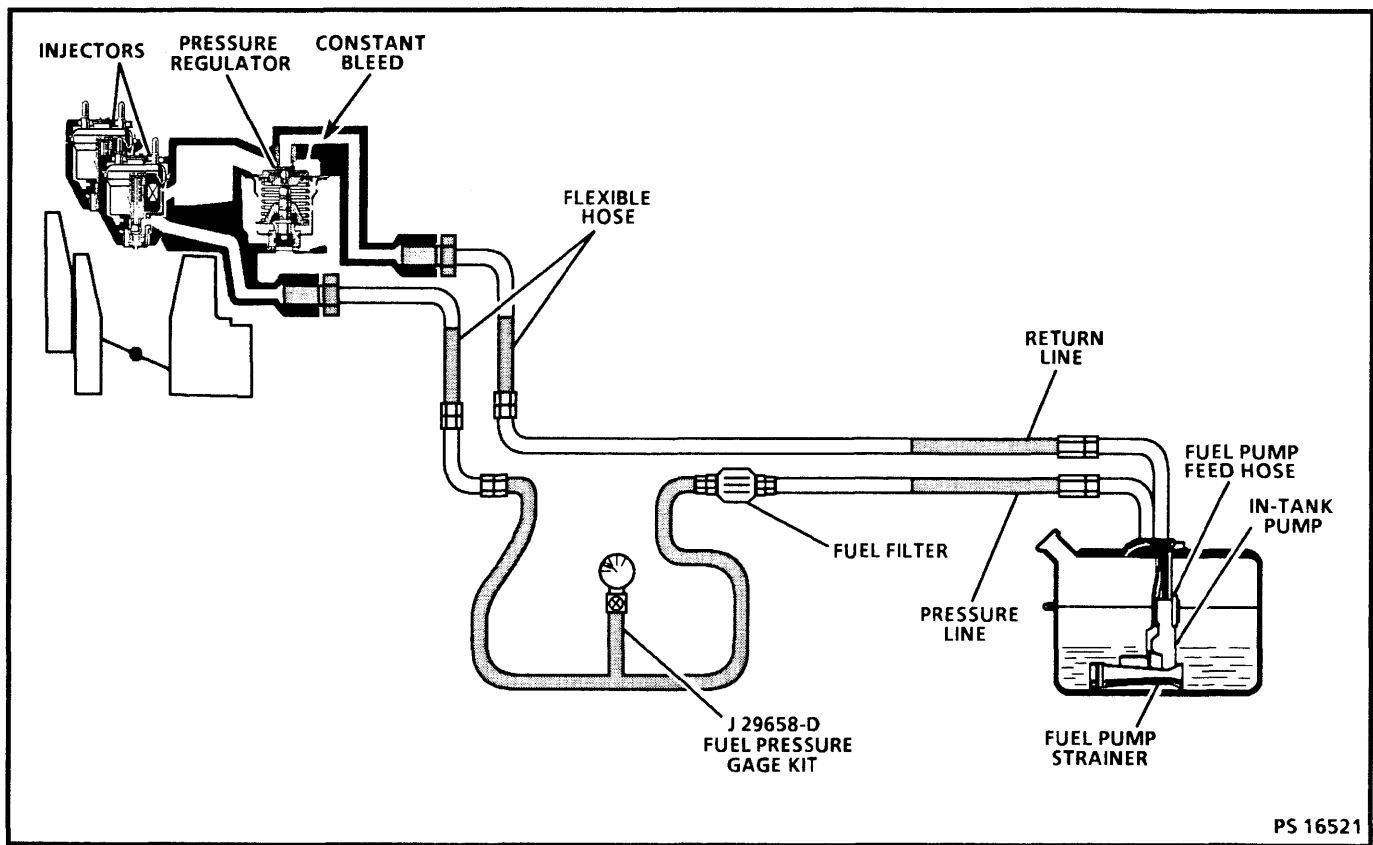


Figure 4A-5 - Fuel Supply System

### DIAGNOSIS

Always begin diagnosis with the **"On-Board Diagnostic (OBD) System Check"** found in SECTION 3, before proceeding to any other diagnostics. This will reduce diagnosis time and prevent unnecessary replacement of parts. The **"On-Board Diagnostic (OBD) System Check"** will give direction to further diagnostics, such as **"Engine Cranks But Won't Run"** and **"Fuel System Diagnosis,"** including diagnosis of injectors, pressure regulator, fuel pump, fuel pump relay, and oil pressure switch.

If a problem occurs in the fuel metering system, it usually results in either a rich or lean exhaust and causes the control module to change the fuel calculation (injector pulse width). The change made to the fuel calculation is indicated by a change in the short term and long term fuel trim values, which can be monitored by a Tech 1 scan tool. Average short term and long term values will be around 128, but vary slightly from engine to engine.

If both the short term and long term fuel trim values are fixed well above 128, refer to DTC 44 for items which can cause a lean system.

- A momentary **rich** condition (system in **control**) will appear on Tech 1 scan tool as:
  - Short term fuel trim value less than 128 (reducing fuel).
  - Long term fuel trim value around 128.
- A long term **rich** condition (system in **control**) will appear on Tech 1 scan tool as:
  - Short term fuel trim value around 128.
  - Long term fuel trim value less than 128 (reduced fuel).
- A long term **rich** condition (system **out of control**) will appear on Tech 1 scan tool as:
  - Short term fuel trim value much less than 128 (reducing fuel).
  - Long term fuel trim value much less than 128 (reduced fuel).

If the short term and long term fuel trim values are fixed well below 128, refer to DTC 45 for items which can cause the system to run rich. If a driveability symptom exists, refer to the particular symptom in SECTION 2 for additional items to check.

#### Fuel Injectors

Testing the fuel injector circuit is in CHART A-3 and additional diagnosis in CHART A-4, SECTION 3A or 3B.

A fuel injector which does not open may cause a no-start condition. An injector which is stuck partly open, could cause loss of pressure after sitting, so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

#### Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3, SECTION 3A or 3B.

If the pressure regulator in the TBI supplies pressure which is too low (below 62 kPa or 9 psi), poor performance could result. If the pressure is too high, excess emissions and unpleasant exhaust odor may result.

#### Idle Air Control (IAC)

The diagnosis of idle air control can be found in this section.

If the IAC valve is disconnected or connected with the engine running, the idle RPM may be wrong. In this case, the IAC valve may be reset by disconnecting negative battery cable for 10 seconds, reconnect battery, then key "ON," engine "OFF" for 5 seconds. Key "OFF" for 10 seconds.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed to the manifold and idle speed will be high. If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

The minimum idle speed is set at the factory with a stop screw. The stop screw should not be adjusted.

Vacuum leaks will cause the IAC valve pintle to be "stepped" closer to the seat or to be closed against its seat in an attempt to maintain controlled idle speed.

#### Throttle Position (TP) Sensor

Refer to SECTION 3A or 3B.

#### Driveability Symptoms

Refer to SECTION 2 for additional fuel control diagnosis.

#### FUEL PUMP

Refer to CHART A-3 in SECTION 3A or 3B.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance. (Refer to "Fuel System Pressure Test" procedure in this section.)

### **Fuel Pump Relay**

Refer to CHART A-5 in SECTION 3A or 3B.

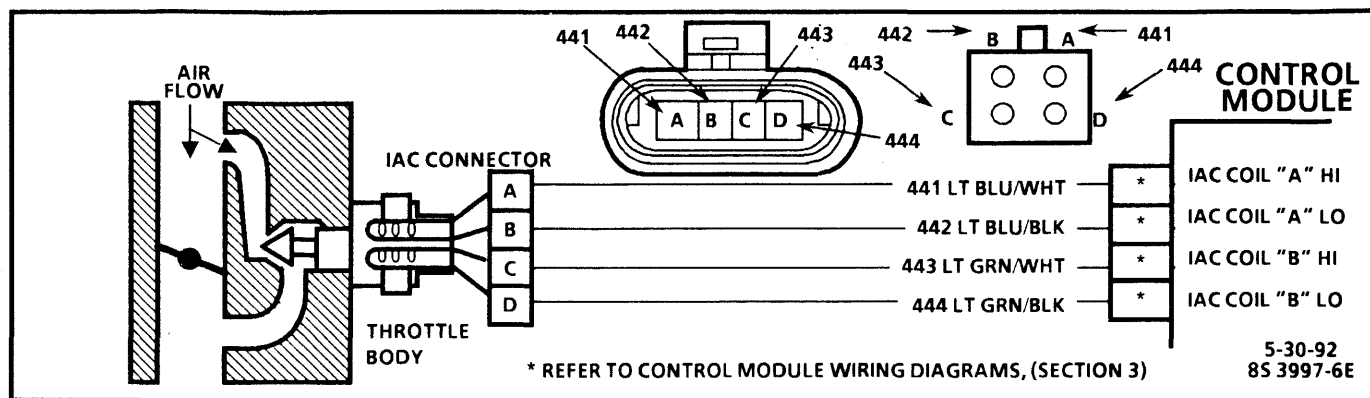
An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn "ON" the fuel pump as soon as oil pressure reaches about 28 kPa (4 psi).

### **Oil Pressure Switch**

Refer to CHART A-5 in SECTION 3A or 3B.

### **EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM**

Refer to SECTION 5.



## IDLE AIR CONTROL (IAC) SYSTEM CHECK

### Circuit Description:

The control module controls engine idle speed with the IAC valve. To increase idle speed, the control module retracts the IAC valve pintle away from its seat, allowing more air to pass by the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing bypass air flow. A Tech 1 scan tool will read the control module commands to the IAC valve in counts. Higher the counts indicate more air bypass (higher idle). The lower the counts indicate less air is allowed to bypass (lower idle).

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in Step 1. Between 700 RPM and about 1500 RPM the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 RPM), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. Each lamp on the node light should flash red and green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash red and green, check the circuits for faults beginning with poor terminal contacts.

### IAC VALVE RESET PROCEDURE

- Disconnect battery cable at battery for 10 seconds then reconnect cable.
- Ignition "ON," engine "OFF" for 5 seconds.
- Ignition "OFF" for 10 seconds.

**Diagnostic Aids:** A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range, IAC Tech 1 scan tool counts will be above 60 if idle is too low, and zero counts if idle is too high. The following

checks should be made to repair a non-IAC system problem.

- Vacuum Leak (High Idle) - If idle is too high, stop the engine. Fully extend (low) IAC with tester. Start engine. If idle speed is above 800 RPM, locate and correct vacuum leak including crankcase ventilation system. Also, check for binding of throttle blade or linkage.
- System too rich (Low Air/Fuel Ratio) - The idle speed will be too low. Tech 1 scan tool IAC counts will usually be above 80. System is obviously rich and may exhibit black smoke in exhaust. Tech 1 scan tool O<sub>2</sub> voltage will be fixed above 800 mV (.8 volt). Check for high fuel pressure, leaking or sticking injector. Silicone contaminated O<sub>2</sub>S scan voltage will be slow to respond.
- Throttle body - Remove IAC valve and inspect bore for foreign material.
- IAC Valve Electrical Connections - IAC valve connections should be carefully checked for proper contact.
- Crankcase Ventilation Valve - An incorrect or faulty crankcase ventilation valve may result in an incorrect idle speed. Refer to "Rough, Unstable, Incorrect Idle or Stalling" in SECTION 2.
- A/C Compressor - Refer to A/C diagnosis if circuit is shorted to ground. If the relay is faulty, an idle problem may exist. Refer to "Rough, Unstable, Incorrect Idle or Stalling," in SECTION 2.
- If intermittent poor drivability or idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance or replace IAC.

# IDLE AIR CONTROL (IAC) SYSTEM CHECK

- 1
- IGNITION "OFF," CONNECT IAC DRIVER \* TO IAC VALVE.
  - SET PARKING BRAKE, BLOCK WHEELS, A/C "OFF."
  - IDLE ENGINE IN PARK (A/T) OR NEUTRAL (M/T).
  - INSTALL "SCAN" TOOL AND DISPLAY RPM.
  - WITH IAC DRIVER, EXTEND AND RETRACT IAC VALVE.
  - ENGINE RPM SHOULD DECREASE AND INCREASE AS IAC IS CYCLED.

**NOTE:** IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

RPM CHANGES

NO RPM CHANGE

- 2
- RPM SHOULD CHANGE SMOOTHLY WITH EACH FLASH OF THE IAC DRIVER LIGHT FROM 700 RPM TO ABOUT 1500 RPM. DOES IT?

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

YES

NO

- 3
- INSTALL APPROPRIATE IAC NODE LIGHT \* IN CONTROL MODULE HARNESS.
  - CYCLE IAC DRIVER AND NOTE LIGHTS.
  - BOTH LIGHTS SHOULD CYCLE RED AND GREEN BUT NEVER "OFF" AS RPM IS CHANGED OVER ITS RANGE. DO THEY?

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

NO

YES

IF CIRCUIT(S) DID NOT TEST GREEN AND RED, CHECK FOR:

- FAULTY CONNECTOR TERMINAL CONTACTS.
- OPEN CIRCUITS INCLUDING CONNECTIONS.
- CIRCUITS SHORTED TO GROUND OR VOLTAGE.
- FAULTY CONTROL MODULE CONNECTION OR CONTROL MODULE..

REPAIR AS NECESSARY AND RETEST.

- USING THE OTHER CONNECTOR ON THE IAC DRIVER PIGTAIL, CHECK RESISTANCE ACROSS IAC COILS.
- SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D".

OK

NOT OK

- CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "C" AND "A" AND "D".
- SHOULD BE INFINITE.

REPLACE IAC VALVE AND RETEST.

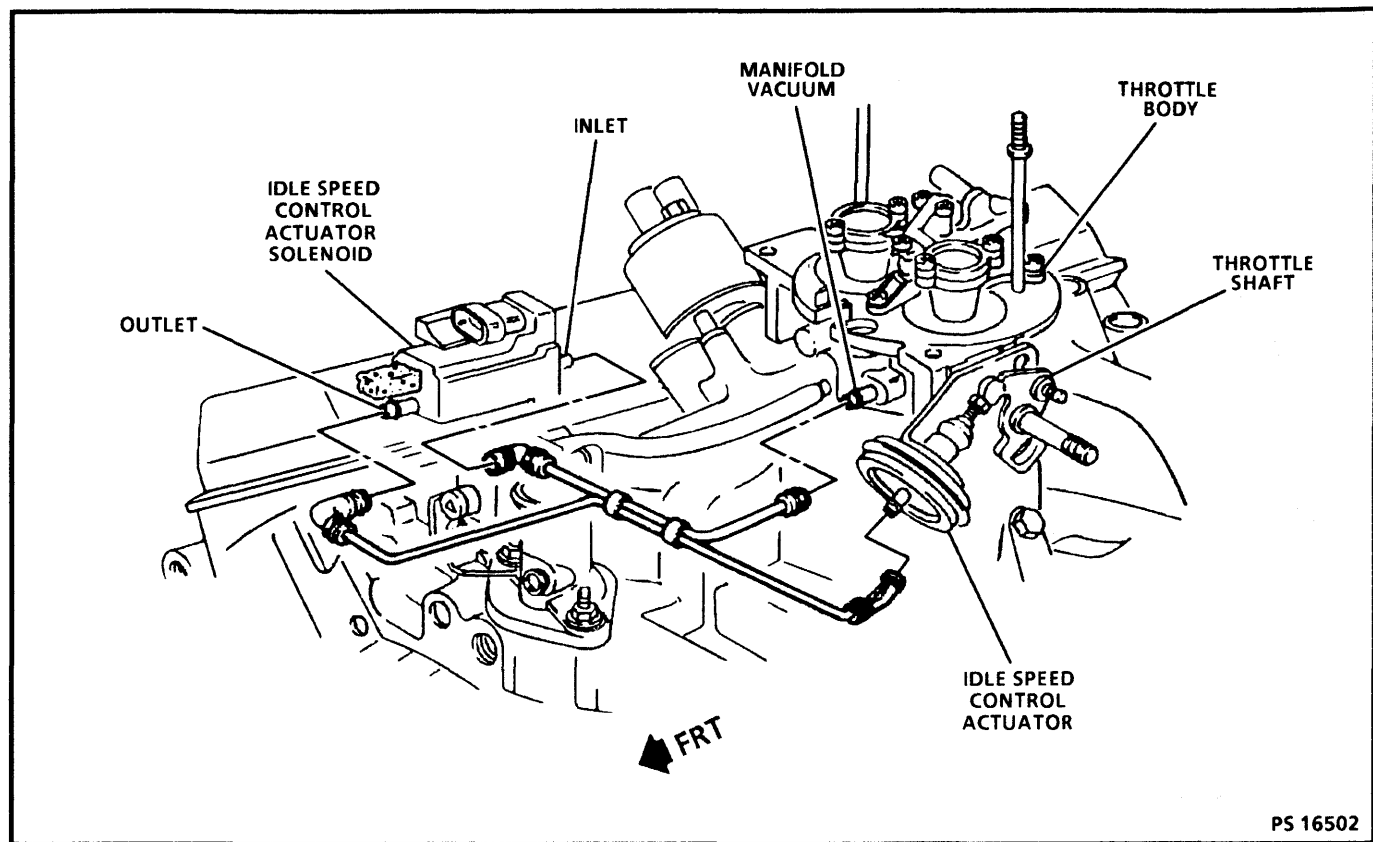
OK

NOT OK

IDLE AIR CONTROL VALVE AND CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

REPLACE IAC VALVE AND RETEST.

\* IAC DRIVER AND NODE LIGHT REQUIRED KIT 222-L FROM: CONCEPT TECHNOLOGY, INC. J 37027 A FROM: KENT-MOORE, INC.



## IDLE SPEED CONTROL ACTUATOR CHECK

(Page 1 of 2)

### Circuit Description:

The idle speed control actuator system assists the idle air control system in controlling the idle speed, primarily at cold temperatures. The idle speed control actuator is a vacuum operated device which opens the throttle slightly (2 to 3 degrees of angle) to increase the cold engine idle speed, to improve the mixing of the air and fuel, and to allow lower warmed up engine idle speeds. The idle speed control actuator is controlled by the idle speed control actuator solenoid, which is controlled by the control module. To increase the idle speed, the solenoid is turned "OFF," and no vacuum is routed to the idle speed control actuator, allowing it to open the throttle slightly. To decrease the idle speed, the solenoid is turned "ON," and vacuum is routed through the solenoid to the idle speed control actuator, allowing the throttle to fully close.

In conjunction with the idle speed control actuator system, the idle air control system continuously monitors and controls the engine idle speed to the desired idle speed. A Tech 1 scan tool will read the control module commands to the idle speed control actuator system.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Checks to see if a vacuum source is present.
2. Checks to see if idle speed control actuator solenoid is commanded "ON."
3. Checks for power to the solenoid, the ground circuit, the connections at the idle speed control actuator solenoid and the solenoid itself.

**Diagnostic Aids:** Check all connections. If OK, refer to "Intermittents" in SECTION 2.

IAC valve reset procedure:

- Disconnect battery terminal for 10 seconds, then reconnect terminal.
- Ignition "ON," engine "OFF" for 5 seconds.
- Ignition "OFF" for 10 seconds.

# **IDLE SPEED CONTROL ACTUATOR CHECK**

(Page 1 of 2)

BEFORE PERFORMING THIS CHECK, THERE SHOULD BE NO DTCs DISPLAYED, IDLE AIR CONTROL HAS BEEN CHECKED AND IGNITION TIMING CORRECT.

- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE 85°C (185°F).
- CHECK PARK/NEUTRAL OPERATION.
- QUICKLY OPEN THROTTLE ABOVE 50% THEN RELEASE.
- IS IDLE SPEED CONTROL ACTUATOR DISENGAGED FROM THROTTLE SHAFT?

YES

NO

1

- IGNITION "ON," ENGINE "OFF."
- WITH TECH 1 COMMAND IAC TO 0 COUNTS.
- DISCONNECT IAC VALVE ELECTRICAL CONNECTOR.
- START ENGINE, ALLOW ENGINE RPM TO STABILIZE. IS RPM AT  $625 \pm 25$  RPM IN PARK/NEUTRAL?

- REMOVE VACUUM HOSE AT IDLE SPEED CONTROL ACTUATOR.
- INSTALL VACUUM PUMP (J 23738-A) TO HOSE. IS VACUUM PRESENT?

NO

YES

REFER TO "IDLE SPEED CONTROL ACTUATOR CHECK (2 OF 2)."

REPLACE IDLE SPEED CONTROL ACTUATOR.

YES

NO

2

- COMMAND IDLE SPEED CONTROL ACTUATOR "ON" WITH SCAN TOOL. DOES SOLENOID ENGAGE?

REFER TO "MINIMUM IDLE SPEED ADJUST PROCEDURE" IN SECTION 4A.

YES

NO

DOES RPM GO TO  $1300 \pm 50$  RPM?

3

- DISCONNECT IDLE SPEED CONTROL ACTUATOR SOLENOID HARNESS CONNECTOR. DOES SOLENOID ENGAGE?

YES

YES

NO

- NO PROBLEM FOUND.
- TURN IGNITION "OFF."
- RECONNECT IAC VALVE ELECTRICAL CONNECTOR.
- REFER TO "IAC RESET PROCEDURE" IN "DIAGNOSTIC AIDS" ON FACING PAGE.

ADJUST IDLE SPEED CONTROL ACTUATOR TO WITHIN SPECIFICATION. REFER TO "IDLE SPEED CONTROL ACTUATOR ADJUSTMENT PROCEDURE" SECTION 4A.

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE HARNESS CONNECTOR "E-F".
- WITH TEST LIGHT CONNECTED TO B+, PROBE CKT 534 AT CONTROL MODULE.

FAULTY IDLE SPEED CONTROL ACTUATOR SOLENOID.

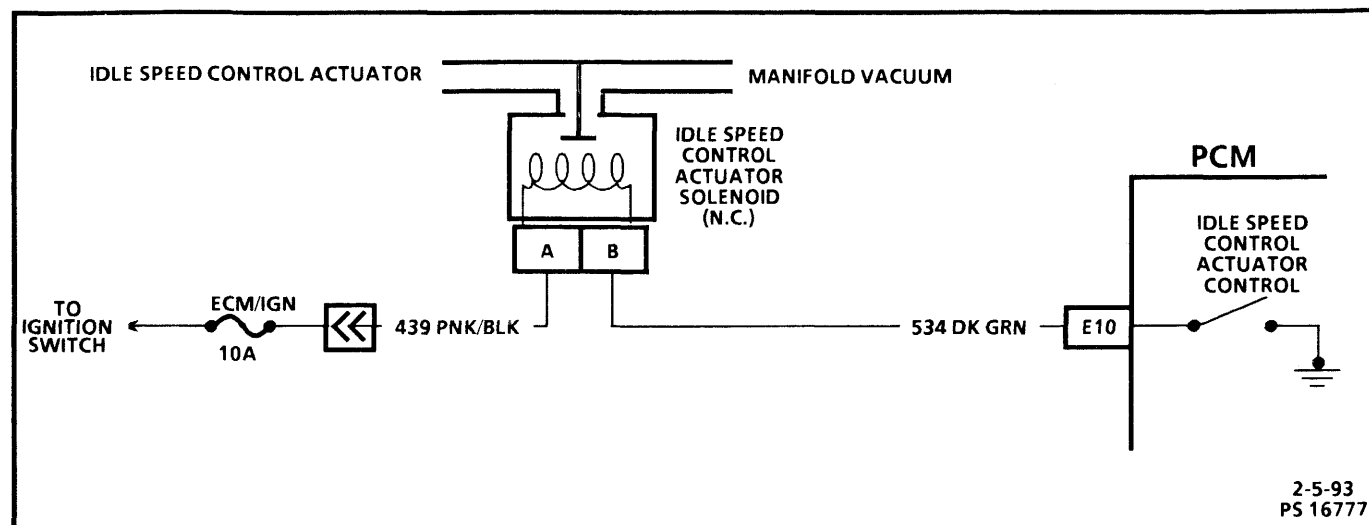
TEST LIGHT "ON."

TEST LIGHT "OFF."

REPAIR SHORT TO GROUND ON CKT 534.

FAULTY CONTROL MODULE.





## IDLE SPEED CONTROL ACTUATOR CHECK

(Page 2 of 2)

### Circuit Description:

The idle speed control actuator system assists the idle air control system in controlling the idle speed, primarily at cold temperatures. The idle speed control actuator is a vacuum operated device which opens the throttle slightly (2 to 3 degrees of angle) to increase the cold engine idle speed, to improve the mixing of the air and fuel, and to allow lower warmed up engine idle speeds. The idle speed control actuator is controlled by the idle speed control actuator solenoid, which is controlled by the control module. To increase the idle speed, the solenoid is turned "OFF," and no vacuum is routed to the idle speed control actuator, allowing it to open the throttle slightly. To decrease the idle speed, the solenoid is turned "ON," and vacuum is routed through the solenoid to the idle speed control actuator, allowing the throttle to fully close.

In conjunction with the idle speed control actuator system, the idle air control system continuously monitors and controls the engine idle speed to the desired idle speed. A Tech 1 scan tool will read the control module commands to the idle speed control actuator system.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

4. Checks to see cause of no vacuum source.
5. Checks idle speed control solenoid and connections.
6. Checks for open or grounded CKT 439.
7. Checks for open CKT 543 or faulty control module.

**Diagnostic Aids:** Check all connections. If OK, refer to "Intermittents" in SECTION 2.

IAC valve reset procedure:

- Disconnect battery terminal for 10 seconds, then reconnect terminal.
- Ignition "ON," engine "OFF" for 5 seconds.

# IDLE SPEED CONTROL ACTUATOR CHECK

(Page 2 of 2)

FROM IDLE SPEED CONTROL ACTUATOR CHECK (1 OF 2)

- CONNECT VACUUM PUMP TO INLET HOSE OF IDLE SPEED CONTROL ACTUATOR SOLENOID. IS VACUUM PRESENT?

YES

NO

4

- RECONNECT INLET VACUUM HOSE.
- DISCONNECT OUTLET HOSE FROM SOLENOID.
- CONNECT VACUUM PUMP TO OUTLET SIDE OF THE IDLE SPEED CONTROL ACTUATOR SOLENOID. IS VACUUM PRESENT?

REPAIR CAUSE OF NO VACUUM.

NO

YES

5

- DISCONNECT IDLE SPEED CONTROL ACTUATOR SOLENOID HARNESS CONNECTOR.
- CONNECT TEST LIGHT BETWEEN CKT 534 AND CKT 439 AT HARNESS CONNECTOR.

REPLACE VACUUM HOSE TO IDLE SPEED CONTROL ACTUATOR.

TEST LIGHT "OFF"

TEST LIGHT "ON"

6

- CONNECT TEST LIGHT TO ALTERNATE GROUND AND PROBE CKT 439.

POOR CONNECTIONS AT IDLE SPEED CONTROL ACTUATOR SOLENOID OR FAULTY IDLE SPEED CONTROL ACTUATOR SOLENOID.

TEST LIGHT "ON"

TEST LIGHT "OFF"

7

- WITH TEST LIGHT CONNECTED TO B + PROBE CKT 534 AT CONTROL MODULE.

REPAIR OPEN OR GROUND IN CKT 439.

TEST LIGHT "OFF"

TEST LIGHT "ON"

POOR CONNECTION AT CONTROL MODULE CONNECTOR OR FAULTY CONTROL MODULE.

REPAIR OPEN CKT 534 TO IDLE SPEED CONTROL ACTUATOR SOLENOID.

### ON-VEHICLE SERVICE

#### CAUTION:

- To prevent personal injury or damage to the vehicle as the result of an accidental start, disconnect the negative battery cable before and reconnect after service is performed (except for those tests where battery voltage is required).
- To minimize the risk of fire, and personal injury, disconnect negative battery cable and relieve the fuel system pressure (where applicable) before servicing the fuel system. (Refer to "Fuel Pressure Relief Procedure," below.)
- Also, catch any fuel that leaks out when disconnecting the fuel lines by covering the fittings with a shop cloth. Place the cloth in an approved container when work is complete.

The following is general information required when working on the fuel system:

- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Fuel pipe fittings require new O-rings when assembling.
- All fuel pipe must meet the GM Specification 124-M, or its equivalent.
- All fuel hose must meet GM Specification 6163-M or its equivalent.
- Do not replace fuel pipe with fuel hose.
- Always allow fuel pressure to bleed off before servicing any fuel system components.
- Do not do any repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Observe all "NOTICES" and "CAUTIONS."

All gasoline engines are designed to use only unleaded gasoline to maintain proper emission control system operation. Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All vehicles covered in the manual are equipped with and Evaporative Emission (EVAP) control system. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere. Information on this system will be found in SECTION 5.

#### SERVICE INFORMATION

The TBI unit repair procedures cover component replacement with the unit on the vehicle. The throttle body replacement requires that the complete unit be removed from the engine.

An eight digit part identification number is stamped on the throttle body (Figure 4A-7). Refer to this number if servicing or part replacement is required.

Refer to the disassembled views (Figure 4A-6) for identification of parts during repair procedures. Service repair of individual components is performed without removing the TBI unit from the engine. If removed, it is essential that care is taken to prevent damage to the throttle valve or sealing surface while performing any service.

When disconnecting the fuel lines, be sure to use a backup wrench (J 29698-B, or BT-8251-A, or equivalent) to keep the TBI nuts from turning.

#### Fuel Pressure Relief Procedure

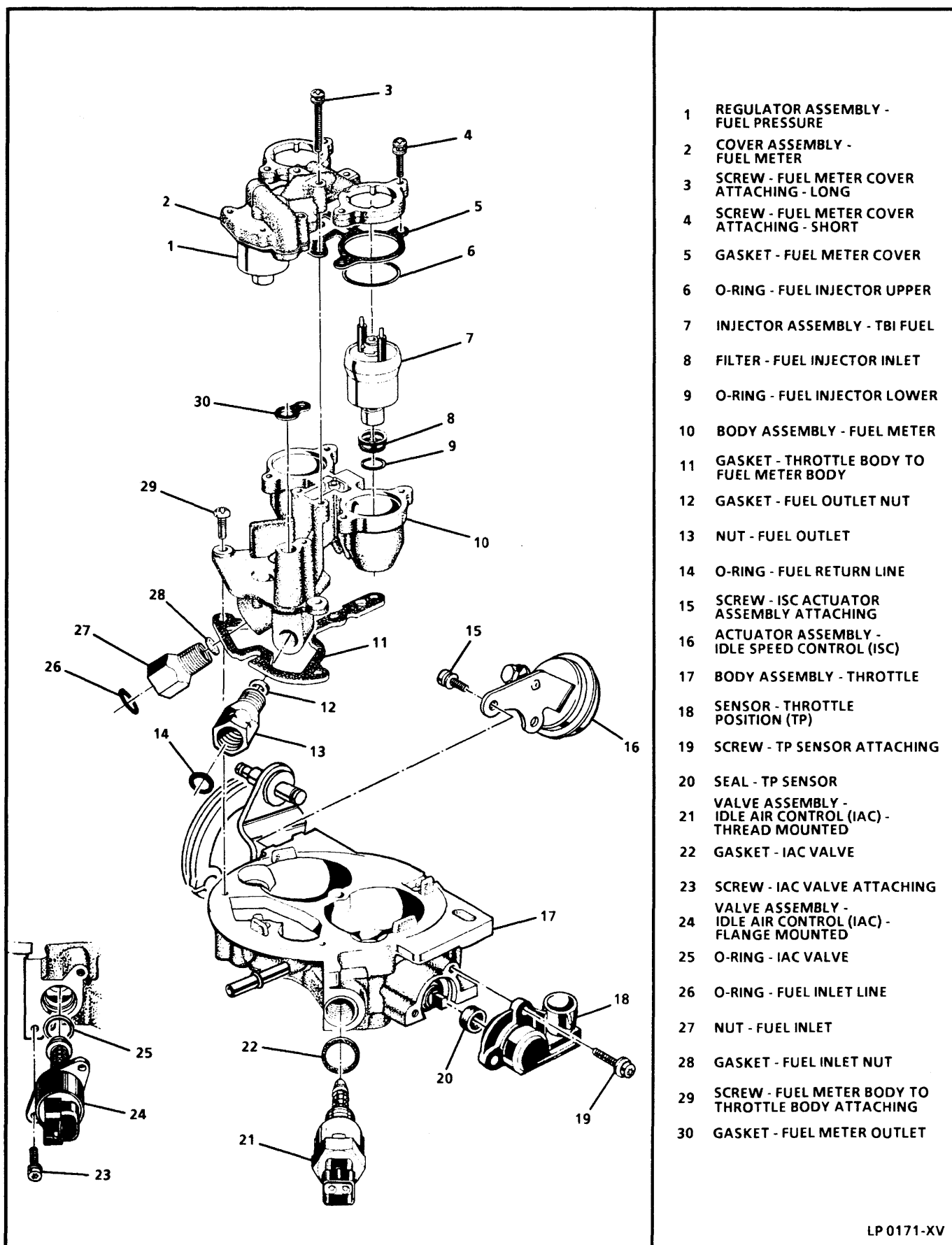
A constant bleed feature in the pressure regulator relieves pressure when engine is turned "OFF."

1. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. The internal constant bleed feature of TBI relieves fuel pump system pressure when the engine is turned "OFF." Therefore, no further pressure relief procedure is required.

#### Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, follow this procedure:

1. Turn engine "OFF" and relieve fuel pressure following above procedure.
2. Disconnect negative battery cable.
3. Install fuel pressure gage (J 29658) on outlet side of fuel filter.
4. Tighten gage in line to ensure no leaks occur during testing.
5. Connect negative battery terminal.
6. Start engine and observe fuel pressure reading. It should be 62-90 kPa (9-13 psi) on 4.3L, 5.0L and 5.7L engines. On 7.4L engines the fuel pressure should be 179 to 220 kPa (26 to 32 psi). If not, refer to CHART A-6, SECTION 3A or 3B.
7. Disconnect negative battery cable.
8. Remove fuel pressure gage.
9. Install new O-ring on fuel feed line.
10. Reinstall fuel line.
11. Reconnect negative battery terminal.
12. Start engine and check for fuel leaks.



LP 0171-XV

Figure 4A-6 - Parts Identification

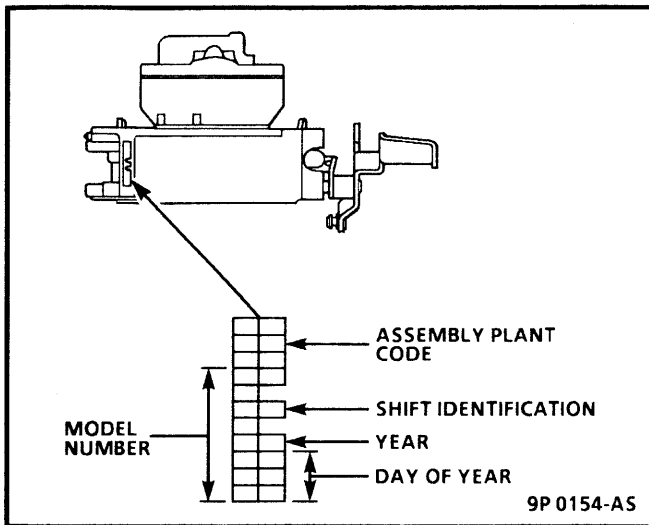


Figure 4A-7 - TBI Identification



## Clean and Inspect

- All TBI component parts, with the exception of those noted below, should be cleaned in a cold immersion cleaner such as GMX-55 or equivalent.

**NOTICE:** The Throttle Position (TP) sensor, Idle Air Control (IAC) valve, pressure regulator diaphragm assembly, fuel injectors or other components containing rubber, should NOT be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or distort. Do Not soak the throttle body with the above parts attached. If the throttle body assembly requires cleaning, soak time in the cleaner should be kept to a minimum. Some models have hidden throttle shaft dust seals that could lose their effectiveness by extended soaking.

1. Clean all metal parts thoroughly and blow dry with shop air. Be sure that all fuel and air passages are free of dirt or burrs.
2. Inspect mating casting surfaces for damage that could affect gasket sealing.

## Thread-Locking Compound

Service repair kits are supplied with a small vial of thread-locking compound with directions for use. If material is not available, use Loctite 262 or equivalent.

**NOTICE:** In precoating screws, do not use a higher strength locking compound than recommended, since to do so could make removing the screw extremely difficult, or result in damaging the screw head.

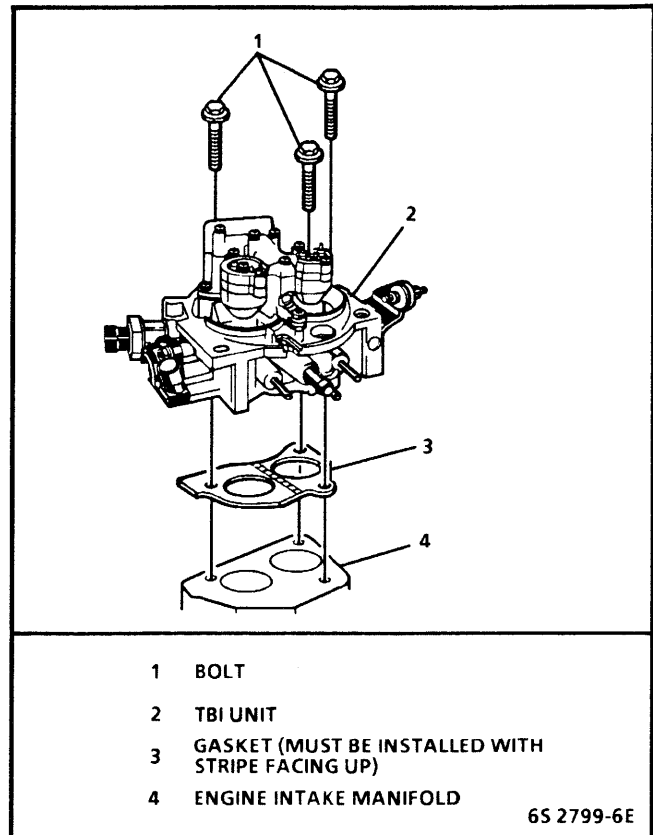


Figure 4A-8 - Replacing TBI Unit - Typical

## TBI Unit Replacement Figure 4A-8



## Remove or Disconnect

1. Air cleaner and adapter.
2. Electrical connectors for idle air control valve, throttle position sensor, and fuel injectors. (Squeeze plastic tabs on injectors and pull straight up.)
3. Grommet with wires from throttle body.
4. Throttle linkage, return spring(s), and cruise control (wherever applicable).
5. Vacuum hoses, noting positions of hoses.
6. Inlet and outlet fuel line nuts, using back-up wrench J 29698-B or BT-8251-A.

**CAUTION:** Refer to "Fuel Pressure Relief Procedure" (above), before disconnecting fuel lines.

7. Fuel line O-rings from nuts and discard.
8. TBI mounting hardware.
9. TBI unit from intake manifold.

**NOTICE:** To prevent damage to the throttle valve, it is essential that the unit be placed on a holding fixture, before performing service.

10. TBI flange (manifold mounting) gasket.

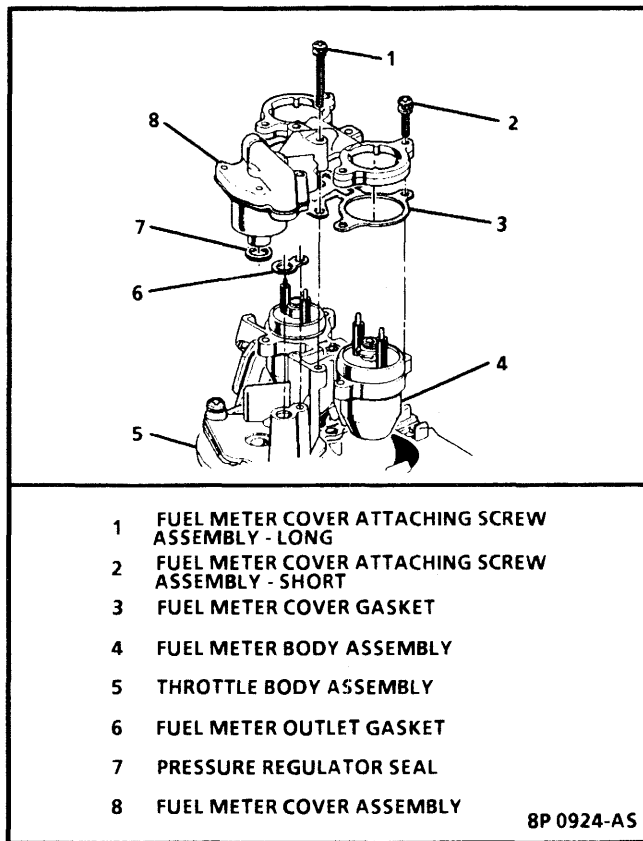


Figure 4A-9 - Replacing Fuel Meter Cover

**NOTICE:** Stuff the manifold opening with a rag, to prevent material from entering the engine, and remove the old gasket material from surface of intake manifold.

### Inspect

- Manifold bore for loose parts and foreign material.
- Intake manifold sealing surface for cleanliness.

### Install or Connect

1. New TBI flange (manifold mounting) gasket.
2. TBI with mounting hardware.

### Tighten

- Hardware on TBI engines, 16.0 N·m (12.0 lb. ft.).
3. New O-rings on fuel line nuts.
  4. Fuel line inlet and outlet nuts by hand.

### Tighten

- Fuel line nut to 26.0 N·m (20.0 lb. ft.). (Use back-up wrench J 29698-B or BT-8251-A to prevent TBI nuts from turning.)
5. Vacuum hoses and bracket.
  6. Throttle linkage, return spring(s), and cruise control (wherever applicable).
  7. Grommet, with wire harness, to throttle body.
  8. Electrical connectors, making sure connectors are fully seated and latched.

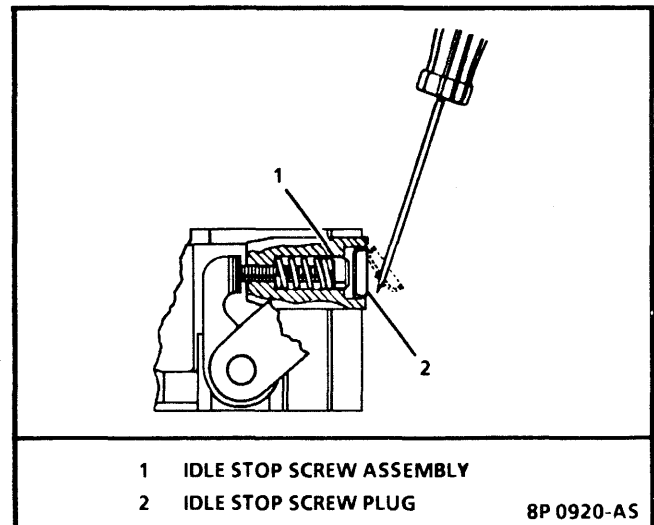


Figure 4A-10 - Removing Stop Screw Plug (7.4L)

9. Check to see if accelerator pedal is free, by depressing pedal to the floor and releasing, while engine is "OFF."
10. With engine "OFF," and ignition "ON," check for leaks around fuel line nuts.
11. Air cleaner and adapter.
12. Start engine and check again for fuel leaks.

## Controlled Idle Speed Check

Before performing this check, there should be no DTC(s) displayed, idle air control system has been checked and ignition timing correct.

1. Set parking brake and block drive wheels.
2. Connect a Tech 1 scan tool to the DLC connector with tool in open mode.
3. Start engine and bring it to normal operating temperature.
4. Check for correct state of PRNDL position (R-D-L) switch on Tech 1 scan tool.
5. Check specifications chart at the end of SECTION 4 for controlled idle speed and IAC valve pintle position (counts).
6. If within specifications, the idle speed is being correctly controlled by the control module.
7. If not within specifications, refer to "Rough, Unstable or Incorrect Idle, Stalling" in SECTION 2.

## Minimum Idle Speed Check (7.4L Only)

1. Check controlled idle speed and perform idle speed control system check first.
2. Set parking brake and block drive wheels.
3. Start engine and bring it to normal operating temperature (85°C-100°C). Turn engine "OFF."
4. Remove air cleaner, adapter and gaskets. Check that the throttle lever is not being bound by the throttle or cruise control cables.

## 4A-18 DRIVEABILITY AND EMISSIONS (GASOLINE)

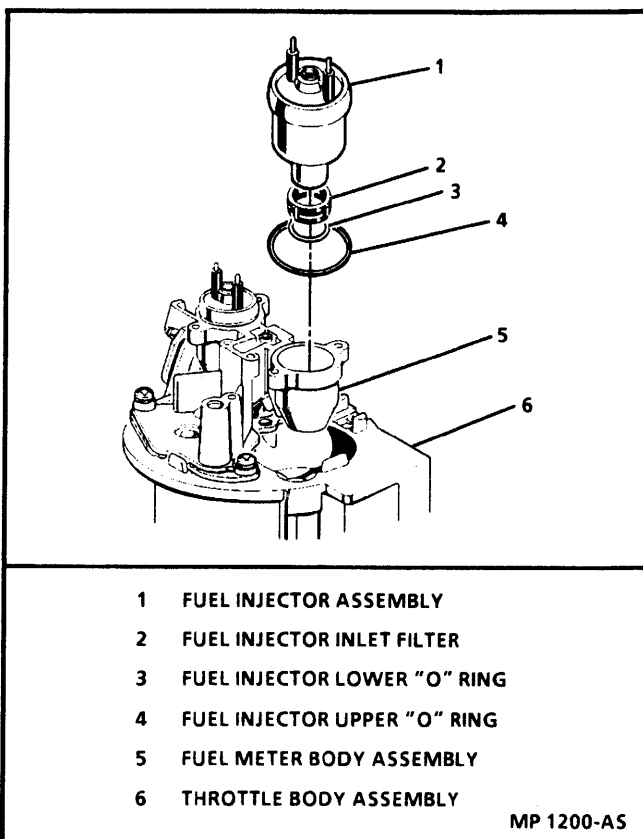
5. With IAC valve connected, Connect Tech 1 and command IAC counts to 0.
6. With ignition "ON," engine stopped, disconnect IAC valve electrical connector. (This disables IAC valve in seated position.) Care should be taken to pull the connector straight out so that the moment of electrical disconnect is the same for all the pins. Otherwise the pintle may move as the connector is removed.
7. Start engine. With transmission in neutral, allow engine RPM to stabilize. Make sure that the ISC actuator is not contacting the throttle lever. If so refer to "IAC Actuator System Check."
8. Check RPM against specifications at the end of SECTION 4. Disregard IAC counts on Tech 1 scan tool with the IAC disconnected. If the engine has less than 500 miles or is checked at altitudes above 1500 feet, the idle RPM with a seated IAC valve should be lower than values above.
9. If the minimum idle speed is within specifications, no further check is required.
10. If the minimum idle speed is not within specifications, perform the following procedures:
11. If present, remove stop screw plug by piercing it with an awl, then applying leverage (see Figure 4A-10). The screw is covered to discourage unauthorized adjustments.
12. With engine at normal operating temperature (85°-100°C), adjust stop screw to obtain nominal RPM per specifications with seated IAC valve.
13. Turn ignition "OFF" and reconnect IAC valve electrical connector.
14. Disconnect Tech 1 scan tool or tachometer.
15. Use silicon sealant or equivalent to cover stop screw hole.
16. Install air cleaner and adapter.
17. Reset IAC valve. Refer to "Idle Air Control (IAC) System Check."

### TBI COMPONENT SERVICE FUEL METER COVER ASSEMBLY

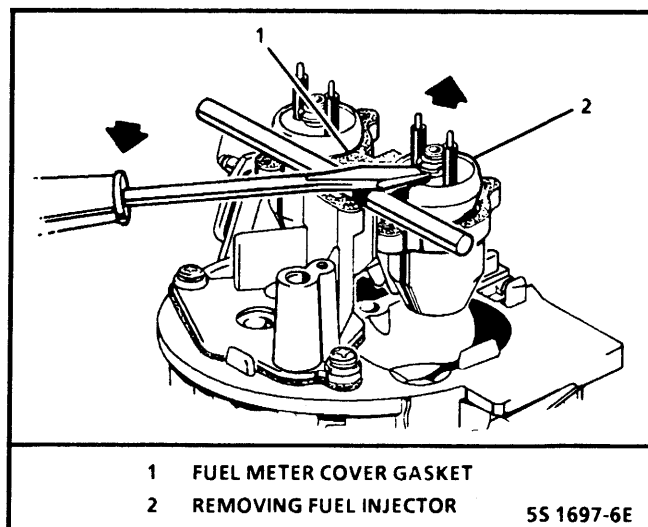
**Figure 4A-9**

The fuel meter cover assembly contains the fuel pressure regulator assembly. The regulator has been adjusted at the factory and should only be serviced as a complete preset assembly.

**CAUTION: DO NOT** remove the four screws securing the pressure regulator to the fuel meter cover. The fuel pressure regulator includes a large spring under heavy compression which, if accidentally released, could cause personal injury. Disassembly might also result in a fuel leak between the diaphragm and the regulator container.



**Figure 4A-11 - Fuel Injector Parts**



**Figure 4A-12 - Removing Fuel Injector**



### Remove or Disconnect

1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Long and short fuel meter cover screw assemblies.

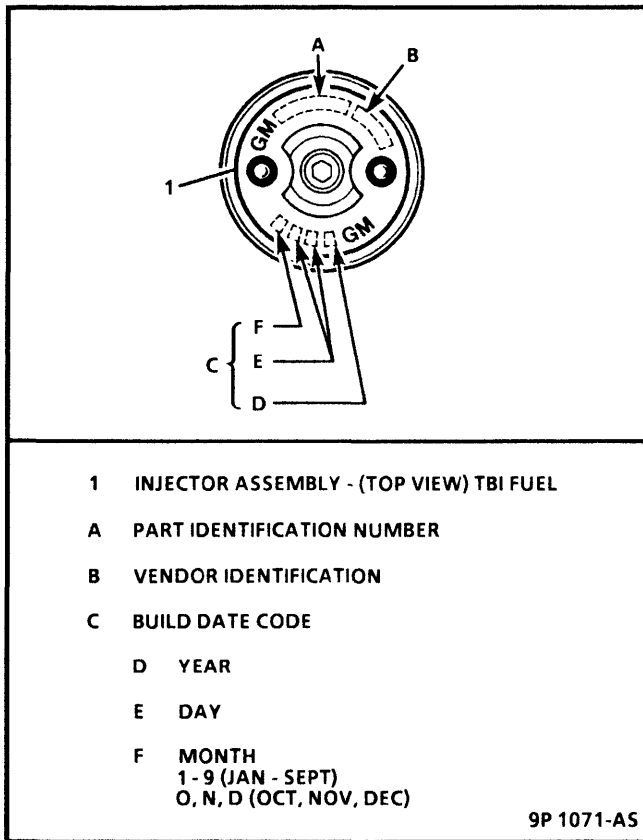


Figure 4A-13 - Fuel Injector Part Number Location

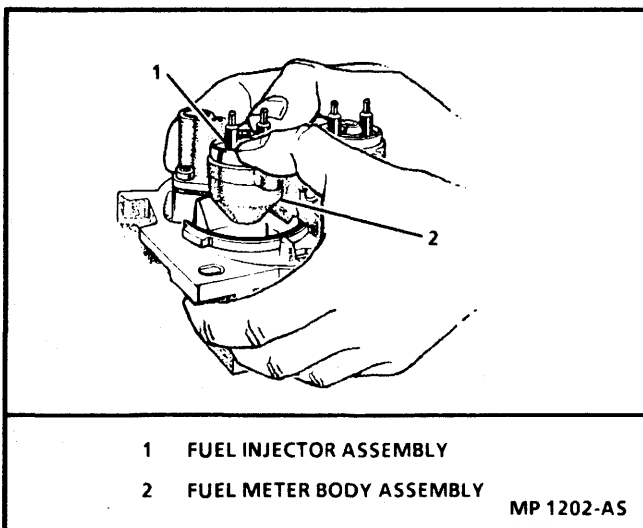


Figure 4A-14 - Installing Fuel Injector

3. Fuel meter cover assembly.

**NOTICE:** DO NOT immerse the fuel meter cover (with pressure regulator) in cleaner, as damage to the regulator diaphragm and gasket could occur.

4. Fuel meter outlet gasket and pressure regulator seal. Discard gaskets and seal.

### Inspect

- For dirt, foreign material and casting warpage.

### Install or Connect

1. New pressure regulator seal, fuel meter outlet passage gasket, and cover gasket.
2. Fuel meter cover assembly.
3. Attaching screw assemblies, precoated with appropriate locking compound to threads. (Short screws are next to injectors.)

### Tighten

- Screw assemblies to 3.0 N·m (28.0 lb. in.).
4. Electrical connectors to fuel injectors.
  5. With engine "OFF," and ignition "ON," check for leaks around gasket and fuel line couplings.

## FUEL INJECTOR ASSEMBLY Figures 4A-11 through 4A-14

**NOTICE:** Use care in removing the fuel injectors to prevent damage to the electrical connector terminals, the injector filter, and the fuel nozzle. The fuel injector (Figure 4A-11) is serviced as a complete assembly only. Also, since the injectors are electrical components, they should not be immersed in any type of liquid solvent or cleaner as damage may occur.

### Remove or Disconnect

1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Fuel meter cover assembly, following above procedure.
3. With fuel meter cover gasket in place to prevent damage to casting, use a screwdriver and fulcrum to carefully lift out each injector (Figure 4A-11).
4. Lower (small) O-rings from nozzle of injectors and discard.
5. Fuel meter cover gasket and discard.
6. Upper (large) O-rings and steel backup washers from top of fuel injector cavity and discard.

### Inspect

- Fuel injector filter for evidence of dirt and contamination. If present, check for presence of dirt in fuel lines and fuel tank.

### Important

- Be sure to replace the injector with one having an identical part number. Injectors from other models can also fit in TBI model 220, but are calibrated for different flow rates. (Refer to Figure 4A-13 for part number location.)



## Install or Connect

1. Lubricate new lower (small) O-rings with automatic transmission fluid and push on nozzle end of injector until it presses against injector fuel filter.
2. Steel injector backup washer in counterbore of fuel meter body.
3. Lubricate new upper (large) O-ring with automatic transmission fluid and install directly over the backup washer. Be sure O-ring is seated properly and is flush with top of fuel meter body surface.

**NOTICE:** Backup washers and O-rings must be installed before injectors, or improper seating of large O-ring could cause fuel to leak.

4. Injector, aligning raised lug on each injector base with notch in fuel meter body cavity. Push down on injector until it is fully seated in fuel meter body (Figure 4A-14). (Electrical terminals of injector should be parallel with throttle shaft.)

## Important

- Be sure to install the injectors in their proper location.
5. Fuel meter cover gasket.
  6. Fuel meter cover, following above procedure.
  7. Electrical connectors to fuel injectors.
  8. With engine "OFF" and ignition "ON," check for fuel leaks.

## FUEL METER BODY ASSEMBLY

Figure 4A-15

## Remove or Disconnect

1. Electrical connections to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Fuel meter cover assembly (following above procedure).
3. Fuel injectors, following above procedure.
4. Fuel inlet and return lines. Discard O-rings.
5. Fuel inlet and outlet nuts and gaskets from the fuel meter body assembly. Discard gaskets.

## Important

- Note locations of nuts, for proper reassembly later. Inlet nut has a larger passage than outlet nut.
6. Fuel meter body to throttle body attaching screw assemblies.
  7. Fuel meter body assembly from throttle body assembly.
  8. Throttle body to fuel meter body gasket and discard.

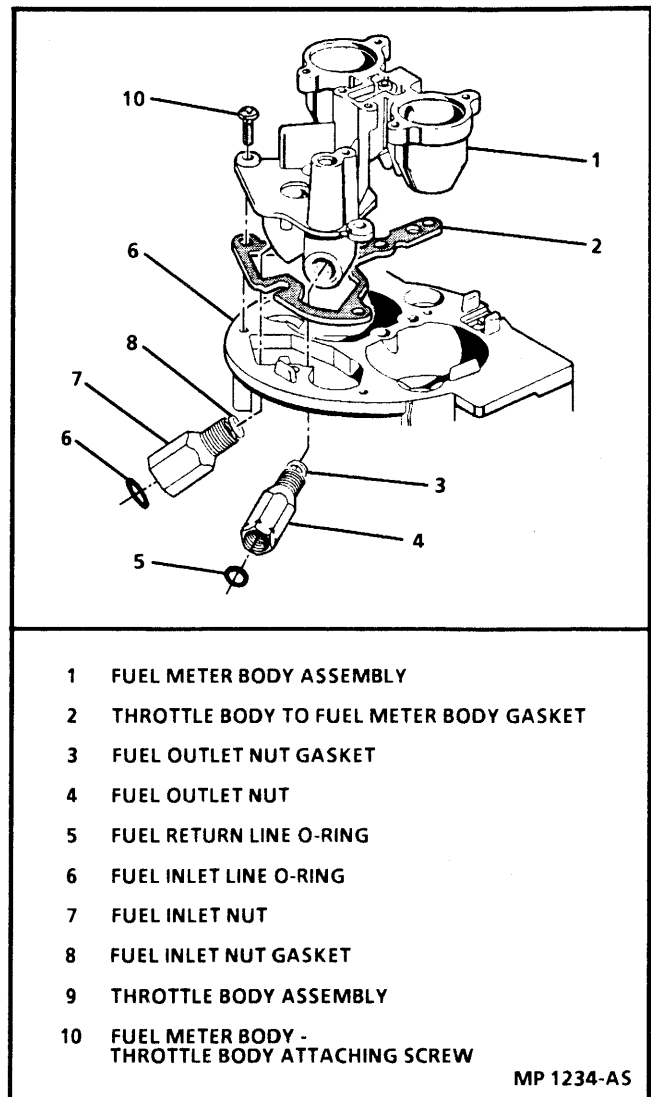


Figure 4A-15 - Fuel Meter Body Assembly

## Install or Connect

1. New throttle body to fuel meter body gasket. Match cut-out portions in gasket with openings in throttle body.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-to-throttle body attaching screw assemblies, precoated with appropriate locking compound.

## Tighten

- Screw assemblies to 4.0 N·m (30.0 lb. in.).
4. Fuel inlet and outlet nuts with new gaskets to fuel meter body assembly.

## Tighten

- Inlet nut to 40.0 N·m (30.0 lb. ft.).
- Outlet nut to 29.0 N·m (21.0 lb. ft.).

- Fuel inlet and return lines and new O-rings. (Use back-up wrench J 29698-B or BT-8251-A to keep TBI nuts from turning.)

### Tighten

- Fuel lines to 23 N·m (17 lb. ft.).
- Injectors, with new upper and lower O-rings in fuel meter body assembly, coated with transmission fluid.
  - Fuel meter cover gasket, fuel meter outlet gasket, and pressure regulator seal.
  - Fuel meter cover assembly.
  - Long and short fuel meter cover attaching screw assemblies, coated with appropriate thread-locking compound.

### Tighten

- Screw assemblies to 3.0 N·m (27.0 lb. in.).
- Electrical connectors to fuel injectors.
  - With engine "OFF," and ignition "ON," check for leaks around fuel meter body, gasket and around fuel line nuts.

## THROTTLE POSITION (TP) SENSOR

Figure 4A-16

### Important

- Since TP configurations can be mounted interchangeably, be sure to order the correct one for your engine with the identical part number of the one being replaced.

### Remove or Disconnect

- Electrical connector.
- Two TP sensor attaching screw assemblies.
- TP sensor from throttle body assembly.

**NOTICE:** The TP sensor is an electrical component and must not be soaked in any liquid cleaner or solvent, as damage may result.

### Install or Connect

- With throttle valve in normally closed position, install TP sensor on throttle shaft and rotate counter clockwise to align mounting hole.
- TP sensor attaching screw assemblies, precoated with appropriate thread-locking compound.

### Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in.).
- Electrical connector.
  - Check for TP sensor output as follows:
    - Connect scan tool scanner to read TP sensor output voltage.

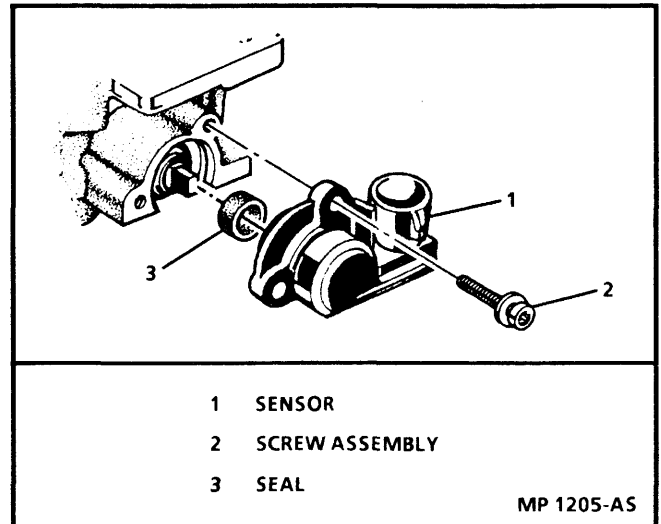


Figure 4A-16 - TP Configuration

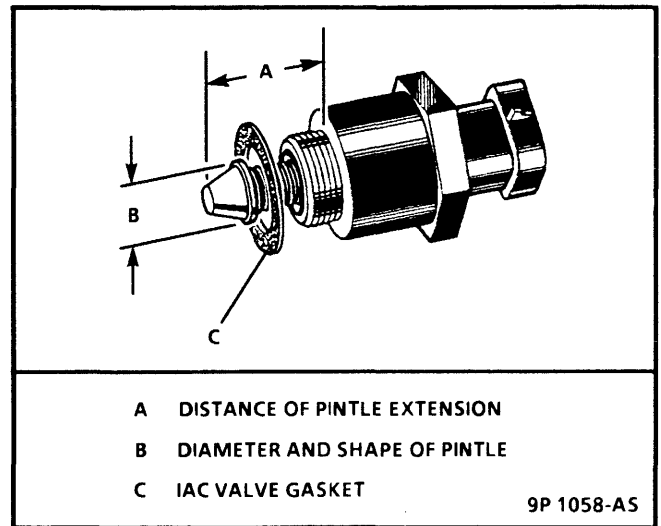


Figure 4A-17 - Thread-Mounted Type IAC Valve

- With ignition "ON" and engine stopped, TP sensor voltage should be less than .85 volt. If more than .85 volt, replace TP sensor.

## IDLE AIR CONTROL (IAC) VALVE

Figures 4A-17 and 4A-18

**NOTICE:** The IAC valve is an electrical component and must not be soaked in any liquid cleaner or solvent. Otherwise damage could result.

### Important

- All IAC valves (except those on the 7.4L engine) are thread-mounted and have a dual taper, 10 mm diameter, pintle. On the 7.4L engine, the IAC valve is flange-mounted and has a 12 mm diameter, dual taper pintle.

## 4A-22 DRIVEABILITY AND EMISSIONS (GASOLINE)

Any replacement of an IAC valve must have the correct part number, with the appropriate pintle taper and diameter for proper seating of the valve in the throttle body.

### Remove or Disconnect

1. Electrical connector.
2. IAC valve.
  - On thread-mounted units, use a 32 mm (1-1/4") wrench (Figure 4A-17).
  - On flange-mounted units, remove screw assemblies (Figure 4A-18).
3. IAC valve gasket or O-ring and discard.

### Clean

- Thread-mounted valve - Old gasket material from surface of throttle body assembly to insure proper seal of new gasket.
- Flange-mounted valve - IAC valve surface on throttle body to assure proper seal of new O-ring and contact of IAC valve flange.

**NOTICE:** If the IAC valve was removed during service, its operation may be tested electrically with the IAC system analyzer (J 37027 or BT-8256K). However, if the valve pintle is extended electrically, it must also be retracted electrically. Before installing an IAC valve, measure the distance between the tip of the valve pintle and the mounting surface. If the dimension is greater than 28 mm (1.10"), it must be reduced to prevent damage to the valve. This may be done electrically using on IAC system analyzer motor tester (J 37027 or BT-8256K).

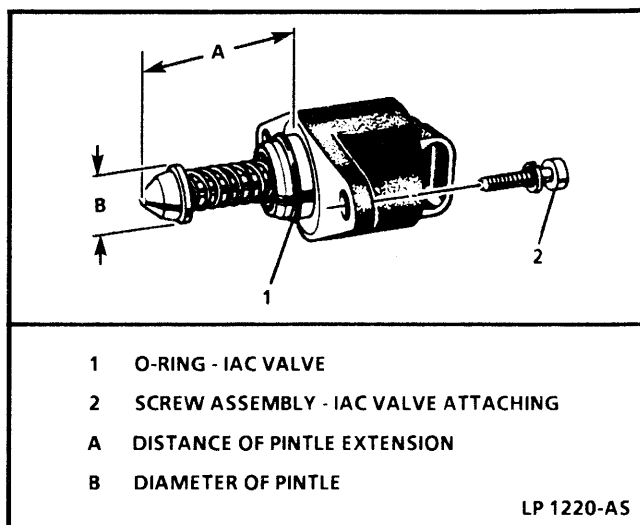
### Measure

#### **Figures 4A-17 and 4A-18**

- Distance between tip of IAC valve pintle and mounting flange.
  - If greater than 28 mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve.

### Important

- No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by the control module system which causes the valve pintle to seat in the throttle body.



**Figure 4A-18 - Flange-Mounted Type IAC Valve**

The control module then has a reset procedure to set the correct pintle position. Proper idle regulation should result.

### Install or Connect

1. IAC valve into throttle body as follows:
  - Thread-mounted valve - Install with new gasket.
  - Flange-mounted valve - Install with new lubricated O-ring, using attaching screw assemblies.

### Tighten

- Thread-mounted IAC valve assembly to 18.0 N·m (13.0 lb. ft.) with 32 mm (1-1/4") wrench.
  - Flange-mounted attaching screw assemblies to 3.2 N·m (28.0 lb. in.).
2. Electrical connector to IAC valve.
  3. Reset IAC valve pintle position:
    - Remove battery cable for 10 seconds.
    - Ignition "ON," engine "OFF" for 5 seconds.
    - Ignition "OFF" for 10 seconds.

## IDLE SPEED CONTROL ACTUATOR

### Remove or Disconnect

1. ISC actuator screws and vacuum hose.
2. ISC actuator.

### Install or Connect

1. ISC actuator and screws.
2. Vacuum hose.
3. Set activated idle speed. (Refer to procedure below.)

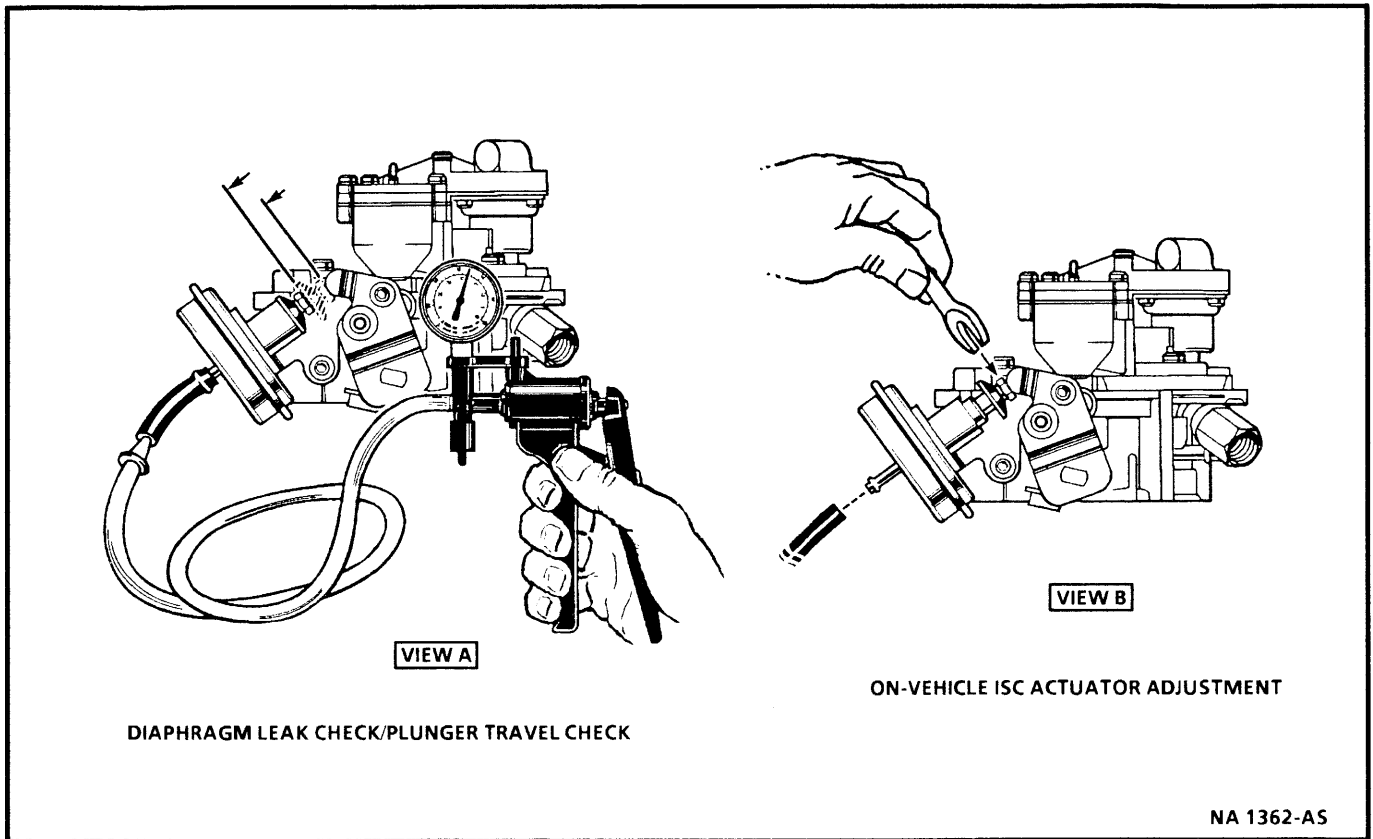


Figure 4A-19 - ISC Actuator Adjustment (7.4L Only)

## IDLE SPEED CONTROL ACTUATOR ADJUSTMENT PROCEDURE

### ⚠ Important

- Before adjusting ISC actuator you must first check minimum idle speed to be within specifications in SECTION 4. (ISC actuator must have vacuum applied so that it is not contacting throttle lever.) See Figure 4A-19 view "A".
- Remove vacuum hose on ISC actuator on warm engine.
- Adjust ISC actuated idle speed to  $1300 \pm 50$ . (Refer to Figure 4A-19 view "B".)
- Install vacuum hose.

## THROTTLE BODY ASSEMBLY

### ↔ Remove or Disconnect

1. TBI unit, as described previously.
2. Fuel meter body-to-throttle body attaching screw assemblies.
3. Fuel meter body assembly.
4. Throttle body-to-fuel meter body gasket and discard.

### ⚡ Disassemble

- TP sensor and IAC valve from old throttle body, according to previous instructions for reuse on new throttle body.

### ⚙ Assemble

- TP sensor and IAC valve onto replacement throttle body assembly, according to previous instructions.

### ↔ Install or Connect

1. New throttle body-to-fuel meter body gasket.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-throttle attaching screw assemblies that have been coated with locking compound.

### ⚙ Tighten

- Attaching screw assemblies to 4.0 N·m (3.50 lb. in.).
4. TBI unit onto intake manifold, as previously described.

## FUEL PUMP RELAY Figure 4A-20

### ↔ Remove or Disconnect

1. Protective cover.
2. Retainer, if installed.
3. Electrical connector.

## 4A-24 DRIVEABILITY AND EMISSIONS (GASOLINE)

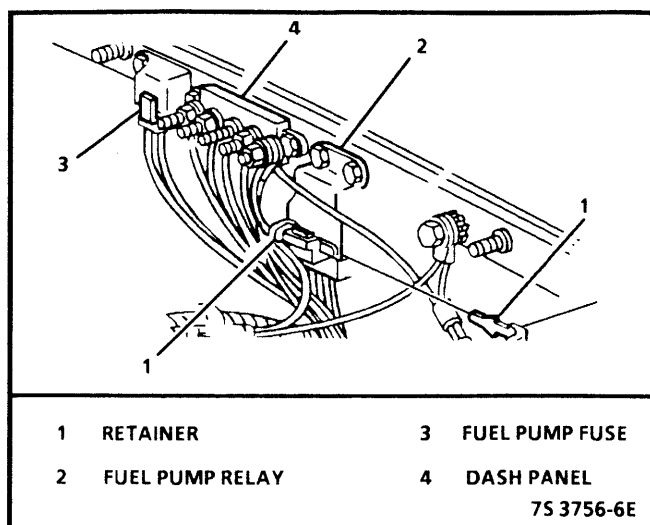


Figure 4A-20 - Fuel Pump Relay

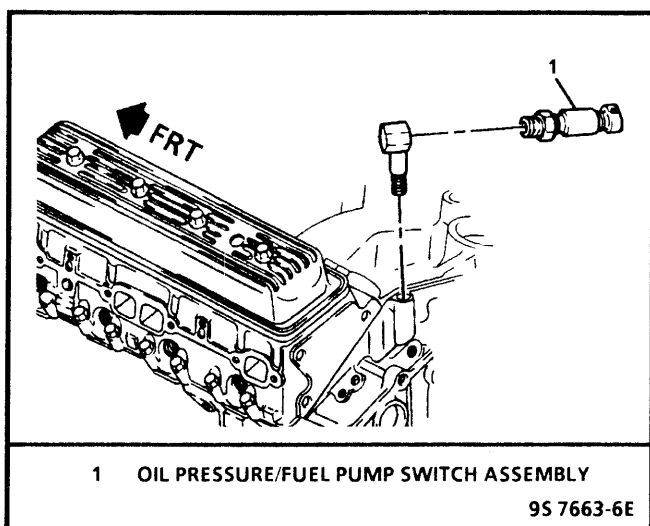


Figure 4A-21 - Oil Pressure Switch (4.3L, 5.0L & 5.7L)

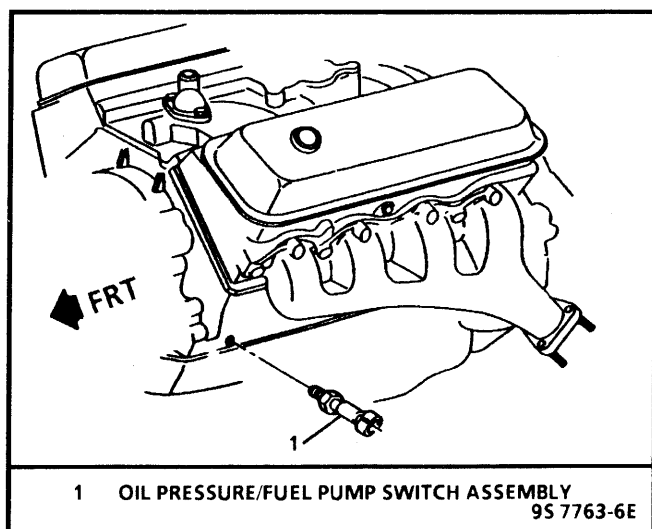


Figure 4A-22 - Oil Pressure Switch (7.4L)

4. Relay by depressing bracket clip at rear of relay, or removing bolts from retaining bracket.

### ↔ Install or Connect

1. Relay.
2. Electrical connector.
3. Retainer.
4. Protective cover.

### OIL PRESSURE SWITCH Figures 4A-21 and 4A-22

### ↔ Remove or Disconnect

1. Electrical connector.
2. Oil pressure switch using wrench J 35748.

### ↔ Install or Connect

1. Oil pressure switch.
2. Electrical connector.

## PARTS INFORMATION

| PART NAME                            | GROUP |
|--------------------------------------|-------|
| Cover, w/Regulator, Fuel Meter:      |       |
| Part of Meter Kit, Fuel .....        | 3.734 |
| Injector, Fuel: Part of Pump,        |       |
| Fuel (In-Tank) .....                 | 3.774 |
| Relay, Fuel Pump .....               | 3.990 |
| Switch, Oil Press. ....              | 1.800 |
| Throttle Body Injection Unit .....   | 3.725 |
| Valve Asm, Idle Air Control: Part of |       |
| Control Kit, Idle Air Valve .....    | 3.820 |
| Idle Speed Control Actuator .....    | 3.440 |
| Idle Speed Control Actuator          |       |
| Solenoid .....                       | 3.440 |

## SECTION 4E

# FUEL SUPPLY SYSTEM

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| Fuel Supply System .....   | 4E-1 | Fuel Pump .....                         | 4E-4 |
| Fuel Pump Operation .....  | 4E-1 | Fuel Filter .....                       | 4E-4 |
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## GENERAL DESCRIPTION

### FUEL SUPPLY SYSTEM

**Figure 4E-1**

The fuel supply system consists of the following components:

- Fuel pump.
- Fuel tank.
- Accelerator control components.
- Fuel lines.
- Fuel filter.

#### Fuel Pump Operation

The fuel supply system has an electric fuel pump, located in the fuel tank on the gage sending unit. It pumps fuel to the fuel injection unit through an in-line fuel filter and fuel supply line. The pump provides fuel at a pressure above the regulated pressure needed by the fuel injector(s).

A pressure regulator in the fuel injector unit keeps fuel available to the injector at a constant pressure. Fuel in excess of injector needs is returned to the fuel tank by a separate line.

Fuel pressure for a TBI 4.3L, 5.0L, 5.7L system is 62-90 kPa (9-13 psi). Fuel pressure for a 7.4L TBI system is 179-220 kPa (26-32 psi).

In order to properly control the fuel supply, the fuel pump is operated by the control module through the fuel pump relay and oil pressure switch (refer to CHART A-5, SECTION 3A or 3B).

#### FUEL FILTER

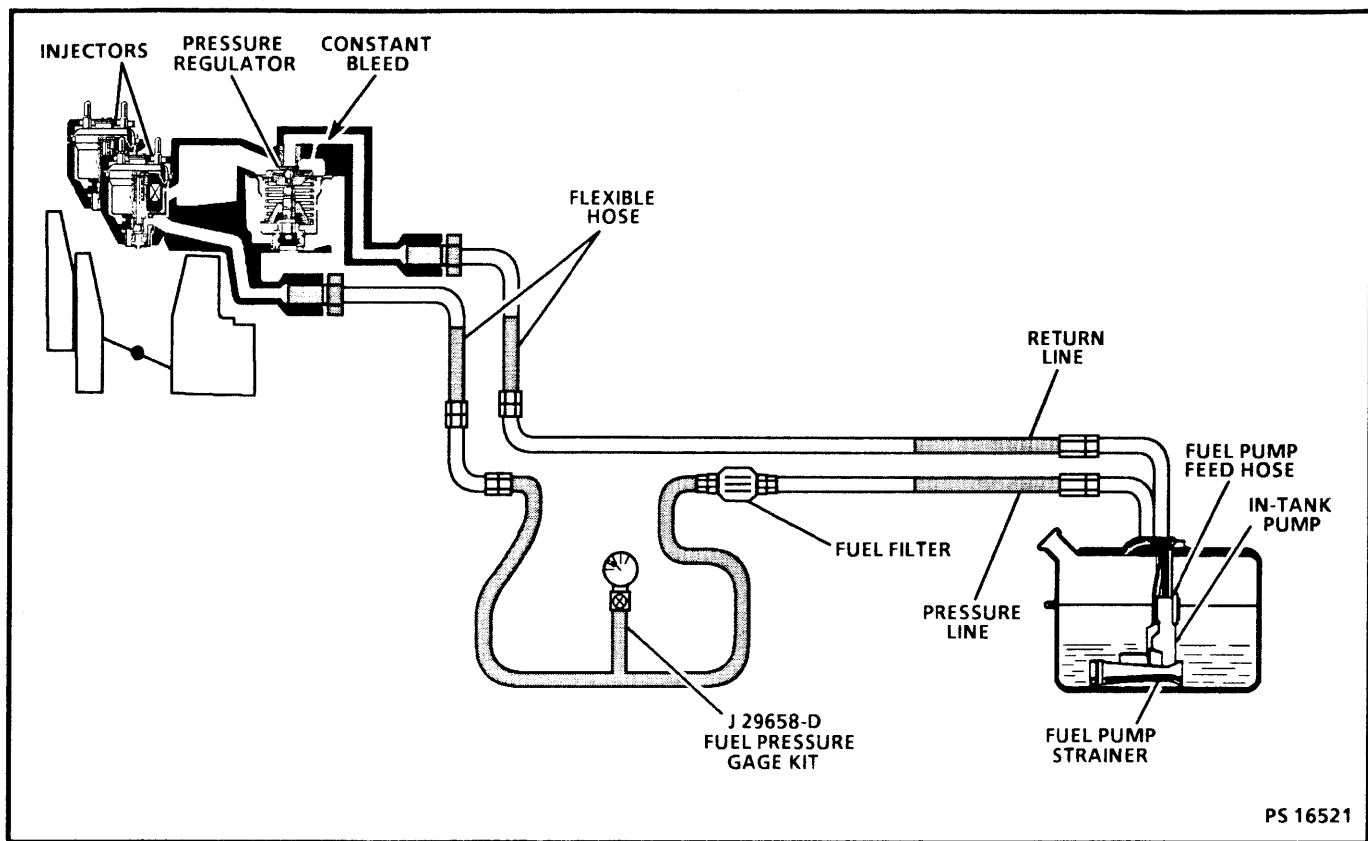
##### In-Line Filter

**CAUTION:** To reduce the risk of fire and personal injury, it is necessary to allow fuel pressure to bleed off before servicing fuel system components. (Refer to "Fuel System Pressure Relief Procedure" in the section that applies to the fuel system being serviced.)

The in-line filter is located in the fuel feed line. It prevents dirt from entering the injection unit.

##### In-Tank Filter

A woven plastic filter is located on the lower end of the fuel pickup tube in the fuel tank. The filter prevents dirt from entering the fuel line and, also, stops water, unless the filter becomes completely submerged in water.



4E-1 - Fuel Supply System - TBI

This filter is self-cleaning and normally requires no maintenance. Fuel stoppage, at this point, indicates that the fuel tank contains an abnormal amount of sediment or water; the tank should, therefore, be thoroughly cleaned.

### FUEL AND VAPOR PIPES

The fuel feed and return pipes and hoses extend from the fuel pump and sender to the CMFI unit and are routed along the frame side member.

The vapor pipe and hoses extend from fuel pump and sender unit to the Evaporative Emission (EVAP) control vapor canister.

### FUEL TANK

The fuel tank, at the rear of the underbody, is held in place by two metal straps. Anti-squeak pieces are used on top of the tank to reduce rattles.

#### Filler Neck

To help prevent refueling with leaded gasoline, the fuel filler neck on a gasoline engine vehicles has a built-in restrictor and deflector. The opening in the restrictor will only admit the smaller unleaded gas nozzle spout, which must be fully inserted to bypass the deflector.

Attempted refueling with a leaded gas nozzle, or failure to fully insert the unleaded gas nozzle, will result in gasoline splashing back out of the filler neck.

#### Fuel Filler Cap

The fuel tank filler neck is equipped with a screw-type cap. The threaded part of the cap requires several turns counterclockwise to remove. The long threaded area was designed to allow any remaining fuel tank pressure to escape, while the cap was being removed. A built-in torque-limiting device prevents overtightening. To install, turn the cap clockwise until a clicking noise is heard. This signals that the correct torque has been reached and the cap is fully seated.

### ACCELERATOR CONTROL

The accelerator control system is a control cable type, attached at one end to an accelerator pedal assembly. On the other end is the throttle blade.

## DIAGNOSIS

### ALCOHOL-IN-FUEL

Alcohol-in-fuel can be detrimental to fuel system components and may cause driveability problems such as hesitation, lack of power, stall no start, etc.

The problems may be due to fuel system corrosion and subsequent fuel filter plugging, deterioration of rubber components and/or air fuel mixture leaning.

Various types and concentrations of alcohol are used in commercial fuel. Some alcohol is more detrimental to fuel system components than others. If an excessive amount of alcohol in the fuel is suspected as the cause of a driveability condition, the following procedure may be used to detect the presence of alcohol in the fuel. In this procedure, water is used to extract the alcohol from the fuel.

#### Testing Procedure

The fuel sample should be drawn from the bottom of the tank so that any water present in the tank will be detected. The sample should be bright and clear. If the sample appears cloudy, or contaminated with water (as indicated by a water layer at the bottom of the sample), this procedure should not be used and the fuel system should be cleaned (refer to "Fuel System Cleaning").

1. Using a 100 ml cylinder with 1 ml graduation marks, fill with fuel to the 90 ml mark.
2. Add 10 ml of water to bring the total fluid volume to 100 ml and install a stopper.
3. Shake vigorously for 10 to 15 seconds.
4. Carefully loosen the stopper to release pressure.
5. Close the stopper and shake vigorously again for 10 to 15 seconds.
6. Put the graduated cylinder on a level surface for approximately 5 minutes to allow adequate liquid separation.

If alcohol is present in the fuel, the volume of the lower layer (which would now contain both alcohol and water) will be greater than 10 ml.

For example, if the volume of the lower layer is increased to 15 ml, it will indicate at least 5 percent alcohol in fuel. The actual amount of alcohol may be somewhat greater because this procedure does not extract all of the alcohol from the fuel.

### FUEL PUMP

Refer to "Fuel System Diagnosis" in SECTION 3A or 3B.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance. (Refer to CHART A-6, SECTION 3A or 3B for procedures.)

#### Fuel Filter

The diagnosis of the fuel filter is covered in CHART A-6, SECTION 3A or 3B.

A plugged fuel filter may cause a restricted fuel delivery, or a no start condition.

#### Fuel Pipes and Hoses

The diagnosis of gasoline odor may be a condition of a leaking fuel feed, or return pipe or hose. Fuel pipes that are pinched, plugged, or mis-routed may cause restricted fuel delivery.

#### Fuel Tank

The diagnosis of gasoline odor may be a condition of leaking fuel tank, filler neck, or filler cap.

A defective filler cap, a plugged or pinched vapor pipe can cause a collapsed fuel tank.

Loose mounting straps, or foreign material in tank, may be the cause of a rattle at the fuel tank.

### ACCELERATOR CONTROL

Check for correct cable routing, or binding, and correct as necessary.



## ON-VEHICLE SERVICE

### TBI FUEL PRESSURE RELIEF PROCEDURE

**Figure 4E-1**

A constant bleed feature in the pressure regulator relieves pressure when engine is turned "OFF."

1. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. The internal constant bleed feature of TBI relieves fuel pump system pressure when the engine is turned "OFF." Therefore, no further pressure relief procedure is required.

### FUEL PUMP

**Figure 4E-2**

#### ↔ Remove or Disconnect

1. Relieve fuel system pressure. Refer to "Fuel System Pressure Relief Procedure" in this section.
2. Negative battery cable.
3. Raise the vehicle on a hoist.
4. Fuel tank.
5. Sender unit and pump by turning the cam lock counterclockwise using tool J 36608 or J 24187.
6. Fuel pump from the sending unit.
  - Pull the fuel pump up into the attaching hose while pulling outward from the bottom support.
  - Do not damage the rubber insulator or the strainer.

#### 🔍 Inspect

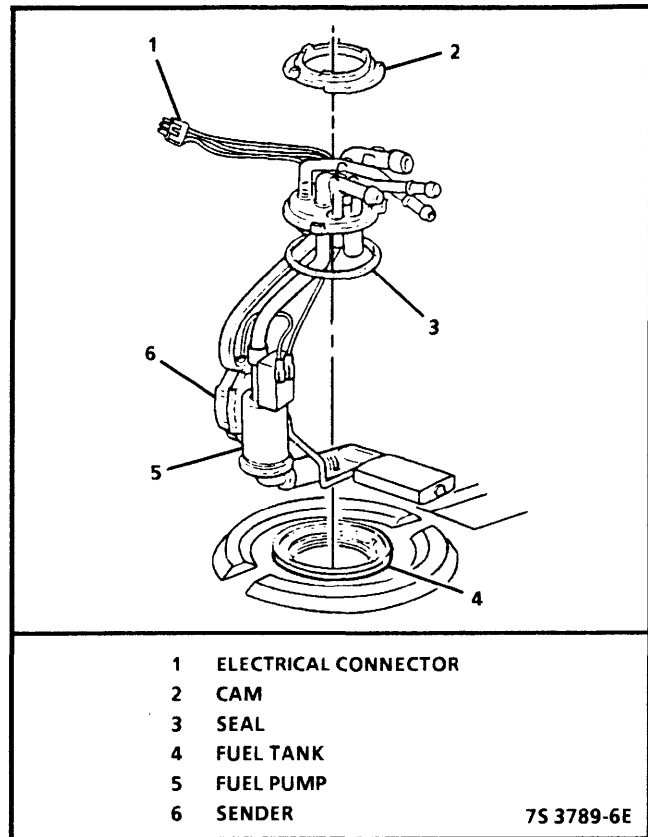
1. Fuel pump attaching hose for signs of deterioration.
2. Rubber sound insulation at the bottom of the pump.
3. Strainer.

#### ↔ Install or Connect

1. Fuel pump assembly into the attaching hose.

**NOTICE:** Care should be taken not to fold over or twist the strainer when installing the sending unit. This can restrict fuel flow.

2. Sending unit and fuel pump assembly into the fuel tank.
  - Insert new O-ring seal.



**Figure 4E-2 - Fuel Pump**

3. Cam lock assembly.
  - Turn the cam lock clockwise to lock it.
4. Fuel tank.
5. Negative battery cable.
6. Check system for leaks.

### FUEL FILTER

#### In-Line Filter Replacement

**Figure 4E-3**

#### ↔ Remove or Disconnect

1. Relieve fuel pressure according to procedure on this page.
2. Fuel filler cap.
3. Fuel feed nuts.
4. Clamp bolt.
5. Filter and clamp from fuel lines.
6. Clamp from filter.

#### ↔ Install or Connect

1. Clamp to filter.
2. Filter and clamp to fuel lines.
3. Clamp bolt.
4. Fuel feed nuts.

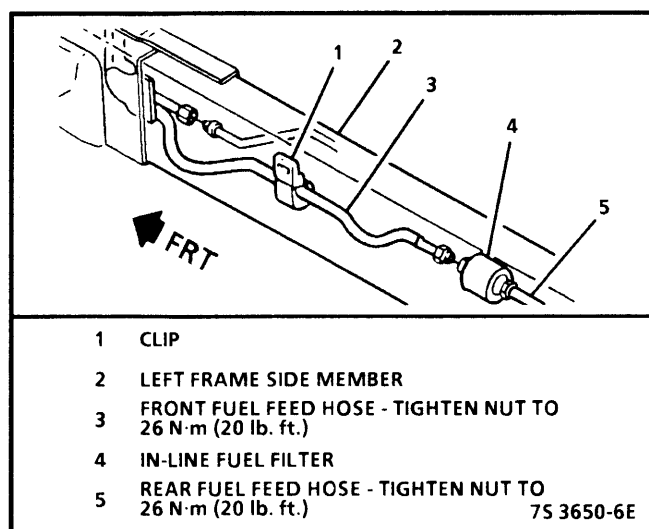


Figure 4E-3 - Fuel Filter

5. Fuel filler cap.
6. Check for leaks.

### In-Tank Filter Replacement

Refer to "Fuel Pump Replacement," if the in-tank filter required service.

### FUEL HOSE AND PIPE ASSEMBLIES

#### Materials

**Fuel Lines** - These are welded steel tubes, meeting GM Specifications 124-M, or its equivalent. The fuel feed line is 3/8" diameter and the fuel return line is 5/16" diameter. Do Not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibration.

**Coupled hose** - These are not to be repaired and are replaced only as an assembly.

**Uncoupled hose** - Use only reinforced furl resistant hose, made of "Fluoroelastomer" material. Do not use a hose within 4" (100 mm) of any part of the exhaust system, or within 10" (254 mm) of the catalytic converter. The hose's inside diameter must match the outside diameter of the steel tubing.

**Clamps** - These are stainless steel, screw bank-type clamps, #2494772, or equivalent.

#### Fuel Line Repair

1. Cut a piece of fuel hose 4" (100 mm) longer than the section of line to be removed. If more than 6" (152 mm) is to be removed, use a combination of steel pipe and hose. The hose length should not be more than 10" total.
2. Cut a section of the pipe to be replaced with a tube cutter. Use the first step of a double flaring tool to form a bead on the ends of the pipe and, also, on the new section of pipe, if used.

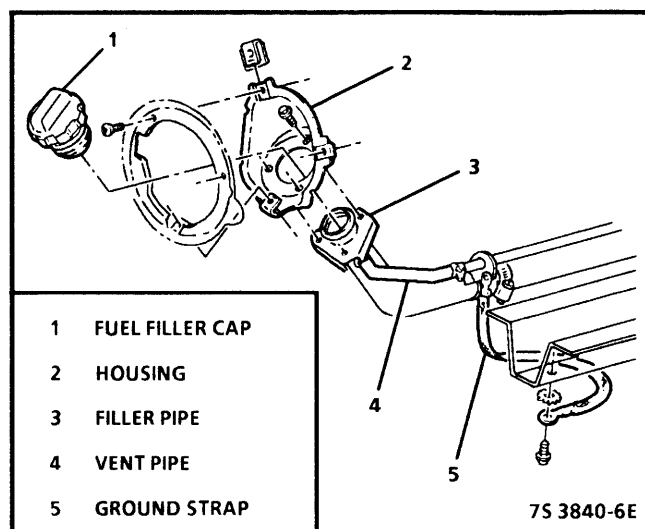


Figure 4E-4 - Filler Neck

3. Slide the hose clamps onto the pipe and push the hose 2" (51 mm) onto each portion of the fuel pipe. Tighten a clamp on each side of the repair.
4. Secure fuel line to the frame.
5. Check for leaks.

### FUEL TANK

#### Draining

**CAUTION:** Gasoline or gasoline vapors are highly flammable. If an ignition source is present, a fire can occur. Never drain or store gasoline in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

1. Disconnect the negative battery cable.
2. Use a hand operated pump device to remove fuel through the filler neck (make sure to hook up static ground wire to a metal part of gas tank before you begin if pump is equipped).

#### Replacement Figures 4E-5 through 4E-8

##### Remove or Disconnect

1. Drain fuel from tank.
2. Raise vehicle.
3. Fuel tank off-road shield if equipped.
4. Loosen the filler neck hose clamp at the fuel tank and disconnect the fuel tank filler neck from the fuel tank.
5. Support the fuel tank and remove the tank straps.
6. Lower the fuel tank and disconnect the fuel/vapor hoses and the electrical connections at the sender.
7. Fuel sender and seal ring, using tool J 36608. Discard the old seal ring. Purge tank, if being repaired.

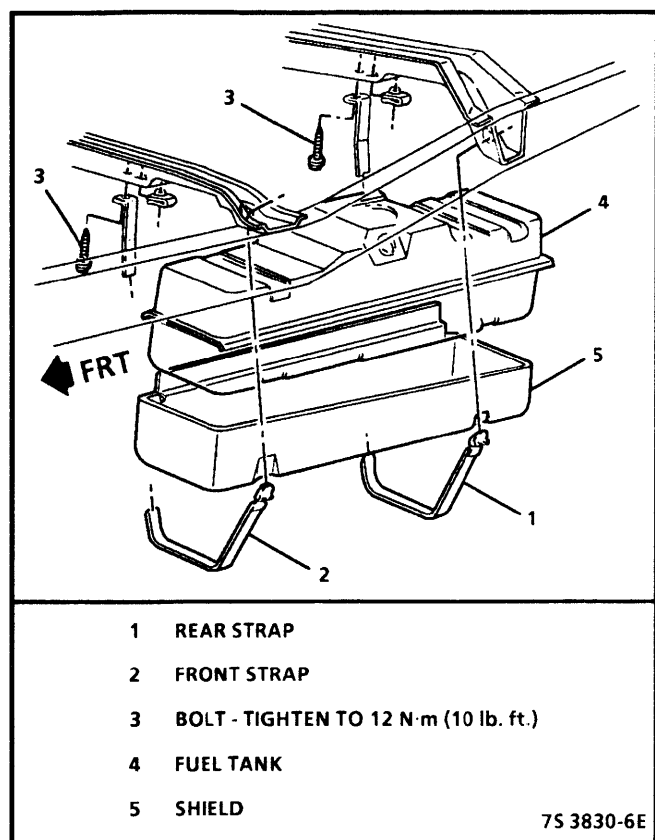


Figure 4E-5 - Fuel Tank - Long Box

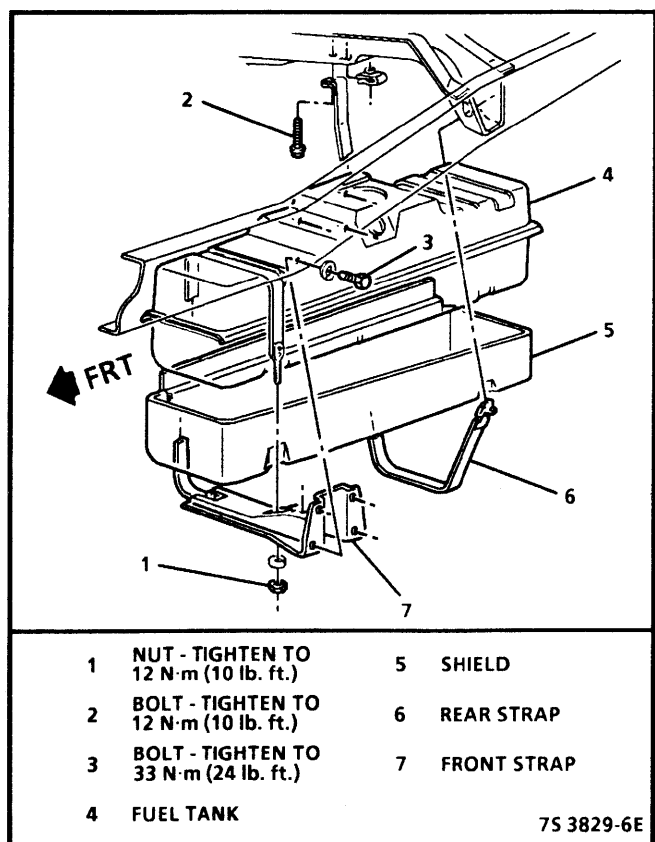


Figure 4E-6 - Fuel Tank - Short Box

## Install or Connect

1. New seal ring and reinstall sender using tool J 36608.
2. Raise tank slightly and reconnect the fuel/vapor hoses and the electrical connections at the sender. Ensure the ground strap is also reinstalled to the body.
3. Raise the tank fully and reinstall the fuel tank filler neck to the tank. Tighten clamp.
4. Fuel tank brackets with insulator strips in place. Tighten the strap nuts to 45 N·m (33 lb. ft.).

**NOTICE:** The strap nuts must be tightened by steps, alternating between the four nuts until the specified torque is reached. Otherwise, the bottom of the tank will flex upward and the fuel gage will indicate fuel remaining when the tank "runs dry."

5. Fuel tank off-road shield if equipped.
6. Replenish fuel. Reinstall fuel tank filler cap.
7. Reconnect the negative battery cable. If a memory retention device was not used, please reset (to the extent possible) all devices that lost their memory after the battery was disconnected.
8. Check for leaks.

## Tighten

- Bolts, as shown in the illustrations.

## Purging

## Important

- Gasoline mixed with water and water mixed with emulsifying agent needs to be treated as a hazardous material. The material needs to be handled in accordance with all applicable local, state, and federal laws and regulations.

The fuel tank should be purged, before being repaired.

## Remove or Disconnect

1. Fuel tank from the vehicle.
2. Fuel gage sending and pump unit.
3. All remaining fuel from the tank.

## Inspect

- Fuel tank for any remaining fuel.

## Install or Connect

1. Tap water into the tank,
  - Move the tank to the flushing area (wash rack).

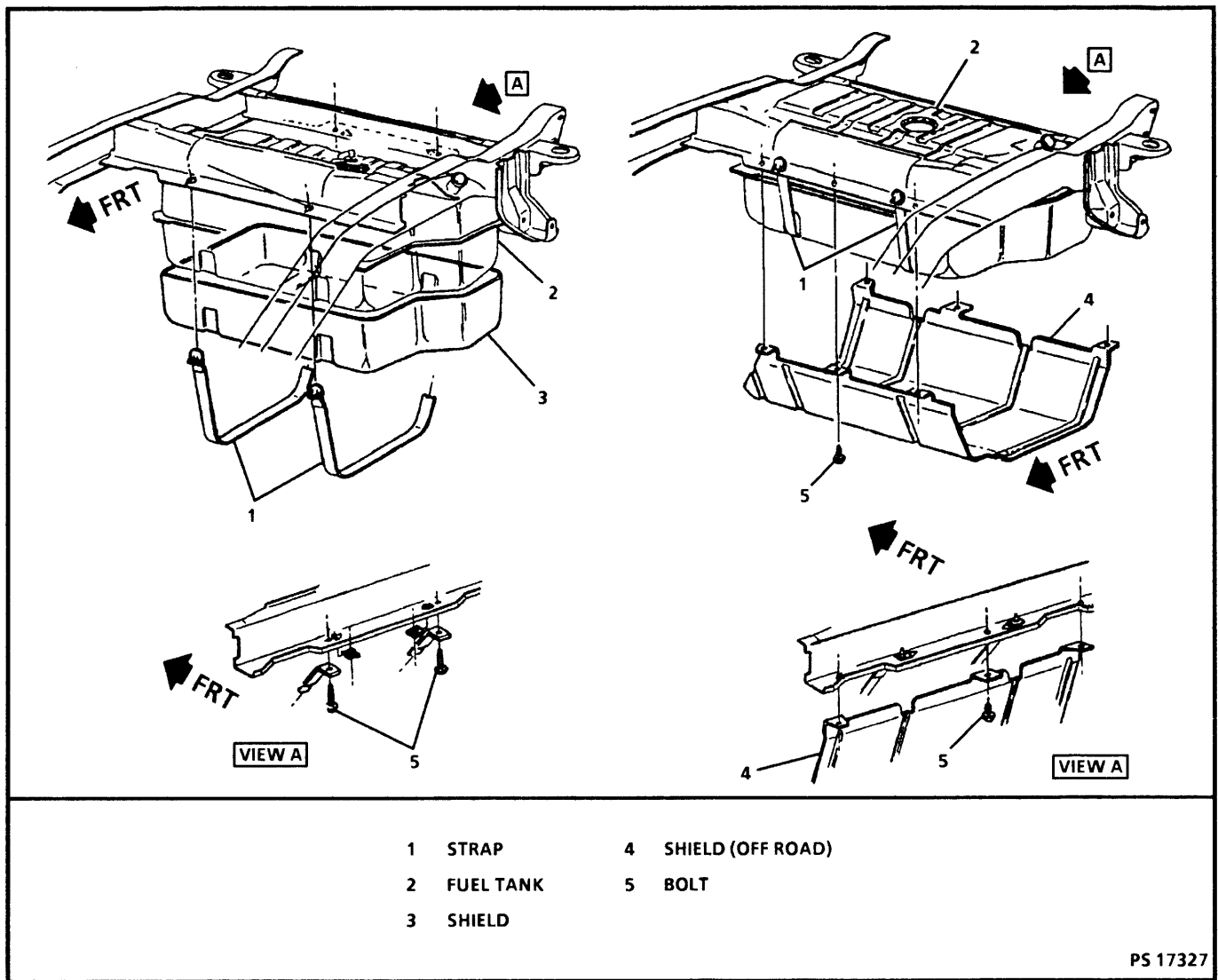


Figure 4E-7 - Fuel Tanks - Suburban

- Agitate the water vigorously and then drain it.
- 2. Gasoline emulsifying agent into the tank.
  - Use an available emulsifying agent.
- 3. Water to the fuel tank.
  - Refer to the emulsifying agent specifications for the mixture ratio.
  - Agitate the mixture for ten minutes.
  - Drain the tank completely.
  - Fill the tank with water, until it overflows.
  - Completely flush out any remaining mixture.
  - Drain the fuel tank.
  - Use an explosion meter (if available) to check for a negative reading.
  - Perform the required service work.
- 4. Repair fuel tank.
- 5. Fuel gage sending and pump unit.
- 6. Fuel tank onto vehicle.
- 7. Check for leaks.

## FUEL SYSTEM CLEANING

### Remove or Disconnect

- Have a dry chemical (Class B) fire extinguisher near the work area.
- 1. Disconnect negative battery cable.
- 2. Relieve fuel system pressure, refer to "Fuel System Pressure Relief" in this section.
- 3. Drain fuel tank, refer to "Draining Fuel Tank" in this section.
- 4. Fuel tank, refer to "Fuel Tank Replacement" in this section.
- 5. Fuel sender assembly, refer to "Fuel Sender Assembly Replacement" in this section.

### Inspect

- Whenever the fuel tank is cleaned, the fuel pump strainer must be inspected. If strainer is contaminated, it must be replaced and the fuel pump must be inspected.

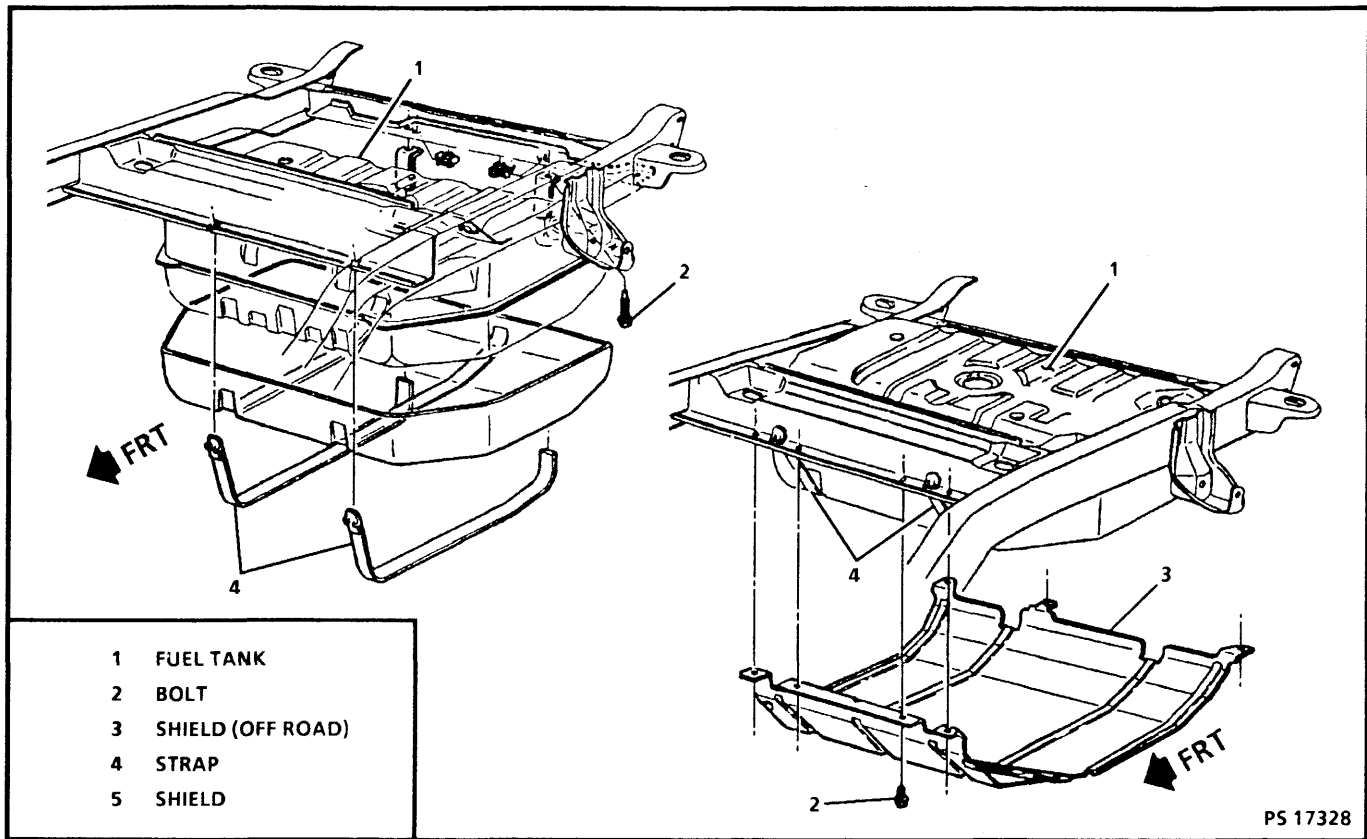


Figure 4E-8 - Fuel Tank - Yukon/Blazer

- Fuel pump inlet for dirt and debris. If found, fuel pump should be replaced.
- 6. Flush fuel tank with hot water.
- 7. Pour water out of fuel sender assembly opening (rock tank to be sure that removal of water from tank is complete).

## In-Line Fuel Filter

### Inspect

- In-line fuel filter, for contamination.
- Replace the filter, if it is plugged.

### Clean

- Fuel lines, by applying air pressure in the opposite direction of fuel flow.

### Install or Connect

1. New strainer (if necessary) on the fuel gage sending and pump unit.

**NOTICE:** Care should be taken not to fold over or twist the strainer, when installing the sending unit, as this will restrict fuel flow.

2. Fuel gage sender and pump unit, with a new seal into the fuel tank.
3. Fuel tank.

4. Disconnect the fuel feed line at the front of the vehicle.
5. Hose to the fuel feed line at the front of the vehicle and insert the end of the hose into a 3.8 liter (one gallon) fuel can.
6. Negative battery cable.
7. Twenty three liters (six gallons) of clean fuel into the fuel tank.
8. Energize fuel pump relay, to operate the fuel pump, until two liters (1/2 gallon) of fuel flows into the fuel can. This will purge the fuel pump.
9. Fuel line, at the front of the vehicle.
  - Check all connections, for leaks, and tighten all hose clamps.

## Leak Test

If fuel is leaking, from the tank, the tank should be replaced. Make sure that the fuel lines are not leaking onto the tank.

1. Remove the fuel tank.
2. Drain the tank.
3. Plug all of the outlets.
4. Apply 7 to 10 kPa (1 to 1 1/2 psi) air pressure through the vent tube.
5. Test for leaks, with a soap solution, or by submersion.
6. Replace the tank, if a leak is found.

## ACCELERATOR CONTROL

### Accelerator Control Cable Figure 4E-9

There are no linkage adjustments. The control cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement, with no rubbing, chafing, or binding.

The accelerator must operate freely, without binding between full closed and side open throttle.

Observe the following, when performing service on the accelerator control cable.

- The retainer must be installed with the tangs secured over the head of the stud.
- The conduit, fitting at both ends of the cable, must have the locking tangs expanded and locked into the attaching holes.
- The braided portion of the cable must not come into contact with the front of dash sealer during replacement.
- Flexible components (hoses, wires, conduit, etc.) must not be routed within 50 mm (2") of the moving parts of the accelerator linkage, unless routing is positively controlled.

#### Remove or Disconnect

1. Retainer from throttle lever stud.
2. Retainer locking tangs from support bracket.
3. Retainer from accelerator pedal rod or release cable from rod.
4. Retainer locking tanks from dash panel.

#### Install or Connect

1. Retainer to dash panel.
2. Retainer to accelerator pedal rod or connect cable in rod slot.
3. Retainer to support bracket.
4. Retainer to throttle lever stud or connect cable to pulley.

### Accelerator Pedal Figure 4E-10

The accelerator pedal controls the throttle, through a cable. There are not linkage adjustment. The accelerator control cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement with no rubbing, chafing, or binding. The accelerator pedal must operate freely, without binding, between full closed and Wide Open Throttle (WOT).

Observe the following, when performing service on the accelerator pedal.

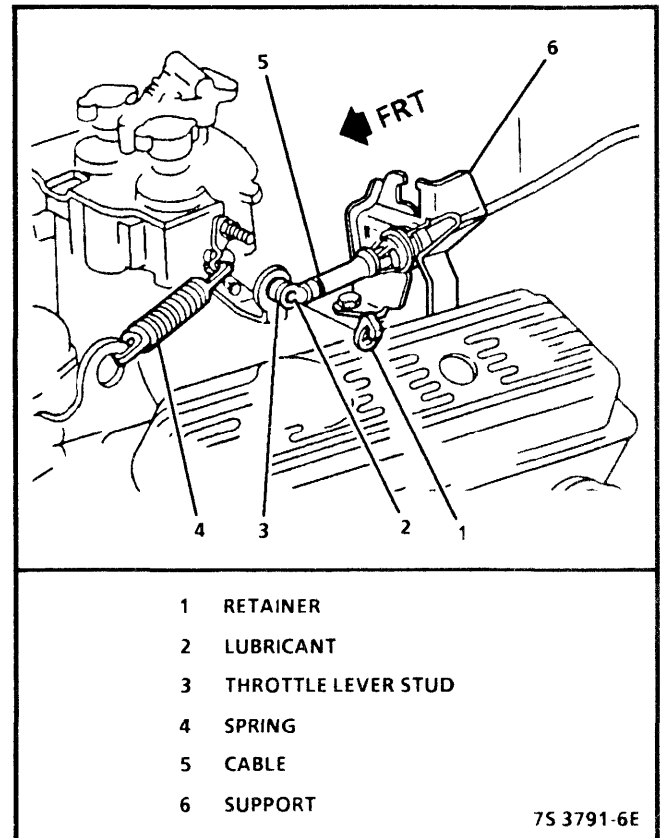


Figure 4E-9 - Accelerator Cable TBI

- The mounting surface between the support and the dash panel, must be free of insulation. The carpet and padding in the pedal and tunnel area must be positioned to lay flat and be free of wrinkles and bunches.
- Slip the accelerator control cable through the slot in the rod, before installing the retainer in the rod. Make sure it is seated properly. Use care in pressing retainer into the hole, so the cable is not kinked, or damaged.
- The linkage must operate freely, without binding, between closed throttle and full throttle.
- Wire, hoses, cable, and other flexible components, must not be placed within 13 mm (0.52") of the cable or rod, at any point, in their travel.

## PARTS INFORMATION

| PART NAME                        | GROUP |
|----------------------------------|-------|
| Filter, Fuel .....               | 3.890 |
| Tank, Fuel .....                 | 3.001 |
| Shield, Fuel Tank .....          | 3.015 |
| Cable, Accelerator Control ..... | 3.430 |
| Pedal, Accelerator .....         | 3.451 |

## 4E-10 DRIVEABILITY AND EMISSIONS (GASOLINE)

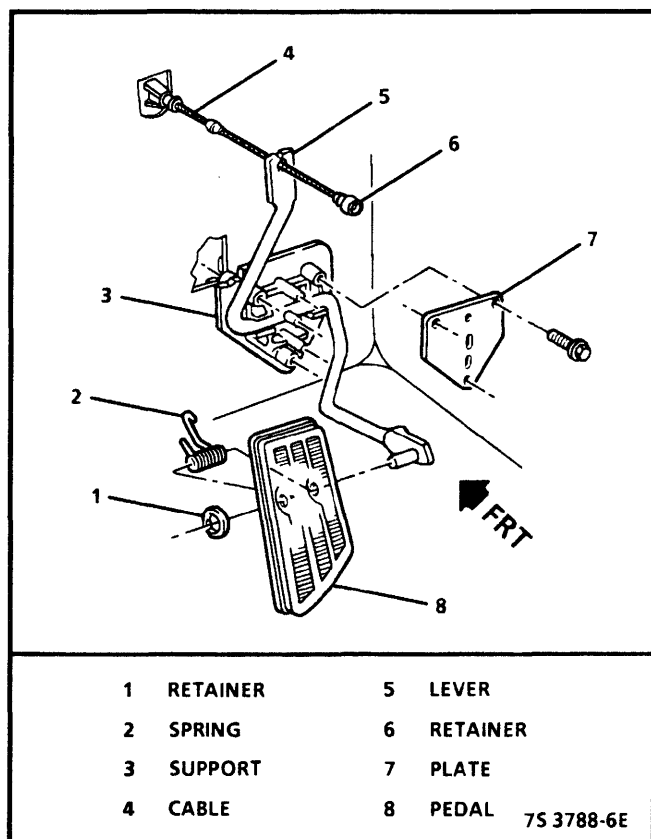


Figure 4E-10 - Accelerator Pedal

## SECTION 5

# EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

## CONTENTS

|                                      |     |                                     |     |
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| Canister Purge Solenoid .....        | 5-2 | Canister Purge Solenoid .....       | 5-6 |
| Canister Location .....              | 5-2 | Vapor Canister Hoses .....          | 5-6 |
| Diagnosis .....                      | 5-2 | Vapor Pipe .....                    | 5-6 |
| Results of Incorrect Operation ..... | 5-2 | Vapor Pipe Repair .....             | 5-6 |
| Visual Check of Vapor Canister ..... | 5-2 | Fuel Cap .....                      | 5-6 |
|                                      |     | Parts Information .....             | 5-6 |

## GENERAL DESCRIPTION

### PURPOSE

The Evaporative Emission (EVAP) control system limits fuel vapors from escaping into the atmosphere. The EVAP transfers fuel vapor from the sealed fuel tank to an activated carbon (charcoal) storage device (vapor canister). The canister will store the vapors until the engine is able to use the extra fuel vapor.

When the engine is able to use the extra fuel vapor, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

The fuel tank is sealed with a fuel cap that is not normally vented to the atmosphere. The fuel tank cap has a safety valve which allows for both pressure and vacuum relief.

### OPERATION

Fuel vapors from the fuel tank are purged and flow into the vapor canister tube labeled "tank" and are absorbed by the carbon. The canister (Figure 5-1) is purged when the engine is able to use the extra fuel vapor. A vacuum source is applied to the vapor canister tube labeled "purge" to draw fresh air through the top of the canister. The air mixes with the fuel vapor and the mixture is drawn into the intake manifold to be consumed in the normal combustion process.

While the canister is purging, fresh air is drawn in through the air inlet at the top of the canister. Air flows to the bottom of the canister and forces the vapors out the "purge" tube.

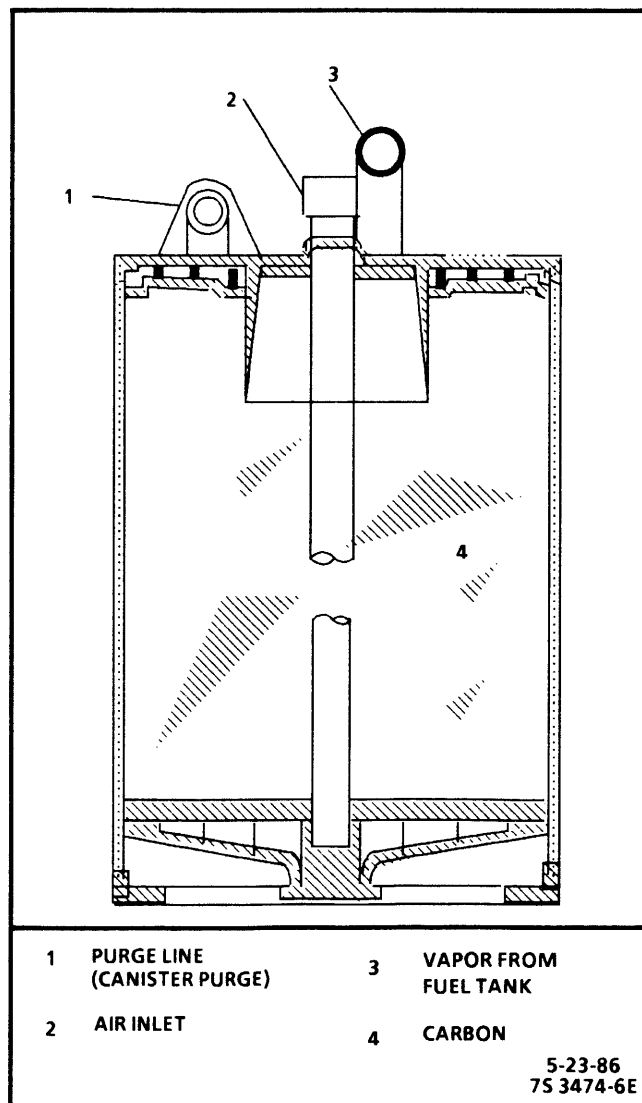


Figure 5-1 - Vapor Canister



### Canister Purge Solenoid

The EVAP system in some applications uses an electrically controlled solenoid to cycle the vacuum to the purge canister. The control module cycles the solenoid when engine coolant temperature is  $> 45^{\circ}\text{C}$  or the short term fuel trim cell is less than 122 counts. In other applications a vacuum line from a port vacuum source on the TB1 unit works on a vacuum

control -valve - which cycles open and closed with port vacuum signal.

**Canister Location:** - The canister is located in the forward part of the left front fender well next to the radiator support. If more information is needed see SECTION 1.

## DIAGNOSIS

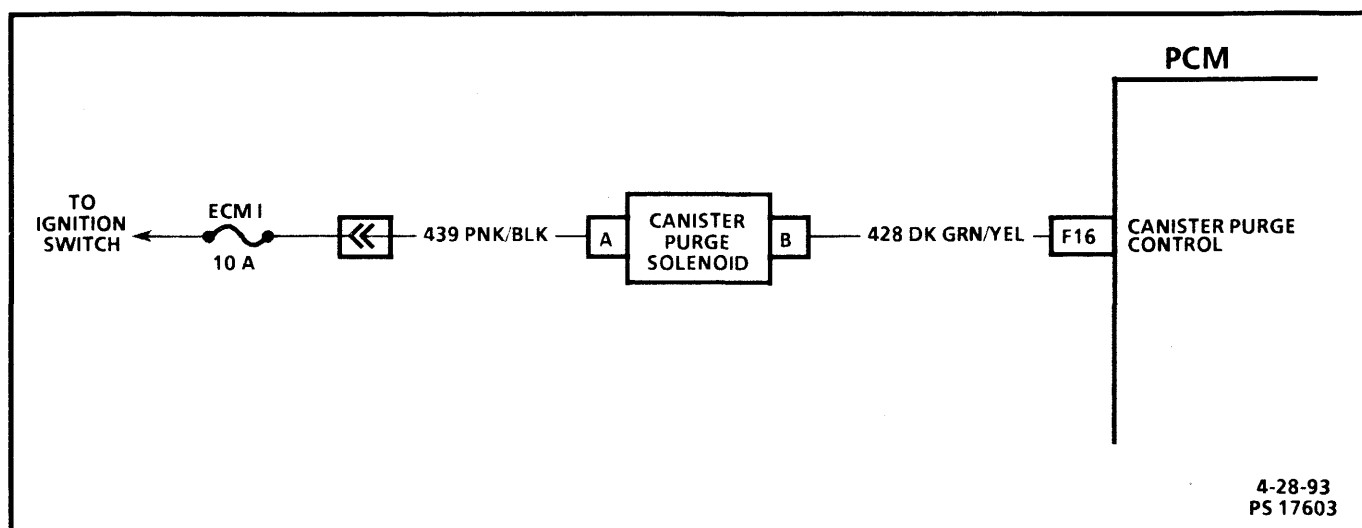
### RESULTS OF INCORRECT OPERATION

- Poor idle, stalling and poor driveability can be caused by:
  - Damaged canister.
  - Hoses split, cracked and or, not connected to the proper tubes.
- Evidence of fuel loss or fuel vapor odor can be caused by:
  - Liquid fuel leaking from fuel lines.
  - Cracked or damaged vapor canister.
  - Disconnected, misrouted, kinked, deteriorated or damaged vapor pipe, or canister hoses.
  - Air cleaner or air cleaner gasket improperly seated.

### VISUAL CHECK OF VAPOR CANISTER

- Replace vapor canister if cracked or damaged.
- Replace vapor canister if fuel is leaking from bottom and then check operation of the total system.

**BLANK**



### CANISTER PURGE SOLENOID CHECK

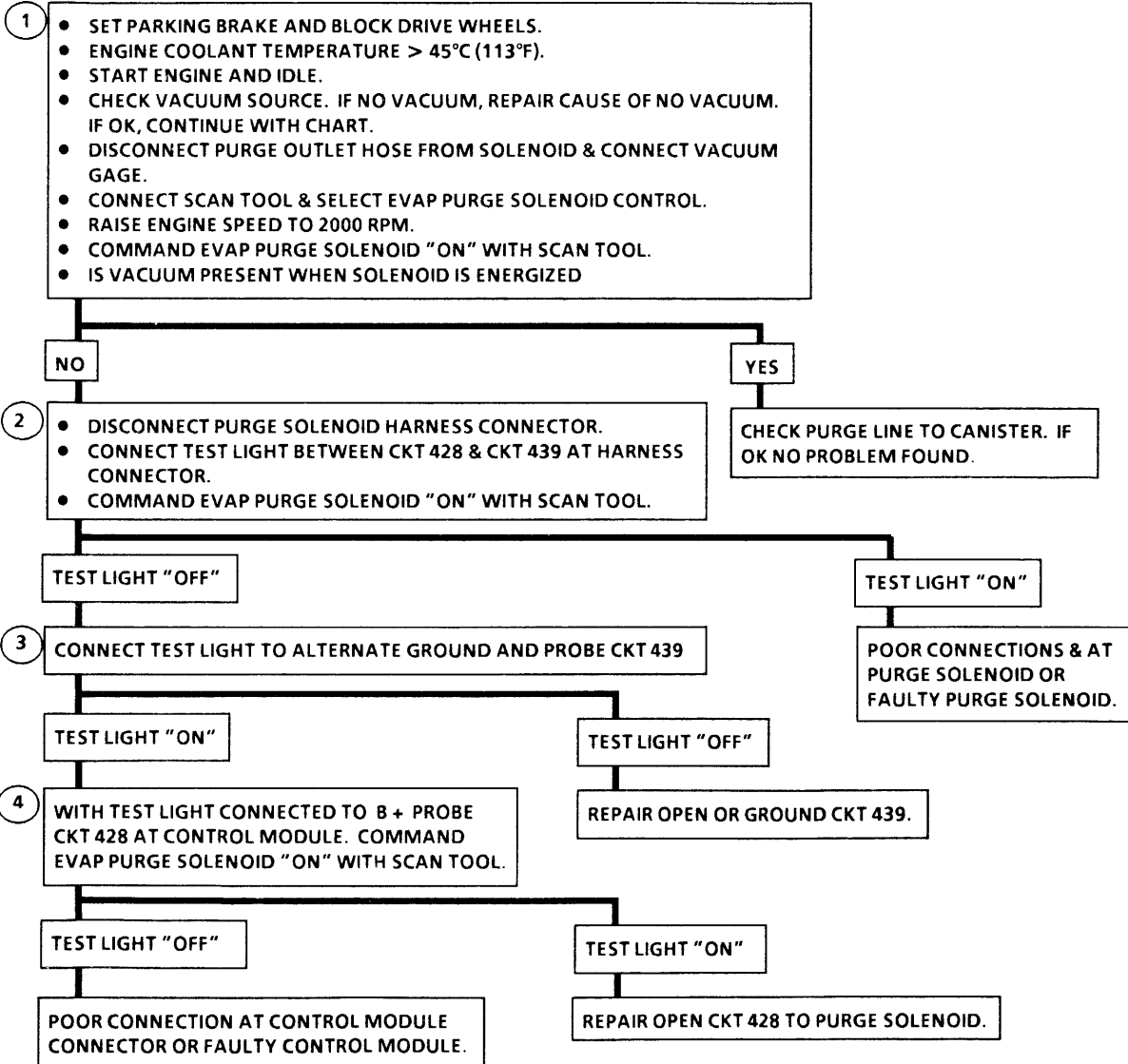
#### Circuit Description:

12 volts is applied to CKT 439 at terminal "A" when the ignition key is turned "ON." As the engine coolant temperature rises during engine operation ( $< 45^{\circ}\text{C}$  -  $113^{\circ}\text{F}$ ) or when short term fuel trim count is  $> 122$ , the control module will then ground CKT 428 at terminal "B". The purge solenoid will then open the vapor canister to purge the fuel, and direct it to the intake manifold for normal combustion when it is needed.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if a vacuum source is present, along with certain conditions before the purge solenoid is commanded "ON." Also shows a change of vacuum as purge solenoid is being cycled.
2. Checks for power to the solenoid, the ground circuit, the connections at the purge solenoid and the solenoid itself.
3. Checks for open or grounded CKT 439.
4. Checks for open CKT 428 or faulty control module.

# CANISTER PURGE SOLENOID CHECK



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

6-10-92  
NS 15130

## ON-VEHICLE SERVICE

### VAPOR CANISTER

Figure 5-1

#### ↔ Remove or Disconnect

1. Hoses from canister. Mark hoses for installation on new canister.
2. Screw from mounting bracket and canister.

#### ↔ Install or Connect

1. Canister and bracket screw.
2. Hoses to canister.

### CANISTER PURGE SOLENOID

Figures 5-2, 5-4 and 5-5

The canister purge solenoid is located in different areas on different engines. See Figures 5-2 and 5-3 for locations.

#### ↔ Remove or Disconnect

1. Negative battery cable.
2. Electrical connector and hoses from solenoid.
3. Solenoid from mounting bracket by pulling away from bracket.

#### ↔ Install or Connect

1. Slide solenoid into bracket.
2. Electrical connector and hoses to solenoid.
3. Negative battery cable.

### VAPOR CANISTER HOSES

Refer to "Vehicle Emission Control Information" label for routing of canister hoses. When replacing hoses, use hose identified with the word "Fluoroelastomer."

### VAPOR PIPE

The vapor pipe is secured to the underbody with clamp and screw assemblies. Flexible hoses are connected at the fuel tank and the fuel vapor canister. The pipe should be inspected occasionally for leaks, kinks, or dents and repaired as required.

### Vapor Pipe Repair

Repair vapor pipe in sections using brazed seamless steel tubing meeting GM Specification 123M or its equivalent or hose identified with the words "Fluoroelastomer." Hose not so marked could cause failure or failure to meet emission standard.

- Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations.
- Do not use rubber hose within 100 mm (4") of any part of the exhaust system or within 250 mm (10") of the catalytic converter. The replacement hose's inside diameter must match the steel tubing outside diameter.

1. In repairable areas, cut a piece of fuel hose 100 mm (4") longer than the portion of the line being removed.

When more than a 150 mm (6") length of pipe is removed, use a combination of steel tubing and hose so that the entire hose length will not be more than 250 mm (10").

2. Cut ends of the pipe remaining on vehicle square by using a tube cutter. By using the first step of a double flaring tool, form a bead on the ends of both pipe sections. If pipe is too corroded to withstand bead operation without damage, the pipe should be replaced. If a new section of pipe is used, form a bead on both ends.
3. Use screw type hose clamp GM part number 2494772 or equivalent. Slide clamps onto pipe and push hose 50 mm (2") onto each portion of fuel pipe. Tighten clamps on each side of repair.

### FUEL CAP

When a fuel tank filler cap requires replacement, use only a cap with the same features. Failure to use the correct cap can result in malfunctioning of the system.

## PARTS INFORMATION

| PART NAME                            | GROUP |
|--------------------------------------|-------|
| Canister, Fuel Vapor .....           | 3.130 |
| Valve, Tank Pressure Control .....   | 3.140 |
| Solenoid Valve, Canister Purge ..... | 3.140 |

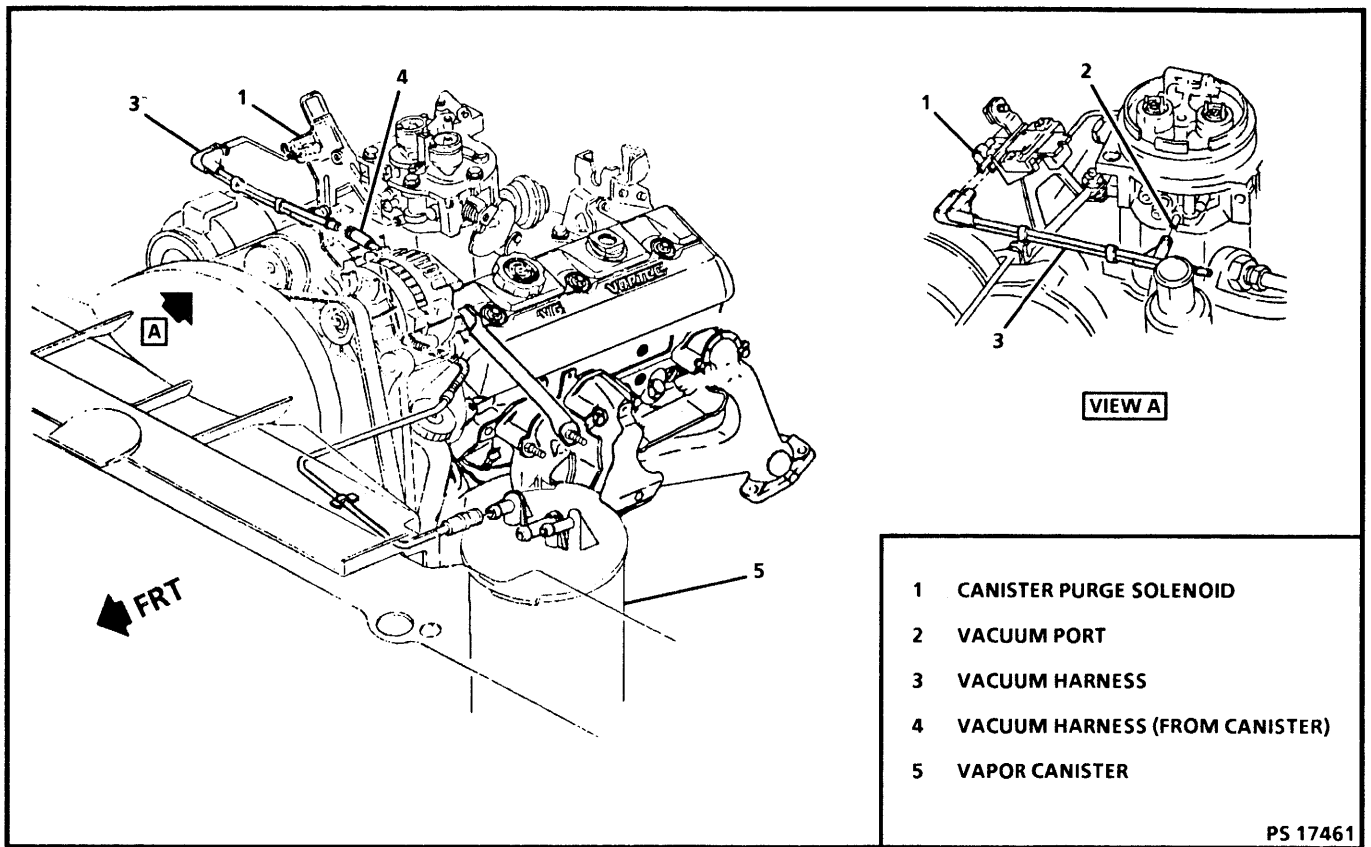


Figure 5-2 - Canister Purge System - 4.3L With California Emissions

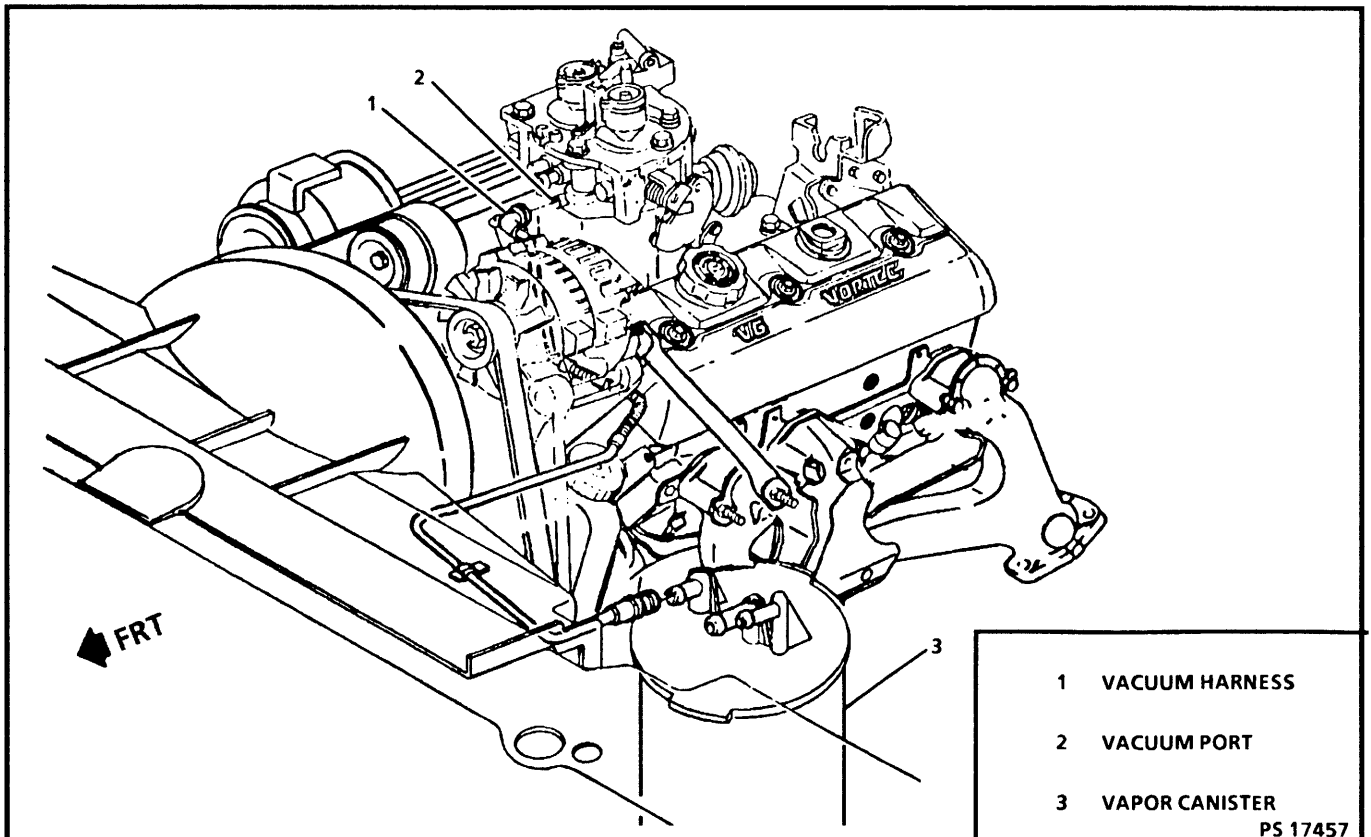


Figure 5-3 - Canister Purge System - 4.3L Federal Emissions

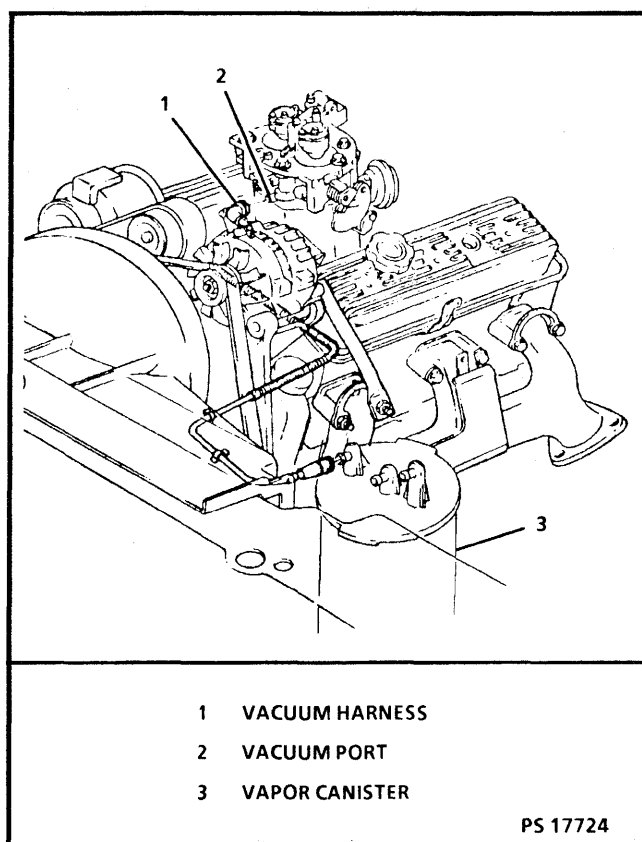


Figure 5-4 - Canister Purge System - 5.7L Without Purge Solenoid

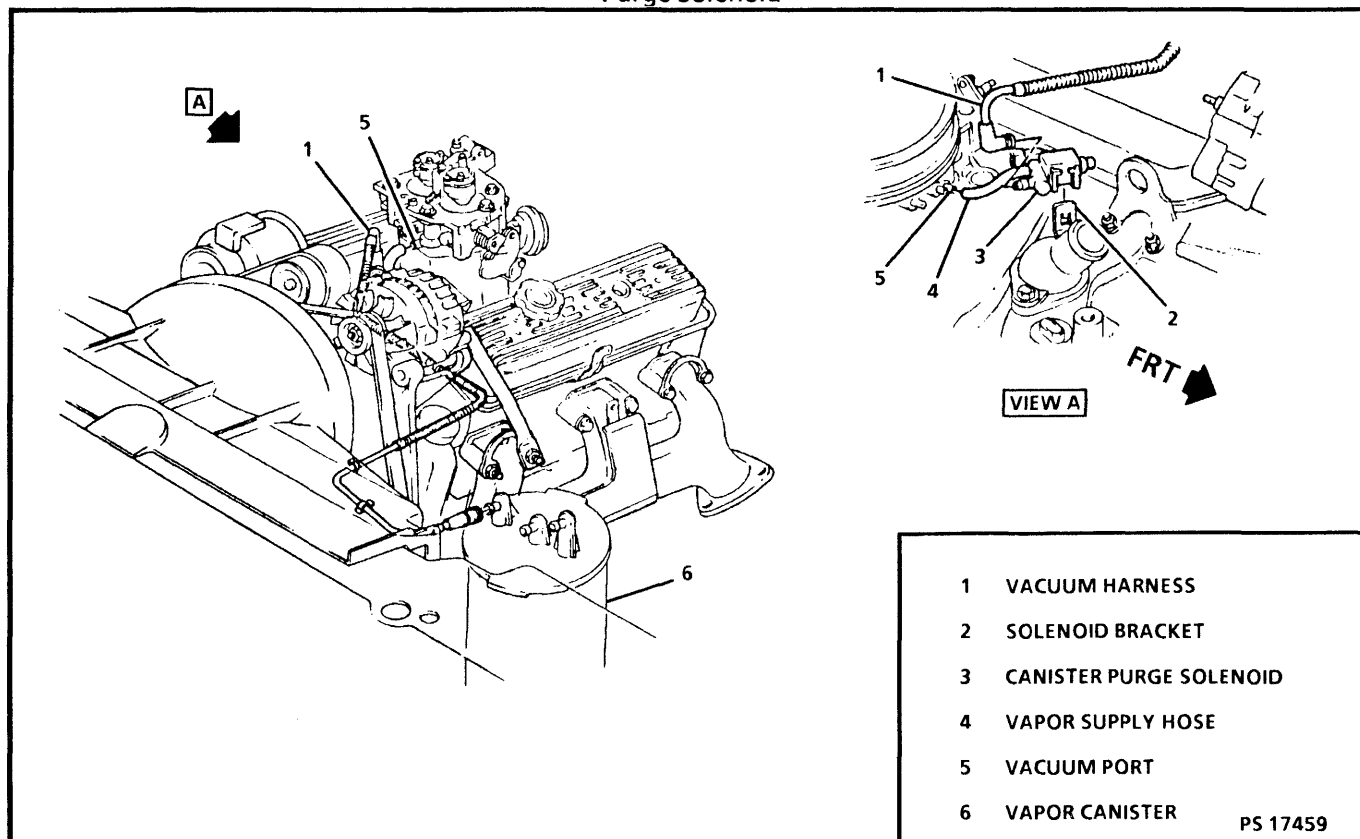


Figure 5-5 - Canister Purge System - 5.0L & 5.7L With Purge Solenoid

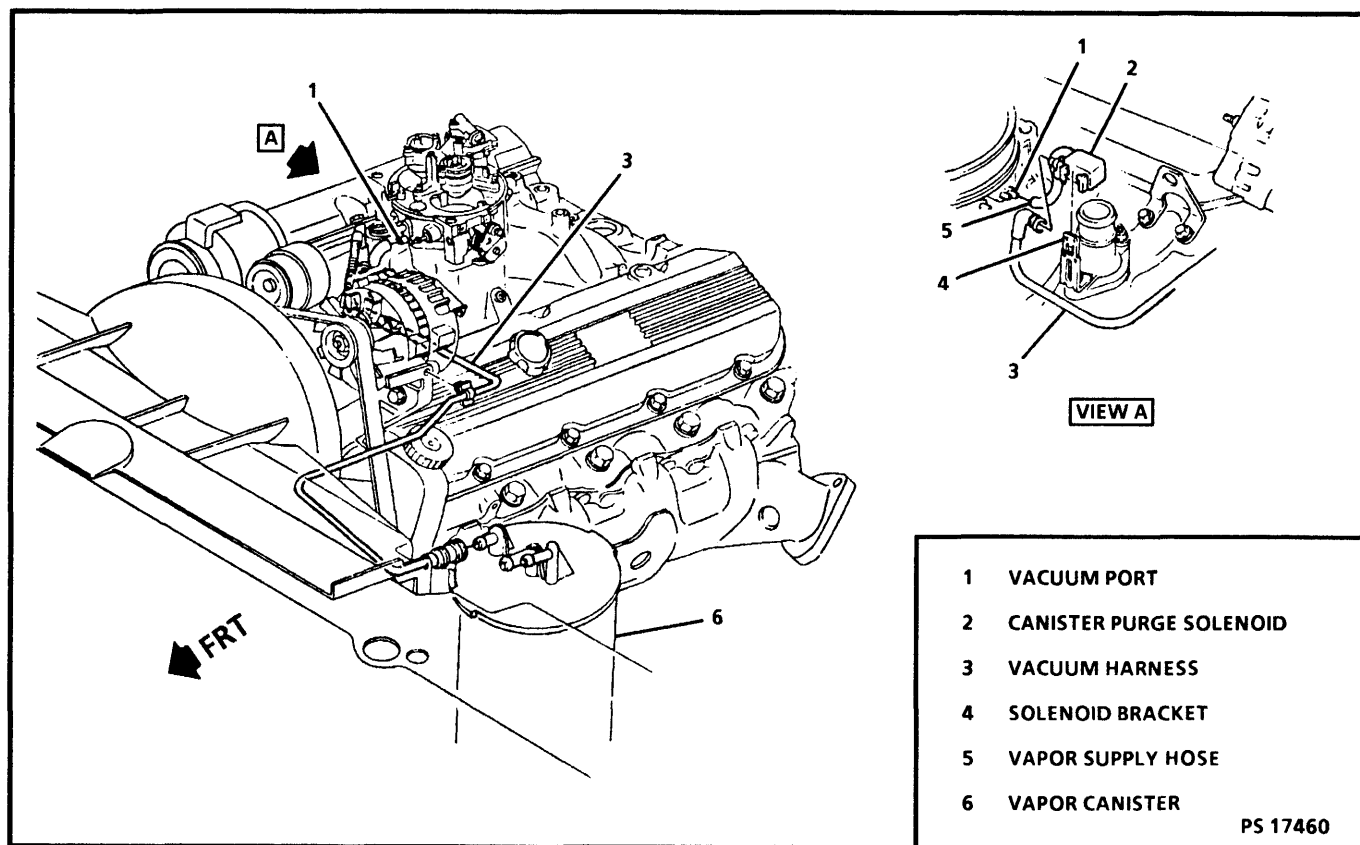


Figure 5-6 - Canister Purge System - 7.4L



**BLANK**

## SECTION 6

# IGNITION SYSTEMS

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|-------------------------------|-----|

### GENERAL DESCRIPTION

The ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide improved engine performance, fuel economy, and control of exhaust emissions, the control module controls distributor spark advance (timing) with the Ignition Control (IC) system.

The ignition system uses a primary and secondary sub systems to accomplish timed spark distribution. The primary system consists of a low voltage trigger device which determines base timing. This signal is modified by the ignition control module and sent to the engine and/or transmission processor (control module) for base timing reference. Another signal is sent back to the ignition control module, which has been adjusted by the control module (advanced or retarded) to trigger the coil, according to the requirements of the engine.

The secondary system consists of the ignition coil which has primary (low voltage) windings and secondary (high voltage) windings. The high voltage the secondary side of the coil generates is conducted to the spark plugs by high tension plug wires.

The distributor ignition system has a distributor module with four terminals for the IC system that are connected by the control module.

To properly control ignition/combustion timing, the control module needs to know:

- Crankshaft position.
- Engine speed (RPM).
- Engine load (manifold pressure or vacuum).
- Atmospheric (barometric) pressure.
- Engine coolant temperature.

**BLANK**

## SECTION 6A

# DISTRIBUTOR IGNITION (DI) SYSTEM

## CONTENTS

|                                         |      |                                   |      |
|-----------------------------------------|------|-----------------------------------|------|
| General Description .....               | 6A-1 | Distributor Ignition System Check |      |
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## GENERAL DESCRIPTION

### PURPOSE

The distributor ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide improved engine performance, fuel economy, and control of exhaust emissions, the control module controls distributor spark advance (timing) with the Ignition Control (IC) system.

Only the IC system will be described here. Additional information on the distributor ignition system is found in SECTION 6D of the appropriate service manual.

### OPERATION

The distributor ignition system has a distributor module with four terminals for the IC system (Figure 6A-1) that are connected by the control module.

To properly control ignition/combustion timing, the control module needs to know:

- Crankshaft position.
- Engine speed (RPM).
- Engine load (manifold pressure or vacuum).
- Atmospheric (barometric) pressure.
- Engine coolant temperature.

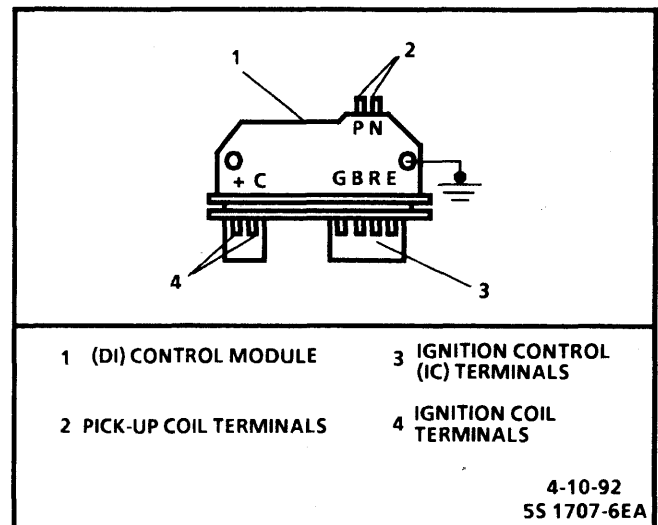


Figure 6A-1 - Ignition Control Module

## 6A-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

The IC system consists of the distributor module, an control module, and connecting wires. The four terminals for IC are lettered in the module.

The distributor four terminal connector is lettered A-B-C-D.

These circuits perform the following functions:

- Terminal "A" - Reference Ground Lo - This wire may be grounded in the distributor. It makes sure the ground circuit, between the module and control module has no voltage drop which could affect performance. If it is open, it may cause poor performance.
- Terminal "B" - Bypass - At about 400 RPM, the control module applies 5 volts to this circuit to switch spark timing control from the module to the control module. An open or grounded bypass circuit will set a DTC 42 and the engine will run at base timing, plus a small amount of advance built into the module.

- Terminal "C" - Distributor Reference Hi - This provides the control module with RPM and crankshaft position information.
- Terminal "D" - IC - This circuit triggers the module. The control module does not know what the actual timing is, but it does know when it gets the reference signal. It then advances or retards the spark from that point. Therefore, if the base timing is set incorrectly, the engine spark curve will be incorrect.

## DIAGNOSIS

The description and operation of the distributor ignition system can be found in SECTION 6D of the appropriate service manual

If the vehicle will not start, refer to "Distributor Ignition System Check."

### IC SYSTEM

DTC 12 is used during the "On-Board Diagnostic System Check" to test the code display ability of the control module. This DTC indicates that the control module is not receiving the engine RPM (Reference) signal. The "Reference" signal also triggers the fuel injection system. Without the "Reference" signal, the engine cannot operate.

### Results of Incorrect IC Operation

The control module uses information from the MAP and coolant sensors in addition to RPM to calculate spark advance as follows:

- Low MAP output voltage = More spark advance
- Cold Engine = More spark advance
- High MAP output voltage = Less spark advance
- Hot engine = Less spark advance

Detonation can be caused by low MAP output or high resistance in the coolant sensor circuit.

Poor performance can be caused by high MAP output or low resistance in the coolant sensor circuit.

### DTC 42

A fault in the IC system will usually set a DTC 42. Refer to DTC 42 in SECTION 3A or 3B.

When the system is operating on the distributor module, there is no voltage on the bypass line and the module grounds the IC signal. The control module expects to find no voltage on the IC line during this condition. If voltage is found, a DTC 42 will set and the system will not go into the IC mode.

When the RPM for IC is obtained (about 400 RPM), the control module applies 5 volts to the bypass line. The IC will no longer be grounded in the module and the IC voltage will be varying.

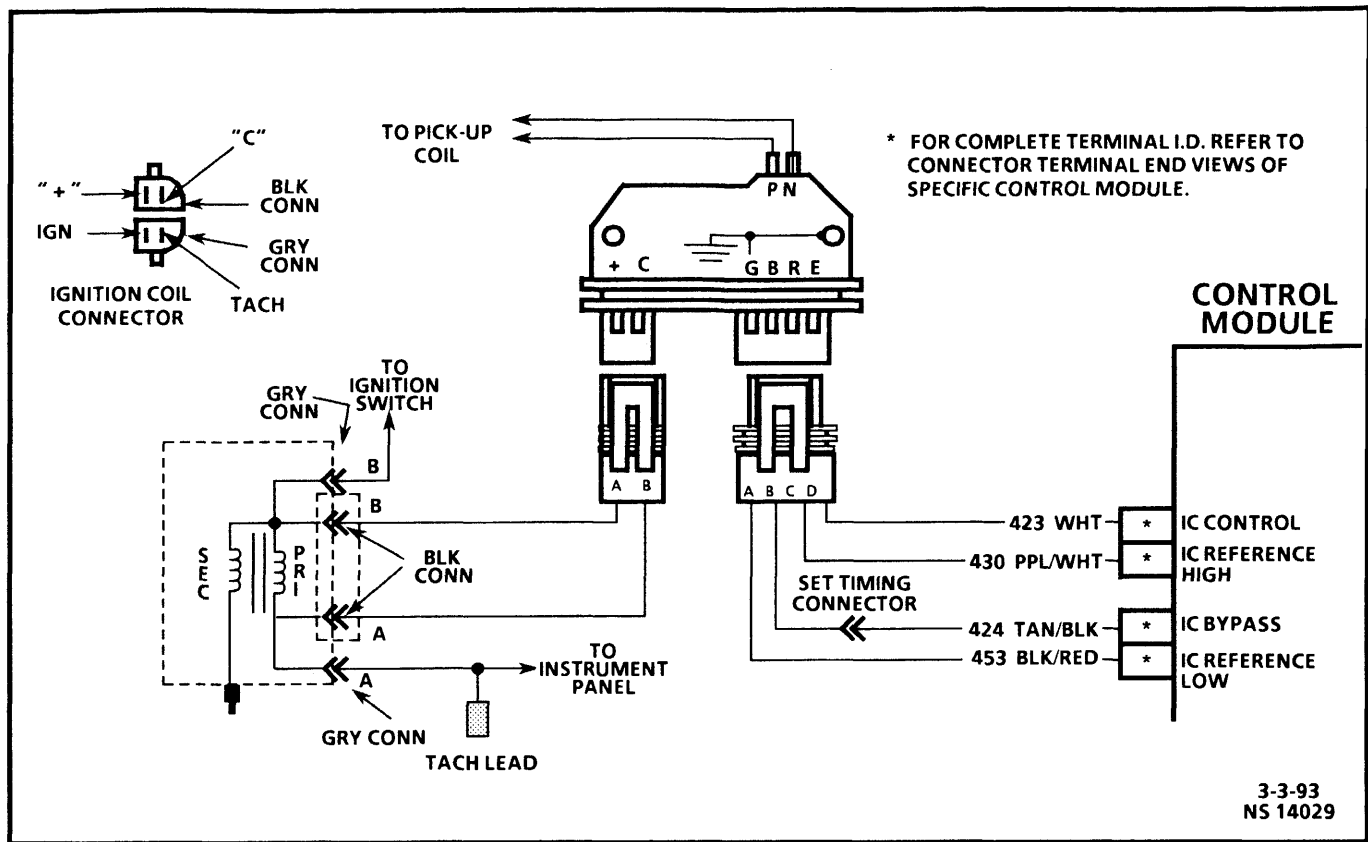
If the bypass line is open, the module will not switch to test mode, so the IC voltage will be low and DTC 42 will be set.

If the IC line is grounded, the module will switch to IC, there will be no IC signal and the engine will not operate. A DTC 42 may or may not set.

An open in the IC circuit will set a DTC 42 and cause the engine to operate on the distributor module timing. This will cause poor performance and poor fuel economy.

To check IC operation, place the vehicle in "Park" or "Neutral" and block the drive wheels. Start the engine and accelerate to 2000 RPM. Note the ignition timing. Disconnect the "Set Timing" connector and again note the timing. The timing will change if the IC system is operating.

**BLANK**



## DISTRIBUTOR IGNITION SYSTEM CHECK

(Page 1 of 2)

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- Two wires are checked, to ensure that an open is not present in a spark plug wire. This step also checks for mechanical problems.
- A spark indicates the problem must be the distributor cap, rotor, or coil output wire.
- Normally, there should be battery voltage at the "C" and "+" terminals on the coil connector. Low voltage would indicate an open or a high resistance circuit from the distributor to the coil or ignition switch. If "C" terminal voltage was low, but "+" terminal voltage is 10 volts or more, circuit from "C" terminal to ignition coil or ignition coil primary winding is open.
- Checks for a shorted module or grounded circuit from the ignition coil to the module. The distributor module should be turned "OFF," so normal voltage should be about 12 volts. If the module is turned "ON," the voltage would be low, but above 1 volt. This could cause the ignition coil to fail from excessive heat. With an open ignition coil primary winding, a small amount of voltage will leak through the module from the "batt" to the "tach" terminal.

# DISTRIBUTOR IGNITION SYSTEM CHECK

(Page 1 of 2)

1

- CHECK SPARK PLUG WIRES FOR OPEN CIRCUITS, CRACKS IN INSULATION OR IMPROPER SEATING OF TERMINALS AT SPARK PLUGS, DISTRIBUTOR, AND IGNITION COIL BEFORE PROCEEDING WITH THIS TEST. IF A TACHOMETER IS CONNECTED TO THE TACH TERMINAL ON THE IGNITION COIL, DISCONNECT IT BEFORE PROCEEDING WITH TEST.
- CHECK SPARK AT PLUG WITH SPARK TESTER J 26792 OR EQUIVALENT ST 125 WHILE CRANKING (IF NO SPARK ON ONE WIRE, CHECK A SECOND WIRE) A FEW SPARKS AND THEN NOTHING IS CONSIDERED NO SPARK.

NO SPARK

SPARK

2

- REMOVE DISTRIBUTOR CAP AND VERIFY ROTATION OF IGNITION ROTOR. IF NO ROTATION, A MECHANICAL REPAIR WILL BE NECESSARY BEFORE CONTINUING WITH THIS TEST.
- DISCONNECT 4 TERMINAL DISTRIBUTOR CONNECTOR. CHECK FOR SPARK AT IGNITION COIL TOWER WITH TESTER J 26792 OR EQUIVALENT ST 125 WHILE CRANKING USING A KNOWN GOOD COIL WIRE. (LEAVE TESTER CONNECTED TO COIL TOWER FOR STEPS 3-6.)

CHECK FUEL, SPARK PLUGS, ETC. REFER TO "DRIVEABILITY SYMPTOMS" IN SECTION 2.

NO SPARK

SPARK

3

- DISCONNECT DISTRIBUTOR 2 TERMINAL "C/+" CONNECTOR HARNESS. ALSO DISCONNECT TACH PIGTAIL FROM HARNESS CONNECTOR IF EQUIPPED.
- IGNITION SWITCH "ON," ENGINE STOPPED.
- CHECK VOLTAGE AT "+" AND "C" TERMINALS OF DISTRIBUTOR AT HARNESS CONNECTOR AND TACH PIGTAIL TERMINAL.\*

CHECK CAP, ROTOR AND COIL WIRES FOR OPENS, DAMAGE, OR WEAR. REPLACE AS NECESSARY.

\*NOTE: IF OTHER COMBINATIONS RESULT FROM TEST #3, A WIRING PROBLEM IS APPARENT AND SHOULD BE REPAIRED BEFORE CONTINUING WITH OTHER TESTS.

ALL 3 TERMINALS 10 VOLTS OR MORE

ALL 3 TERMINALS UNDER 10 VOLTS

UNDER 10 VOLTS "C" TERMINAL ONLY

4

- RECONNECT DISTRIBUTOR 2 TERMINAL CONNECTOR.
- WITH IGNITION "ON," CHECK VOLTAGE FROM TACH PIGTAIL TO GROUND. (PIGTAIL MAY BE TAPED BACK IN HARNESS.)

REPAIR WIRE FROM DISTRIBUTOR IGNITION CONTROL MODULE "+" TERMINAL TO "B" TERMINAL OF BLACK IGNITION COIL CONNECTOR OR VOLTAGE SUPPLY TO COIL.

CHECK FOR OPEN OR GROUND IN THE CIRCUIT FROM "C" TERMINAL TO IGNITION COIL. IF CIRCUIT IS OK, CHECK IGNITION COIL FOR OPEN COIL PRIMARY OR CONNECTION.

GREATER THAN 10 VOLTS

1 TO 10 VOLTS

- CONNECT TEST LIGHT FROM TACHOMETER TERMINAL TO GROUND.
- CRANK ENGINE AND OBSERVE LIGHT.

REPLACE DISTRIBUTOR IGNITION CONTROL MODULE AND CHECK FOR SPARK FROM COIL AS IN STEP 6.

REFER TO IGNITION SYSTEM CHECK (2 OF 2).

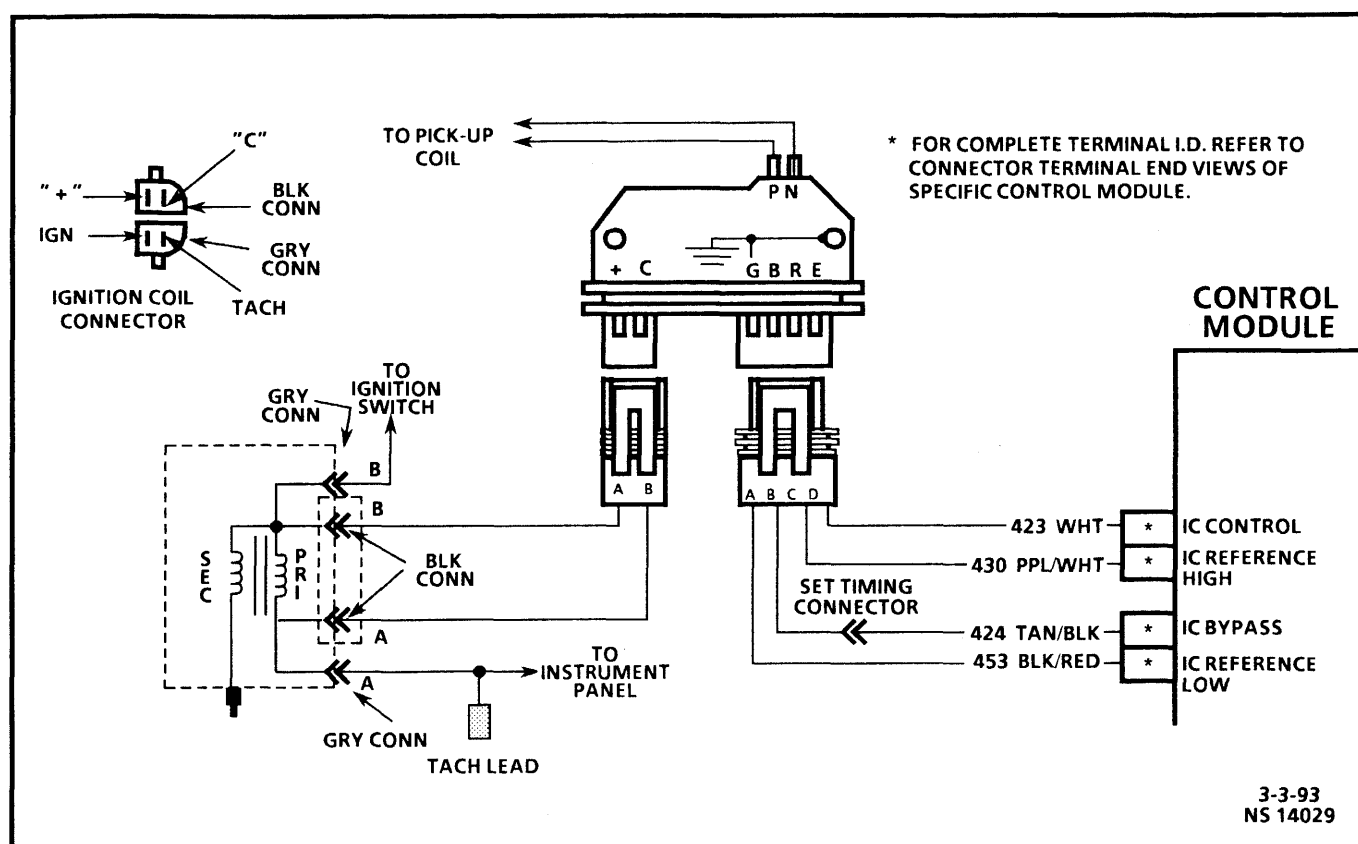
SPARK

NO SPARK

SYSTEM OK.

REPLACE IGNITION COIL.





## DISTRIBUTOR IGNITION SYSTEM CHECK

**(Page 2 of 2)**

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.
- Applying a voltage (1.35 to 1.50 volts) to module terminal "P" should turn the module "ON" and the "tach" terminal voltage should drop to about 7-9 volts. This test will determine whether the module or coil is faulty or if the pick-up coil is not generating the proper signal to turn the module "ON." This test can be performed by using a DC test battery with a rating of 1.5 volts. (Such as AA, C, or D cell.) The battery must be a known good battery with a voltage of over 1.35 volts.
  - This should turn "OFF" the module and cause a spark. If no spark occurs, the fault is most likely in the ignition coil because most module problems would have been found before this point in the procedure. A distributor ignition control module tester (J 24642) could determine which is at fault.
- Diagnostic Aids:** A Tach filler could cause an ignition system problem. If voltage measured at distributor 2 terminal connector (Terminal "C") with ignition "ON" increases when tach terminal connector is disconnected the filter is faulty and should be

**Diagnostic Aids:** A Tach filler could cause an ignition system problem. If voltage measured at distributor 2 terminal connector (Terminal "C") with ignition "ON" increases when tach terminal connector is disconnected the filter is faulty and should be replaced.

# DISTRIBUTOR IGNITION SYSTEM CHECK

(Page 2 of 2)

FROM IGNITION SYSTEM  
CHECK PAGE (1 OF 2).

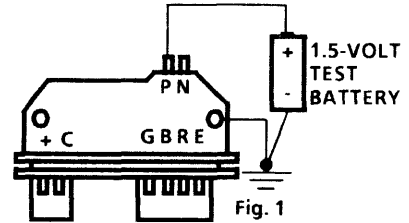
LIGHT "ON" STEADY

5

- DISCONNECT DISTRIBUTOR 4 TERMINAL CONNECTOR.
- REMOVE DISTRIBUTOR CAP.
- DISCONNECT PICK-UP COIL CONNECTOR FROM DISTRIBUTOR IGNITION CONTROL MODULE.
- CONNECT VOLTMETER FROM TACHOMETER PIGTAIL TO GROUND.
- IGNITION "ON."
- CONNECT POSITIVE (+) END OF KNOWN GOOD 1.5-VOLT TEST BATTERY TO "P" TERMINAL ON DISTRIBUTOR IGNITION CONTROL MODULE. OBSERVE VOLTMETER AT TACH TERMINAL AS NEGATIVE (-) END OF TEST BATTERY IS MOMENTARILY GROUNDED TO DISTRIBUTOR HOUSING.

LIGHT FLASHES

REPLACE IGNITION COIL AND RECHECK FOR SPARK WITH SPARK TESTER. IF STILL NO SPARK, RE-INSTALL ORIGINAL COIL AND REPLACE DI CONTROL MODULE.



VOLTAGE DROPS

6

- CHECK FOR SPARK FROM COIL WIRE WITH SPARK TESTER AS TEST BATTERY IS REMOVED FROM MODULE TERMINAL.

NO DROP IN VOLTAGE

CHECK DISTRIBUTOR IGNITION CONTROL MODULE GROUND. IF OK, REPLACE DISTRIBUTOR IGNITION MODULE.

NO SPARK

- IF NO MODULE TESTER J 24642 IS AVAILABLE; REPLACE IGNITION COIL AND REPEAT STEP 5.

NO SPARK

IGNITION COIL REMOVED IS OK, REINSTALL COIL AND CHECK COIL WIRE FROM IGNITION COIL TO SPARK TESTER (ST-125). IF OK, REPLACE DISTRIBUTOR DISTRIBUTOR IGNITION CONTROL MODULE.

SPARK

SYSTEM OK.

- IF MODULE TESTER J 24642 IS AVAILABLE: TEST DISTRIBUTOR IGNITION CONTROL MODULE.

OK

CHECK COIL WIRE FROM ST-125 TO COIL. IF OK, REPLACE COIL.

NOT OK

REPLACE DISTRIBUTOR IGNITION CONTROL MODULE.

SPARK

CHECK PICK-UP COIL OR CONNECTIONS. (COIL RESISTANCE SHOULD BE 500-1500 OHMS AND NOT GROUNDED.)

YES

CK RELUCTOR TO BE SECURE TO DISTRIBUTOR SHAFT. IF LOOSE, REPLACE DISTRIBUTOR SHAFT.

NO

REPLACE PICKUP COIL.

## ON-VEHICLE SERVICE

## IGNITION SYSTEM

Refer to SECTION 6D for on-vehicle service of distributor, pick-up coil, distributor cap, ignition coil, rotor, or distributor module.

## SETTING TIMING

*Figures 6A-2 and 6A-3*

Set timing according to instructions on "Vehicle Emission Control Information" label under the hood.

Timing specifications for each engine are listed on the "Vehicle Emissions Control Information" label on the radiator support. When using a timing light, connect an adapter between the No. 1 spark plug and the No. 1 spark plug cable, or use an inductive type pickup. Do not pierce the spark cable plug. Once the insulation of the spark plug cable has been broken, voltage will jump to the nearest ground, and the spark plug will not fire properly. Always follow "Vehicle Emissions Control Information" label procedures when adjusting timing.

Some engines incorporate a magnetic timing probe hole for use with special electronic timing equipment. Consult manufacturer's instructions for use of this equipment.

The ignition system will go into bypass mode by disconnecting the timing connector. This is a single wire sealed connector that has a tan with black stripe lead. The connector breaks out of the engine wiring harness conduit adjacent to the distributor. The ignition timing specification for LB4 engines is 0° BTDC, L03 and L05 engines are 0° BTDC. The L19 engines are 4° BTDC.

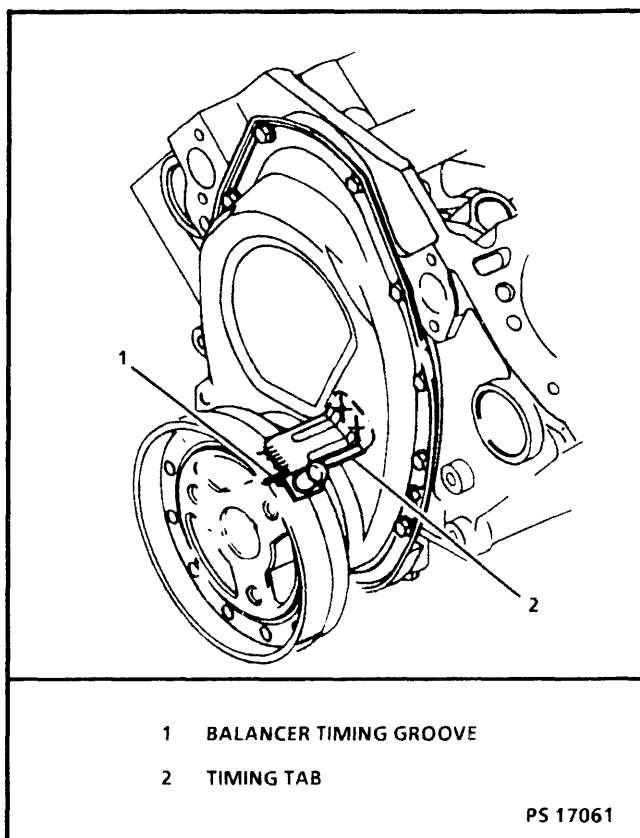


Figure 6A-2 - Distributor Ignition Timing Mark  
Location 4.3L

## IC SYSTEM

Refer to SECTION 6D of appropriate service manual for replacement of the distributor module.

Refer to SECTION 3A or 3B for repair of IC wires, connectors and for replacement of the control module.

## PARTS INFORMATION

| PART NAME           | GROUP |
|---------------------|-------|
| Distributor .....   | 2.361 |
| Module, Distr ..... | 2.383 |
| Coil, Distr .....   | 2.170 |

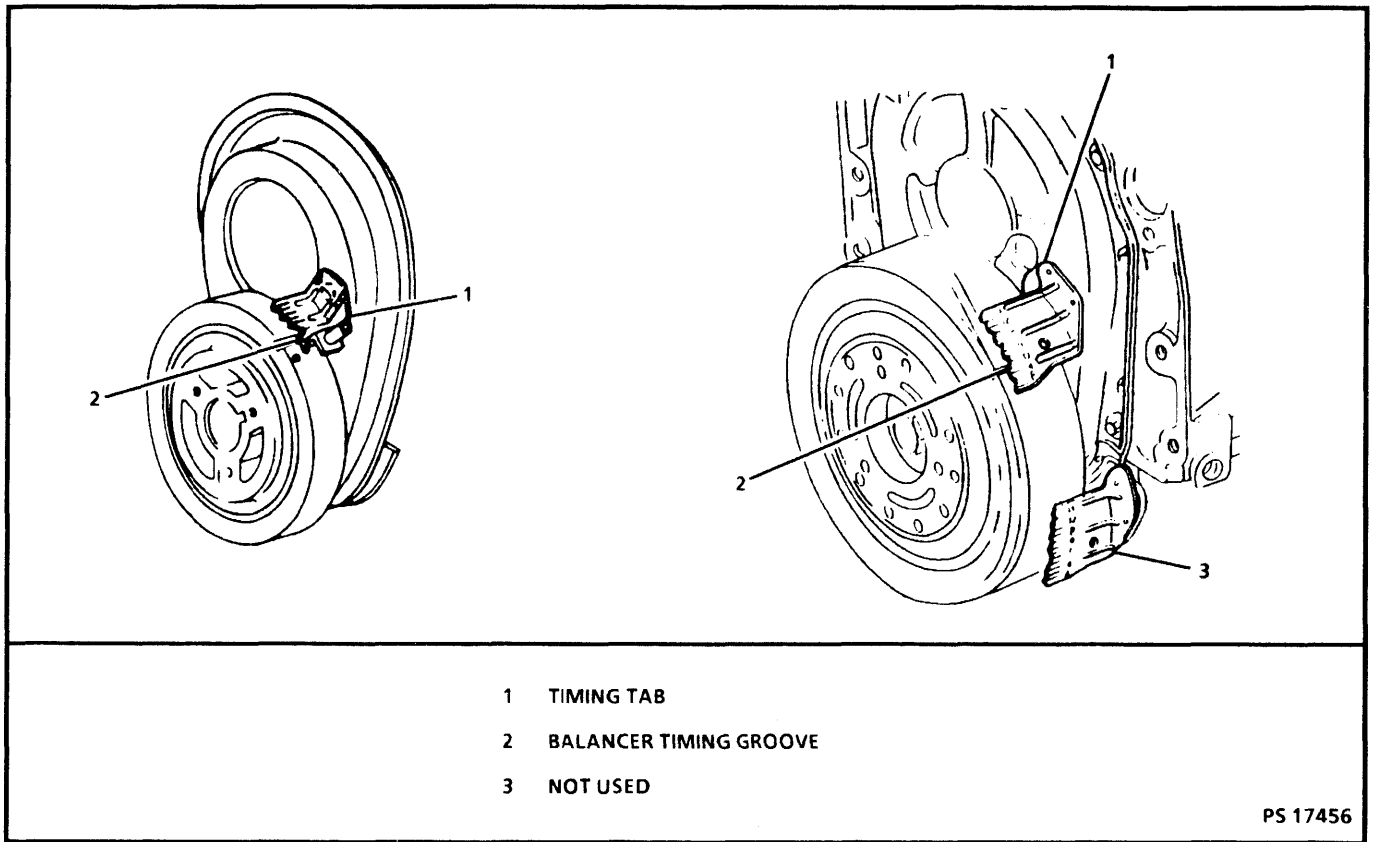


Figure 6A-3 - Distribution Ignition Timing Mark Location 5.0L, 5.7L, 7.4L

**BLANK**

## SECTION 7

# KNOCK SENSOR (KS) SYSTEM

### CONTENTS

|                               |     |                                              |      |
|-------------------------------|-----|----------------------------------------------|------|
| General Description .....     | 7-1 | Knock Sensor (KS) System Check - with Manual |      |
| Purpose .....                 | 7-1 | Transmission and ECM 5.0L, 5.7L .....        | 7-4  |
| Operation .....               | 7-1 | Knock Sensor (KS) System Check (Single Knock |      |
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| Knock Sensors (KS) DTCs ..... | 7-2 | Sensor System) 4.3L .....                    | 7-8  |
| DTC: 43 (ECM and PCM) .....   | 7-2 | On-Vehicle Service .....                     | 7-10 |
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### GENERAL DESCRIPTION

#### PURPOSE

Varying octane levels in today's gasoline can cause detonation (also known as spark knock) in an engine.

The Knock Sensor (KS) system has two knock sensors that are used on 4.3L engines. All other applications use one knock sensor. The KS system reduces spark knock (detonation) in the engine. This allows the engine to have maximum spark advance for improved driveability and fuel economy.

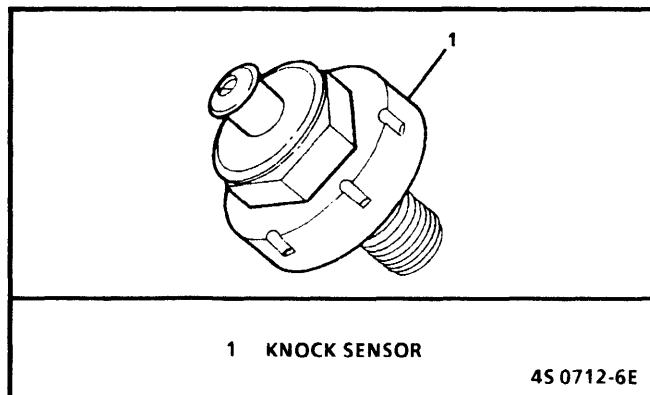


Figure 7-1 - Knock Sensor

#### OPERATION

A control module (ECM or PCM) is used in conjunction with one or two knock sensors to control detonation. A KS module will be found on ECM applications. On PCM application no KS module will be found as it is internal to the control module.

A 5 volt reference is applied to the knock sensor(s) which has an internal resistance of about 8200 ohms on dual knock systems. On single knock systems the resistance of the knock sensor is 3900 ohms. This resistance will lower the applied voltage to about half or 2.5 volts. When a knock is present, a small AC voltage is produced by the knock sensors and transmitted to the control module riding on top of the already existing 2.5 volts. An AC voltage monitor inside the control module will detect the knock and trigger the control module to start retarding the spark incrementally.

### DIAGNOSIS

#### KNOCK SENSORS

Two separate diagnostic checks are performed by the control modules. The first check monitors the voltage on the KS circuit and if the voltage is below about .63 or over about 3.1, DTC 43 will set. The second check, is a system performance check. It is only used on vehicle's equipped with an ECM. During the course of operation, the ECM will begin advancing the timing in increments while anticipating a knock signal. If no signal appears after the self check has advanced 32°, DTC 43 will set.

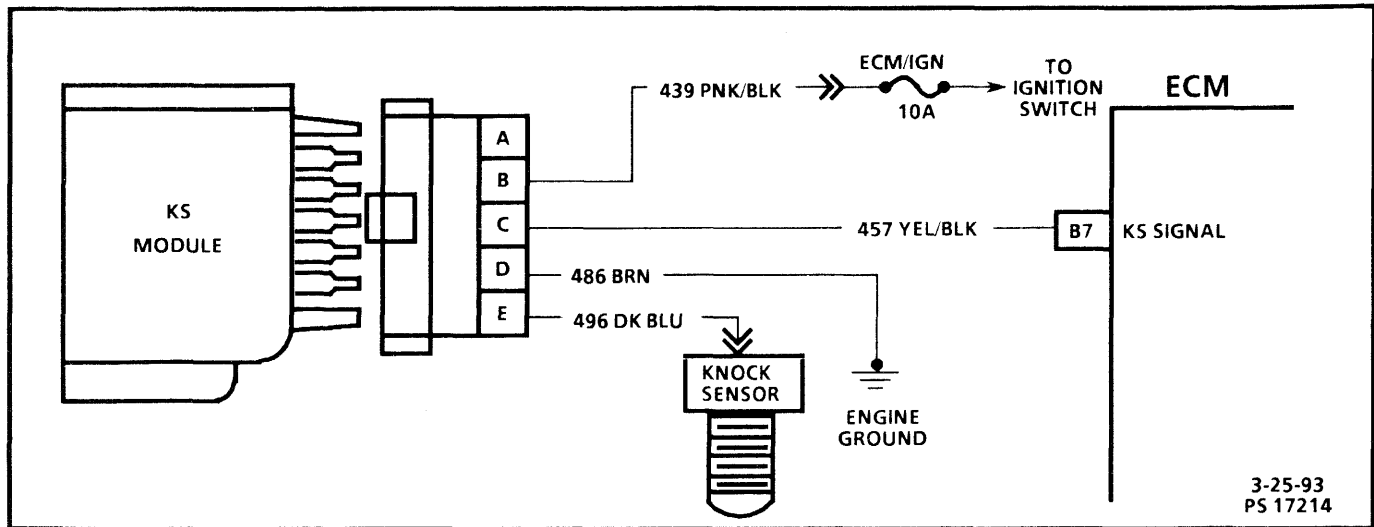
#### KNOCK SENSORS (KS) DTCs

##### DTC: 43 (ECM and PCM)

Diagnostic Trouble Code (DTC) 43 will set when system is in a self check, and voltage on the KS circuit is above or below the specified range. Refer to SECTION 3A and 3B.

**BLANK**





## KNOCK SENSOR (KS) SYSTEM CHECK

### WITH MANUAL TRANSMISSION AND ECM 5.0L, 5.7L

#### Circuit Description:

The Knock Sensor (KS) system has a module that sends a voltage signal to the ECM. As the knock sensor detects detonation, the voltage from the KS module to the ECM will drop. This signal allows the ECM to retard timing. The ECM will retard the timing when knock is detected and RPM is above 900 RPM. Diagnostic Trouble Code (DTC) 43 will set when the ECM has detected low voltage at CKT 457 on terminal "B7" for longer than 5 seconds with the engine operating or when the system has failed the functional check.

The ECM continually monitors voltage on CKT 457 on terminal "B7".

The ECM will advance the spark timing when:

- Engine coolant temperature is above 95°C.
- Engine is under heavy load (near WOT).

The ECM will then check the signal voltage at terminal "B7" to determine if knock is detected. If no knock is detected, the Malfunction Indicator Lamp (MIL) will remain "ON" until the next ignition cycle, or until a knock signal is detected. The functional check will only be performed once per ignition cycle.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

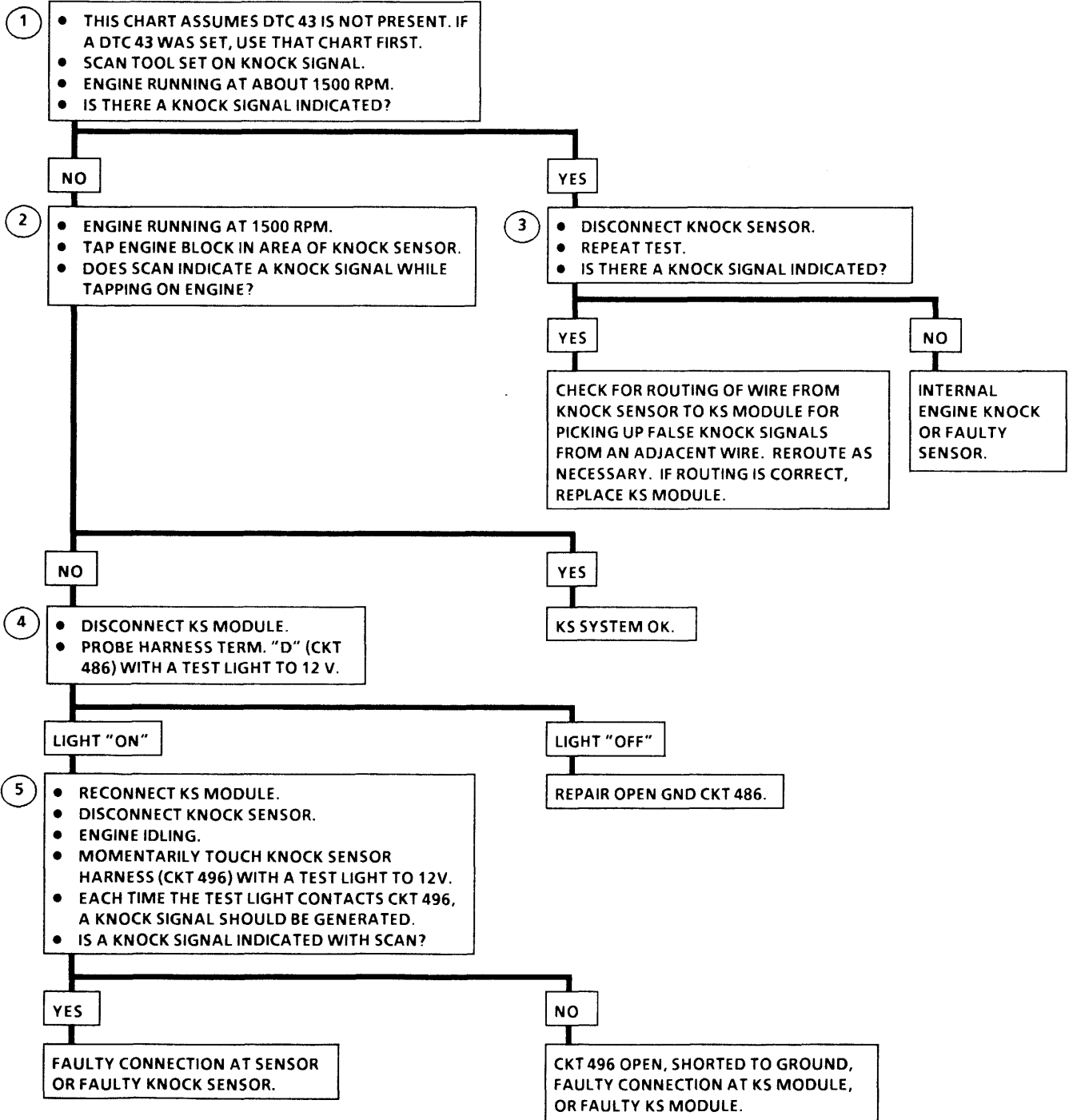
1. If a DTC 43 is not set, but a knock signal is indicated while operating at 1500 RPM, listen for an internal engine noise. Under a no load condition there should not be any detonation, if knock is indicated, an internal engine problem may exist.
2. Usually a knock signal can be generated by tapping on the right exhaust manifold. This test can also be performed at idle. Test Number 1 was run at 1500 RPM to determine if a constant knock signal was present, affecting engine performance.
3. This tests whether the knock signal is due to the sensor, a basic engine problem, or the KS module.
4. If the module ground circuit is faulty, the KS module will not function correctly. The test light should light indicating the ground circuit is OK.

5. Contacting CKT 496 with a test light to 12 volts should generate a knock signal to determine whether the knock sensor is faulty, or the KS module can't recognize a knock signal.

**Diagnostic Aids:** Scan tools may be used to diagnose the KS system. The knock signal can be monitored to see if the knock sensor is detecting a knock condition and if the KS module is functioning, knock signal should display "YES," whenever detonation is present. The ECM can retard the timing up to 20 degrees.

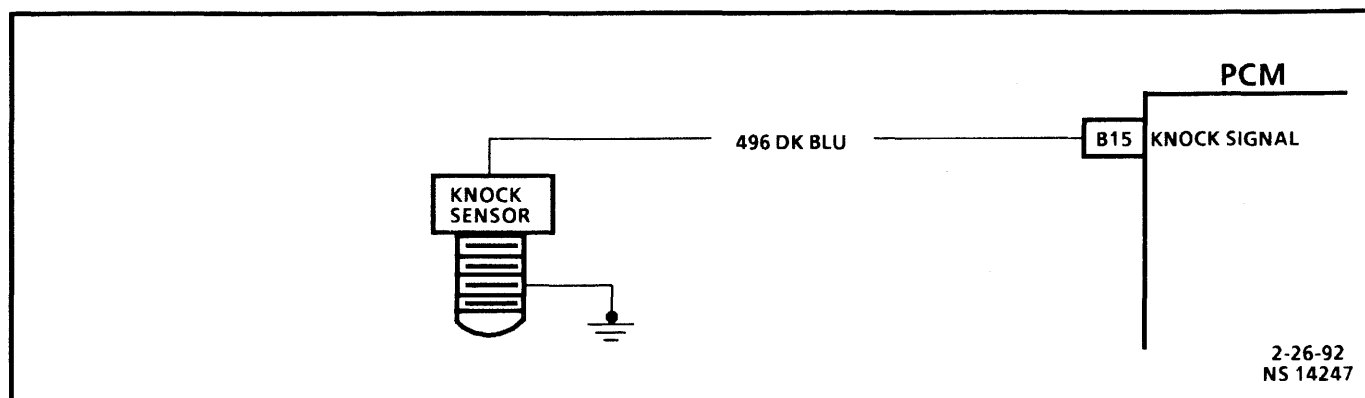
If the KS system checks OK, but detonation is the complaint, refer to "Detonation/Spark Knock" in SECTION 2.

# **KNOCK SENSOR (KS) SYSTEM CHECK** **WITH MANUAL TRANSMISSION AND ECM 5.0L, 5.7L**



"AFTER REPAIRS," REFER TO DTC CRITERIA ON FACING PAGE AND CONFIRM DTC DOES NOT RESET.

4-1-92  
75 3711



### KNOCK SENSOR (KS) SYSTEM CHECK (SINGLE KNOCK SENSOR SYSTEM) 5.0L , 5.7L, 7.4L

#### Circuit Description:

The Knock Sensor (KS) system consist of two knock sensors with one wire that goes directly to the PCM. There is a check performed by the PCM. The check consist of monitoring CKT 496 for a voltage that is more than .04 volt and less than 4.6 volts.

If the voltage is either too high or too low for 16 or more seconds, DTC 43 will set.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

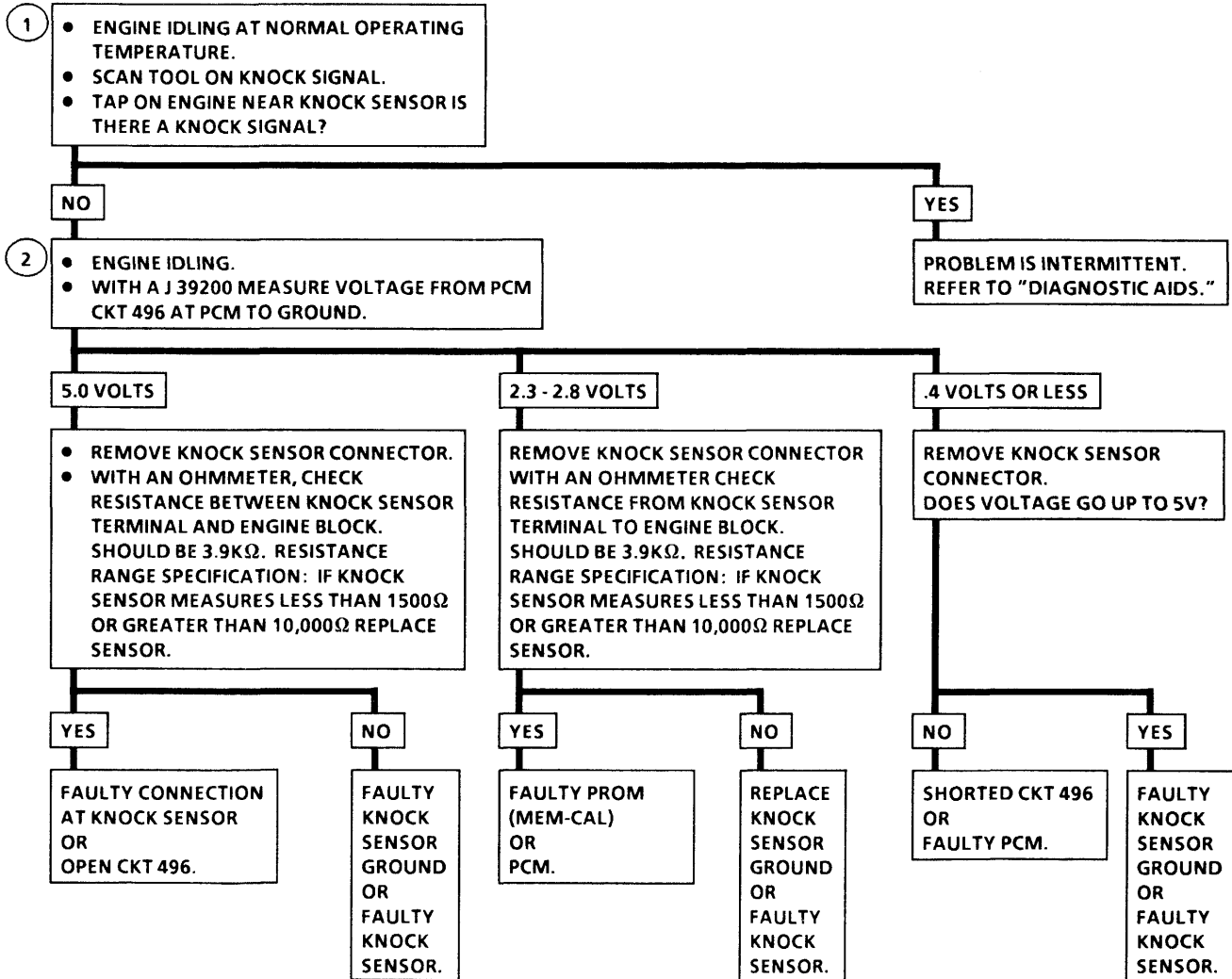
1. The first test is to determine if the system is functioning at the present time.
2. Test two determines the state of the 5 volt reference voltage applied to the knock sensor circuit.

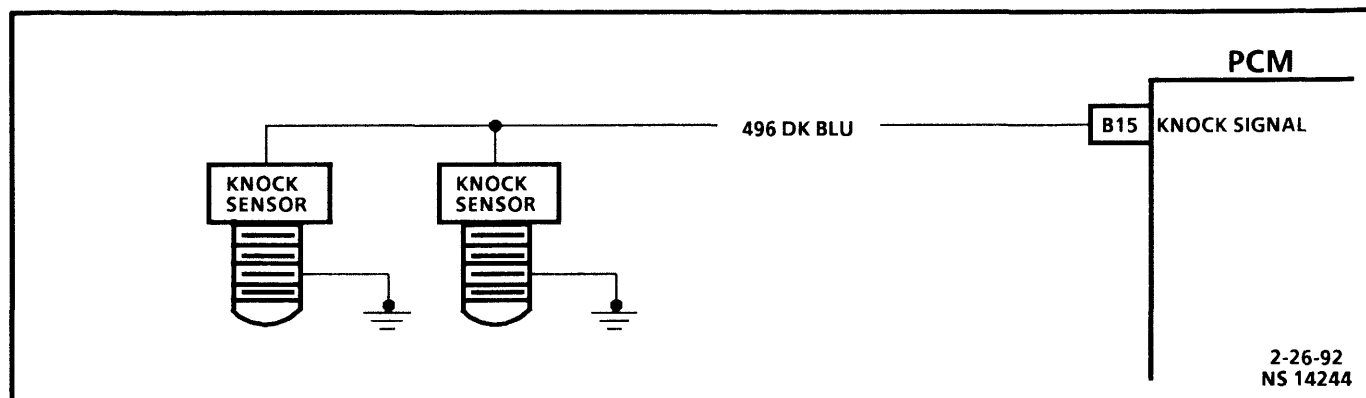
**Diagnostic Aids:** The PCM applies 5 volts to CKT 496. A 3900 ohm resistor in the knock sensors reduces the voltage to about 2.5 volts. When knock occurs, the knock sensor produces a small AC voltage that rides on top of the 2.5 volts already applied. An AC voltage monitor, in the PCM, is able to read this signal as knock and incrementally retard spark.

If the KS system checks OK, but detonation is the complaint, refer to "Detonation/Spark Knock" in SECTION 2.

# KNOCK SENSOR (KS) SYSTEM CHECK

## (SINGLE KNOCK SENSOR SYSTEM) 5.0L, 5.7L, 7.4L





### KNOCK SENSOR (KS) SYSTEM CHECK (DUAL KNOCK SENSOR SYSTEM) 4.3L

#### Circuit Description:

The Knock Sensor (KS) system consists of two knock sensors with one wire that goes directly to the control module. There is a Knock Sensor (KS) check performed by the PCM. The check consists of monitoring CKT 496 for a voltage that is more than .63 volt and less than 3.1 volts.

If the voltage is either too high or too low for 10 or more seconds, DTC 43 will set. The PCM uses this self check only.

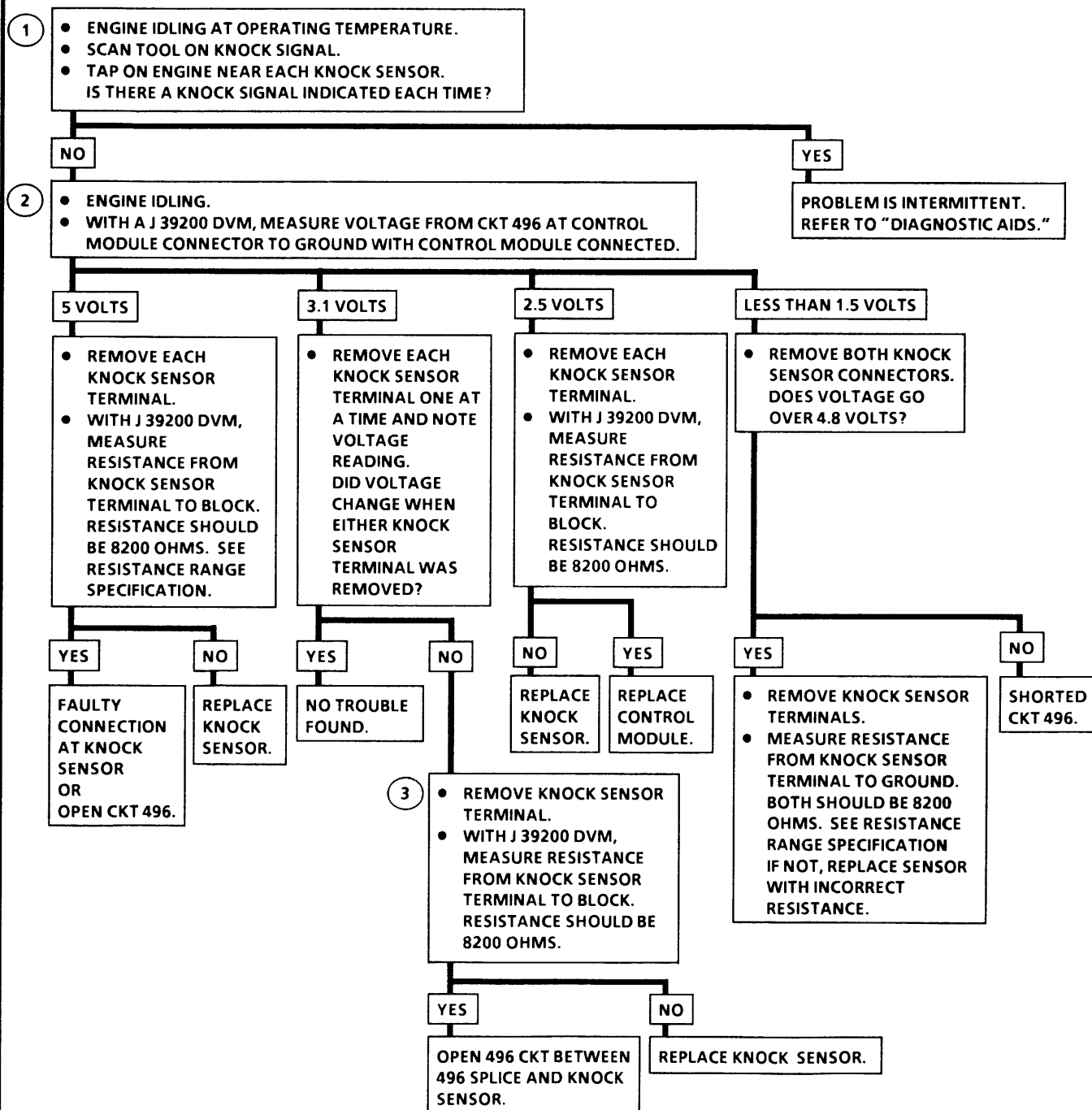
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test is to determine if the system is functioning at the present time.
2. Test two determines the state of the 5 volt reference voltage applied to the knock sensor circuit.
3. Test 3 determines the state of the knock sensors and connections themselves.

**Diagnostic Aids:** The control module applies 5 volts to CKT 496. A 8200 ohm resistor in the knock sensors reduces the voltage to about 2.5 volts. When knock occurs, the knock sensor produces a small AC voltage that rides on top of the 2.5 volts already applied. An AC voltage monitor, in the control module, is able to read this signal as knock and incrementally retard spark.

If the KS system checks OK, but detonation is the complaint, refer to "Detonation/Spark Knock" in SECTION 2.

## KNOCK SENSOR (KS) SYSTEM CHECK (DUAL KNOCK SENSOR SYSTEM) 4.3L



RESISTANCE RANGE SPECIFICATION: IF KNOCK SENSOR MEASURES LESS THAN 2100  $\Omega$  OR OPEN CIRCUIT REPLACE SENSOR.

4-20-93  
MS 10853

## ON-VEHICLE SERVICE

## KNOCK SENSORS

Figure 7-2

The knock sensors are located in areas of the cylinder heads and block. On most applications, the knock sensors are installed in a hole which is exposed to engine coolant. Care should be exercised when servicing these sensors.

### Remove or Disconnect

1. Negative battery cable.
2. Drain cooling system. Refer to SECTION 6B1.

**NOTICE:** On knock sensors which are mounted in the end of the cylinder head draining the cooling system will not be necessary.

3. Wiring harness connector from knock sensor.
4. Knock sensor from cylinder head or block.

### Install or Connect

1. Knock sensor into cylinder head or block. Apply water base caulk to sensor threads. Do not use silicon tape as this will insulate sensor from engine block.
  - Tighten to 19 N·m (14 lb. ft.).
2. Wiring harness connector to the knock sensor.
3. Negative battery cable.
4. Refill cooling system if required. Refer to SECTION 6B1.

## PARTS INFORMATION

| PART NAME                  | GROUP |
|----------------------------|-------|
| Control Module .....       | 3.670 |
| Module, Knock Sensor ..... | 2.393 |
| Sensor, Knock .....        | 3.682 |

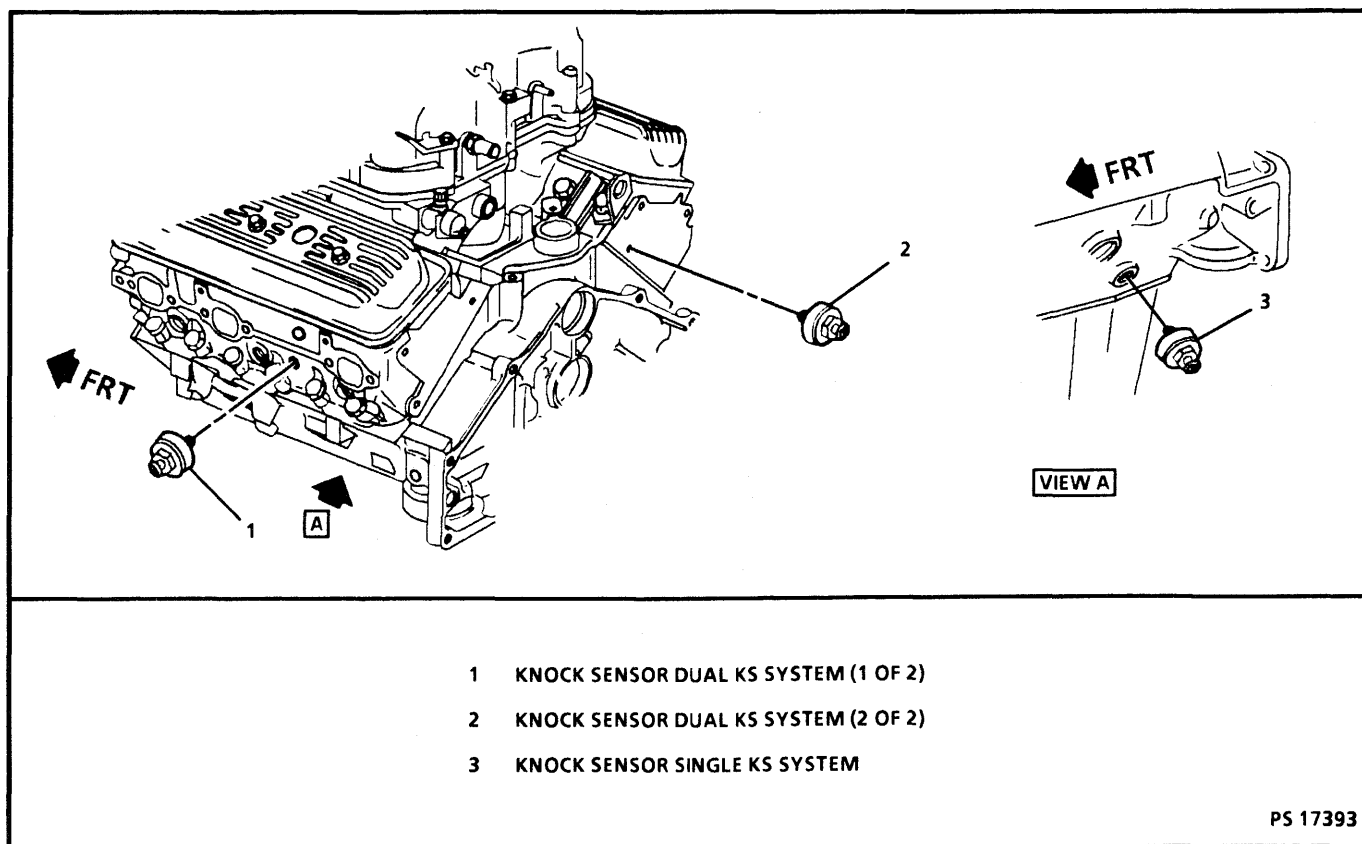


Figure 7-2 - Knock Sensors - 4.3L, 5.0L, 7.4L

## SECTION 8

# SECONDARY AIR INJECTION (AIR) SYSTEM

### CONTENTS

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|                            |     | Parts Information .....              | 8-7 |

### GENERAL DESCRIPTION

#### PURPOSE

The AIR management system is used on 5.7L (C/K) 10 series with standard transmission and California Emissions to reduce Carbon Monoxide (CO) and Hydrocarbon (HC).

This system, Secondary Air Injection (AIR) system, under certain conditions, adds air (oxygen) to the exhaust manifold to continue oxidation after the exhaust gases have left the combustion chamber. The heat from this reaction brings the catalytic converter up to operating temperature faster when the engine is cold.

#### AIR SYSTEM OPERATION

This system consists of an AIR pump, an (electric) AIR control valve with solenoid, check valve(s), and necessary plumbing.

A belt driven AIR pump supplies air through a centrifugal filter fan to the secondary AIR injection bypass valve (Figures 8-3 and 8-4). The shape of the centrifugal filter fan blades and the direction of fan rotation prevents foreign material from entering the pump with the incoming air. The AIR bypass valve directs the air to either the engine exhaust manifold ports or to the air cleaner.

The air cleaner acts as a silencer for diverted air. The check valve, on the AIR injection pipe, prevents back flow of the exhaust gases into the AIR pump.

When the engine is started with a coolant temperature above approximately 15°C (45°F), the ECM energizes the solenoid on the AIR control valve which directs air to the exhaust manifold ports.

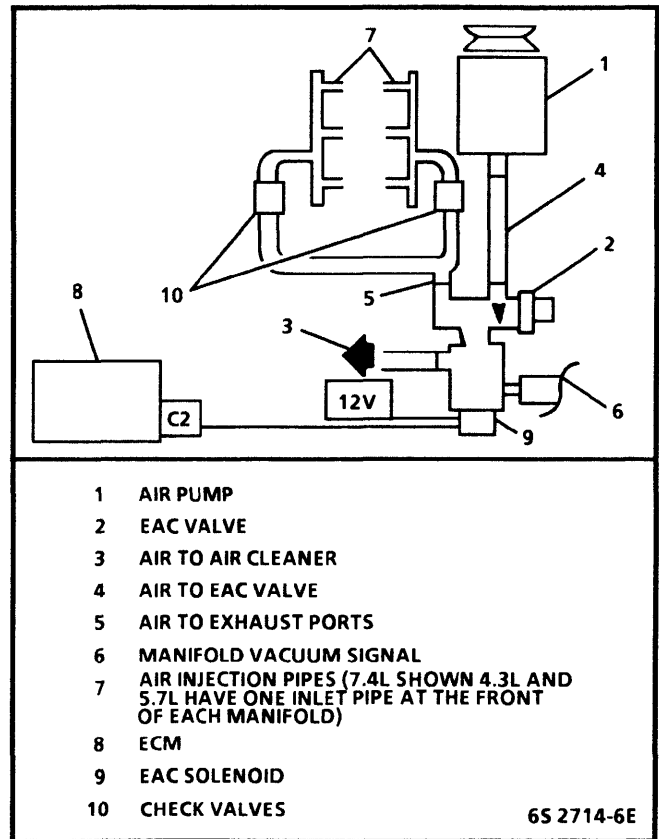


Figure 8-1 - AIR System

- At higher engine speeds, air can be redirected to the air cleaner by the pressure relief valve even though the solenoid is energized.
- Air can also be directed to the air cleaner because of:
  - Low manifold pressure (overrun).
  - Quick vacuum rise (rapid decel).
  - Rich engine condition.



## 8-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

3. The solenoid can be de-energized and air is directed to the air cleaner, under the following conditions:
- If the engine coolant temperature is too low.
  - If the throttle is opened to power enrichment for more than a short time.
  - If the system is in "Closed Loop" mode.
  - If the MIL (Service Engine Soon) is "ON."
4. Some applications will switch air to the ports for a short time when entering power enrichment. Also, note:
- Some applications have a "Closed Loop" idle with air directed to the air cleaner.

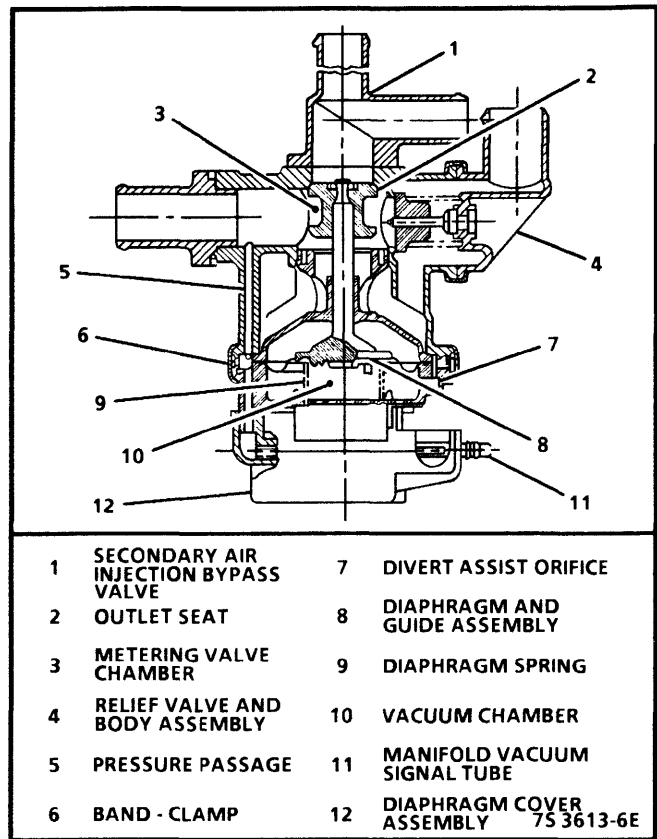


Figure 8-2 - AIR Bypass Valve

## DIAGNOSIS

### AIR SYSTEM

Refer to "Secondary Air Injection System Check" chart for the diagnosis of the AIR system.

**NOTICE:** If the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the centrifugal filter fan should be masked off to prevent liquids from entering the pump.

Air flowing to the exhaust ports at wrong times can cause a false lean O2S indication and cause the control module to add extra fuel. This will result in increased catalytic converter temperature, because more fuel and air will be oxidizing in the converter.

The AIR system is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases.

If noise is caused by the AIR system, check for:

- A seized AIR pump.
- Proper mounting and bolt torque of pump.
- Proper routing and connections of hoses.
- Replace pump if there is excessive noise.

### AIR Pump

**NOTICE:** The AIR pump is a positive displacement vane type which is permanently lubricated and requires no periodic maintenance.

Accelerate engine to approximately 1500 RPM and observe air flow from hose. If air flow increases as engine is accelerated, pump is operating satisfactorily. If air flow does not increase or is not present, proceed as follows:

#### Inspect

1. For proper drive belt tension.
2. For a leaking pressure relief valve. Air may be heard leaking with the pump running.

### Check Valve

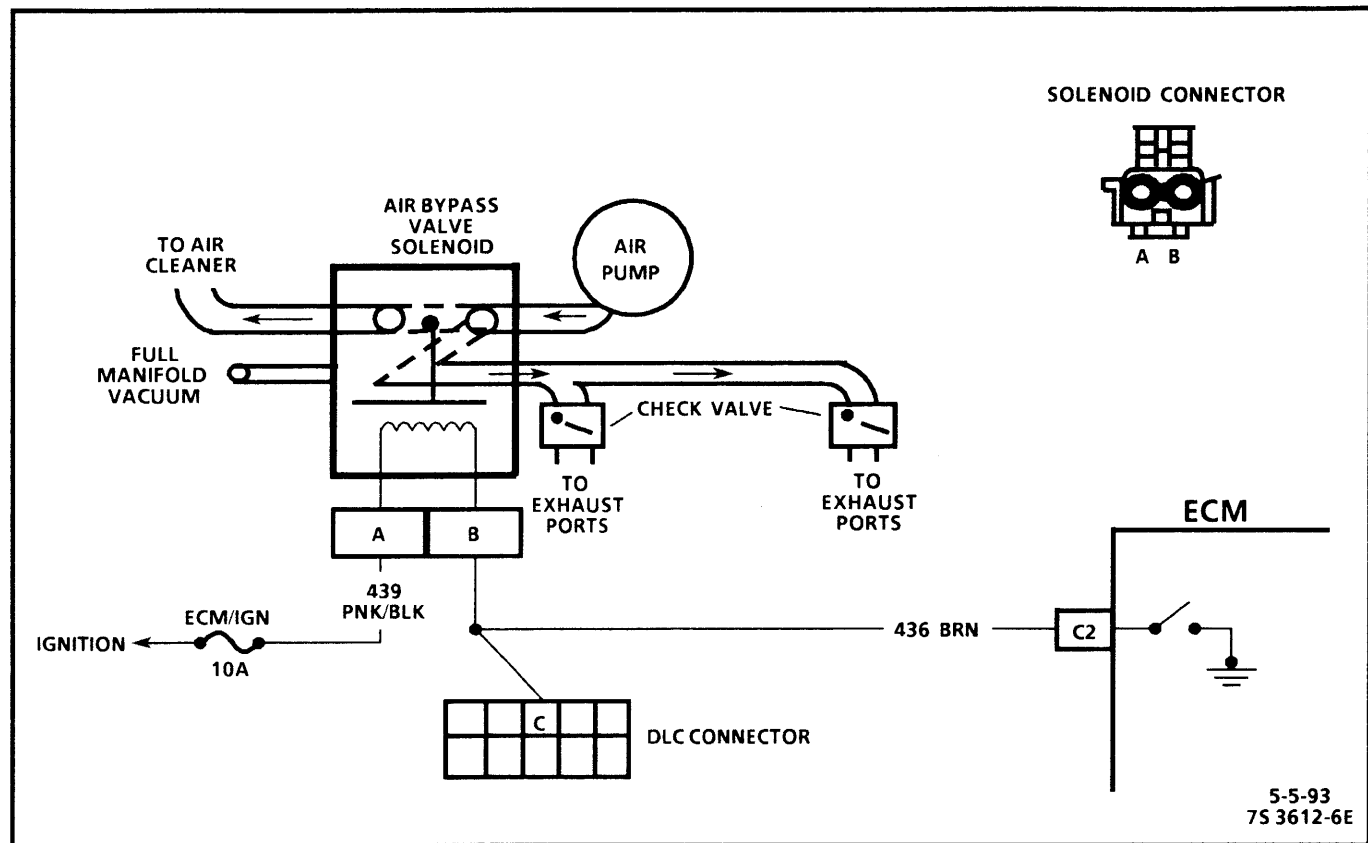
#### Inspect

1. A check valve should be inspected whenever the hose is disconnected from it or whenever check valve failure is suspected (a pump that has become inoperative and had shown indications of having exhaust gases in the pump would indicate check valve failure).
2. Remove the check valve.
3. Blow through the check valve toward the exhaust manifold side. Air should pass freely. Turn the valve around and attempt to blow through the valve toward the AIR pump side. No air should pass through the valve.
4. Replace valve which does not operate properly.

### Hoses and Pipes

#### Inspect

1. Hose or pipe for deterioration.
2. All hoses or pipe connections, and clamp torque.
3. Hose or pipe routing. Interference may cause wear.
4. When a leak on the pressure side is suspected, the area will need to be inspected.
  - Take a soapy water solution and inspect the area connections.
  - Bubbles will form at any bad connections when the pump is operating.



## SECONDARY AIR INJECTION SYSTEM CHECK (AIR BYPASS VALVE)

### Circuit Description:

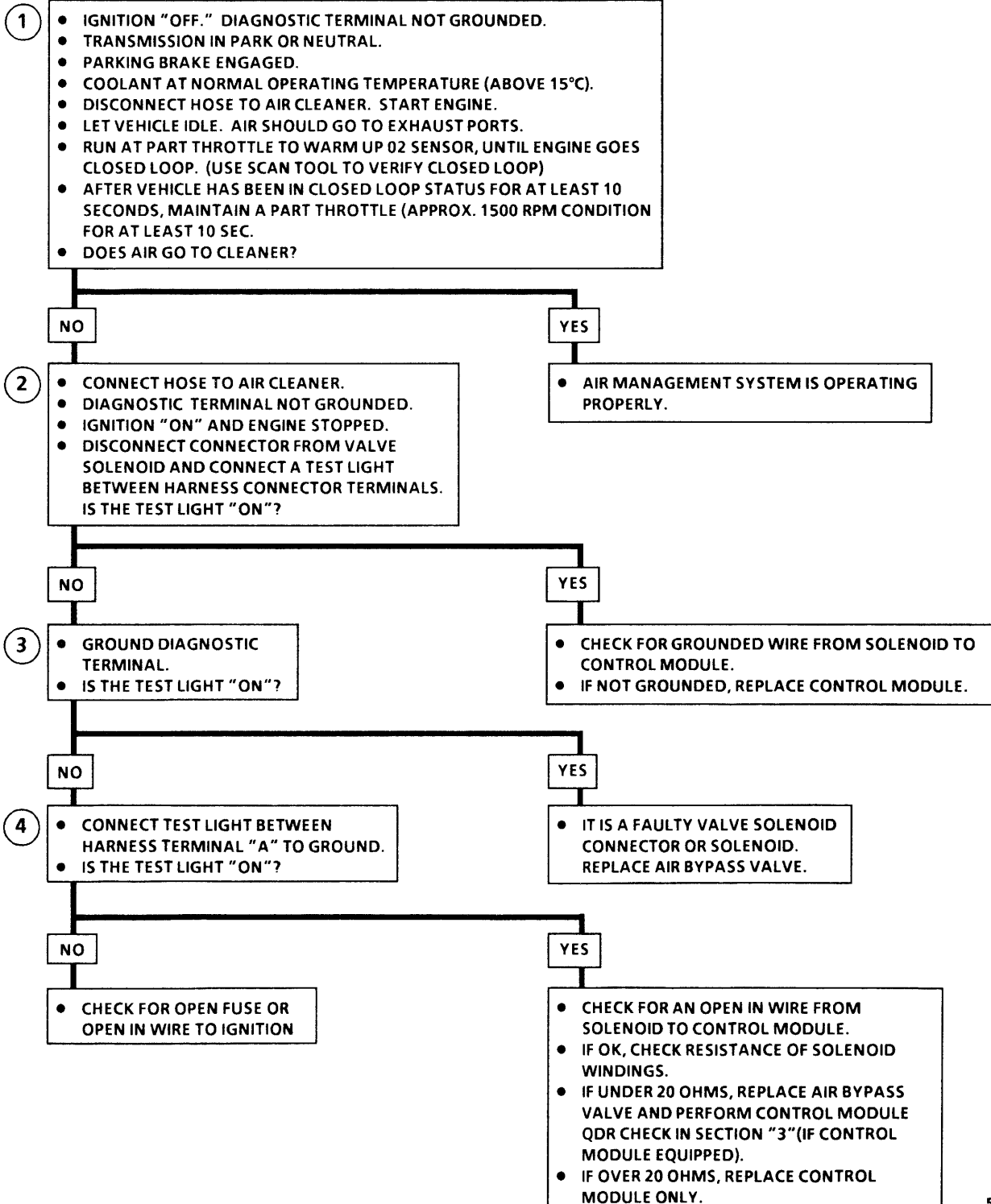
An electric AIR control valve solenoid directs air into the exhaust ports or the air cleaner. During cold start the control module completes the ground circuit, the solenoid is energized, and air is directed to the exhaust ports. As the system goes to "Closed Loop," the control module opens the ground circuit, the solenoid is de-energized, and air goes to the air cleaner.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This is a system performance test, to be performed if a malfunction is suspected or observed. When the vehicle goes to "Closed Loop," air will switch from the ports and divert to the air cleaner. (Under normal, steady-state condition, and vehicle not at idle.)
2. Tests for a grounded electric divert circuit. Normal system light will be "OFF."
3. Checks for an open control circuit. Grounding diagnostic terminal will energize the solenoid, if control module and circuits are normal. In this step, if test light is "ON," circuits are normal and fault is in valve connections or valve.
4. Checks for voltage from battery through a fuse to the solenoid.

## SECONDARY AIR INJECTION SYSTEM CHECK (AIR BYPASS VALVE)

ASSUMES MANIFOLD VACUUM SIGNAL AT VALVE WITH ENGINE IDLING, AND VOLTAGE ON PIN A WITH IGNITION "ON."



### ON-VEHICLE SERVICE

#### DRIVE BELT

##### Remove or Disconnect

- Refer to "Engine Cooling," SECTION 6 of the appropriate service manual.

#### PUMP CENTRIFUGAL FILTER FAN

The centrifugal filter fan should not be cleaned, either with compressed air or solvents.

**NOTICE:** Centrifugal fan should not be removed from pump unless it is damaged, as removal will destroy the fan.

Before removing fan, note the following:

- Do not allow any filter fragments to enter the AIR pump intake hole.
- Do not remove filter fan by inserting a screwdriver between pump and filter fan. Damage to pump sealing lip will result.
- Do not remove metal drive hub from filter fan.
- It is seldom possible to remove the filter fan without destroying it.

##### Remove or Disconnect

##### *Figure 8-3*

1. AIR pump.
2. Pump pulley.
3. Insert needle nose pliers and pull filter fan from pump hub.

##### Install or Connect

1. New filter fan on pump hub.
2. Spacer and pump pulley against centrifugal filter fan.
3. Pump pulley bolts and tighten equal to torque specifications in Figure 8-6. This will compress the centrifugal filter fan onto the pump hole. Do not drive filter fan on with a hammer. A slight amount of interference with the housing bore is normal. After a new filter fan has been installed, it may squeal upon initial operation or until O.D. of sealing lip has worn in. This may require a short period of pump operation at various engine speeds.
4. AIR pump.

#### AIR PUMP

##### *Figure 8-4*

##### Remove or Disconnect

1. Hold pump pulley from turning by compressing drive belt, then loosen pump pulley bolts.
2. Loosen bolt, holding pump to mounting brackets, release tension on drive belts.
3. Move belts out of the way, then remove pump hoses, vacuum and electrical connections, and control valve.
4. Pulley, then pump.
5. If required, insert needle nose pliers and pull filter fan from hub. Refer to Figure 8-5.

##### Install or Connect

1. AIR pump assembly, and tighten mounting bolts.
2. Hose.
3. New filter fan on pump hub.
4. Spacer and pump pulley against centrifugal filter fan.
5. Pump pulley bolts and tighten equally to torque specifications in Figure 8-6. This will compress the centrifugal filter fan onto the pump hole. Do not drive filter fan on with a hammer. A slight amount of interference with the housing bore is normal. After a new filter fan has been installed, it may squeal upon initial operation or until O.D. sealing lip has worn in. This may require a short period of pump operation at various engine speeds.
6. Pump drive belt and adjust.
7. Check AIR management system for proper operation. Refer to "Secondary Air Injection System Check" chart.

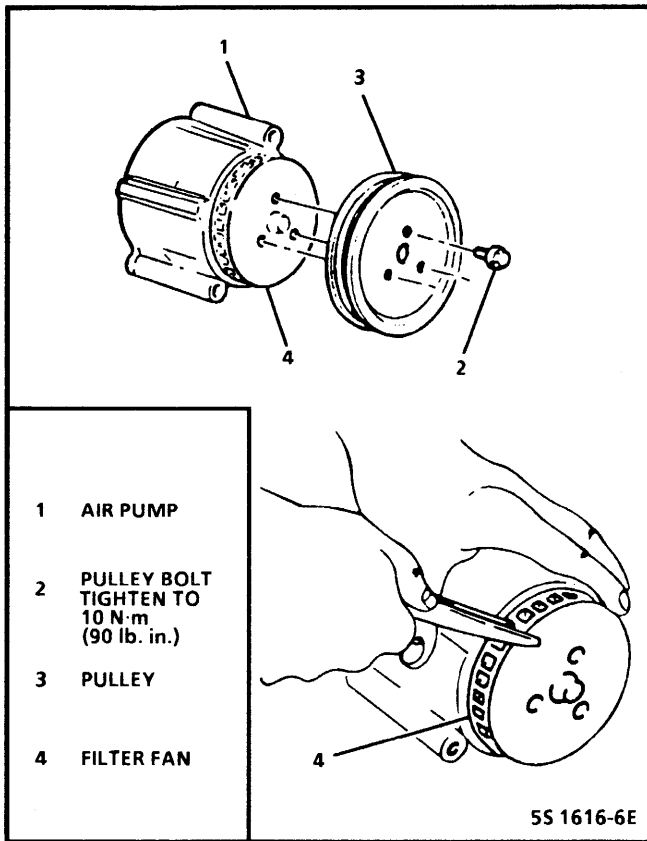


Figure 8-3 - Pump Filter Fan Service

## AIR CONTROL VALVE Figure 8-5

### Remove or Disconnect

1. Battery ground cable.
2. Electrical connector on control valve.
3. Manifold vacuum signal hose.
4. Air inlet and outlet hoses from valve.
5. Control valve.

### Install or Connect

1. Control valve.
2. Air inlet and outlet hoses to valve.
3. Manifold vacuum signal hose.
4. Electrical connector on control valve.
5. Battery ground cable.
6. Check system operation. Refer to "Secondary Air Injection System Check" chart.

## CHECK VALVE Figures 8-7 through 8-9

### Remove or Disconnect

1. Any parts required for access.
2. Release clamp and disconnect air hoses from check valve.
3. Unscrew check valve from AIR injection pipe.

### Install or Connect

1. Screw check valve onto AIR injection pipe.
2. Position air hose on check valve and secure with clamp.
3. Any parts removed for access.

## AIR INJECTION PIPE ASSEMBLY

### Remove or Disconnect

1. Hose.
2. Check valve.
3. Nuts attaching pipes-to-manifold.
4. Pipe assembly.

### Install or Connect

1. Nuts attaching pipes-to-manifold.
2. Check valve.
3. Hose.

## PARTS INFORMATION

| PART NAME                                 | GROUP  |
|-------------------------------------------|--------|
| Adapter, AIR Inj Cont Vlv . . . . .       | 3.675  |
| Bracket, AIR Inj Pump Supt . . . . .      | 3.655  |
| Bracket, AIR Inj Pump . . . . .           | 3.655  |
| Fan, AIR Pump . . . . .                   | 3.665  |
| Gasket, AIR Inj Dvtr Vlv El . . . . .     | 3.680  |
| Harness, AIR Inj Cont Vlv Vac . . . . .   | 3.675  |
| Hose, AIR Inj Cont Vlv . . . . .          | 3.675  |
| Hose, AIR Inj Cont Vlv Dvtr . . . . .     | 3.675  |
| Pulley, AIR Inj Pump . . . . .            | 3.650  |
| Pump, AIR Inj . . . . .                   | 3.660  |
| Valve, AIR Inj Cont . . . . .             | 3.670  |
| Valve, AIR Inj Eng Chk . . . . .          | 3.670  |
| Valve, AIR Inj Control (Divert) . . . . . | 3.670  |
| Valve, AIR Inj Switching . . . . .        | 3.670  |
| Bracket, AIR Inj C/Vlv . . . . .          | 3.671  |
| Hose, 5/8 ID x 25 ft. (GM6140) Heater . . | 8.962  |
| Pipe, AIR Inj Eng Chk Vlv . . . . .       | 3.675  |
| Valve, AIR Inj Eng Chk . . . . .          | 3.670B |
| Shield, AIR Inj Bypass Vlv . . . . .      | 3.675  |

## 8-8 DRIVEABILITY AND EMISSIONS (GASOLINE)

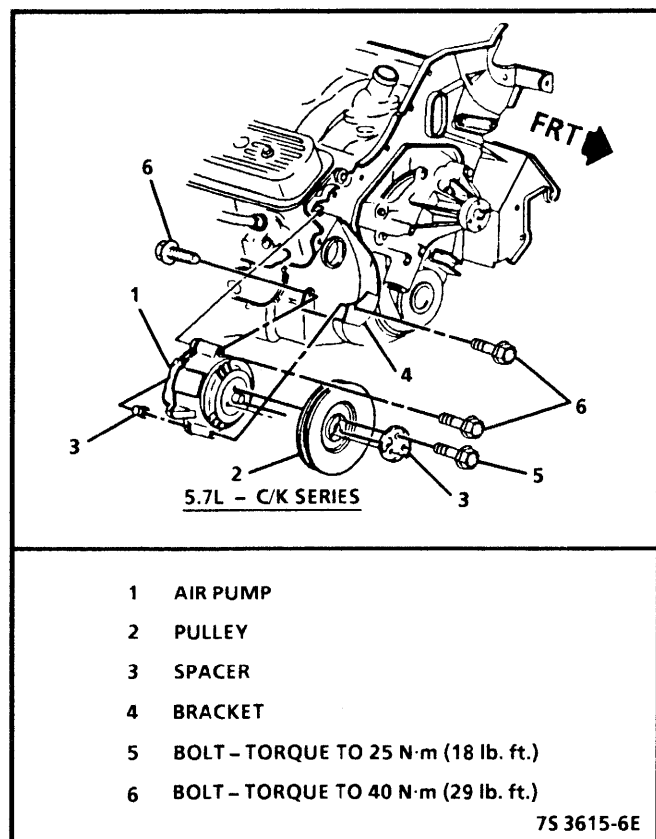


Figure 8-4 - Air Pump Mounting

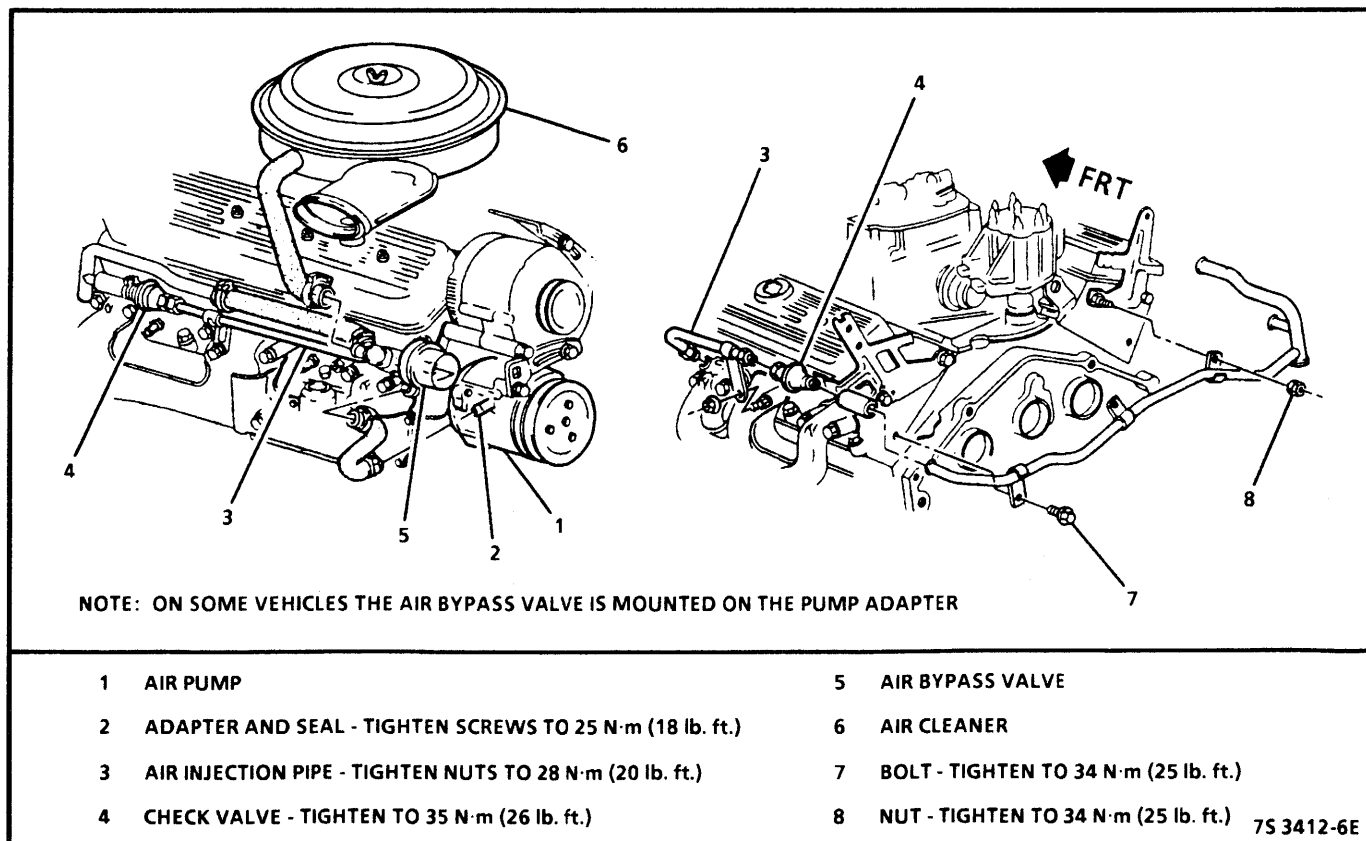


Figure 8-5 - Air System 5.7L - "C/K" Series

## SECTION 9

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

### CONTENTS

|                           |     |                                  |     |
|---------------------------|-----|----------------------------------|-----|
| General Description ..... | 9-1 | EGR Valves and Controllers ..... | 9-1 |
| Purpose .....             | 9-1 | EGR Application Chart .....      | 9-1 |
| Operation .....           | 9-1 | EGR Valve Identification .....   | 9-2 |

## GENERAL DESCRIPTION

### PURPOSE

The EGR system is designed to lower NO<sub>x</sub> (oxides of nitrogen) emission levels created by high combustion temperatures. The main element of the system is an EGR valve. The EGR valve opens in one of two ways, vacuum or electrical depending on which valve or control system is being used. On vehicles equipped with California emissions, a linear EGR valve and a cansiter purge solenoid are used in most applications.

### OPERATION

The EGR valve will open when conditions of operation have been met. The valve will open and allow exhaust gasses to reenter the combustion chamber. When too much exhaust gas is allowed to enter the chamber, proper combustion will not occur. For this reason only very little exhaust gas is allowed to re-enter the combustion chamber.



### Important

- When performing an inspection of the EGR system, Do Not connect exhausting shop air to the tailpipe of the vehicle. The vacuum created by the shop air could cause false EGR valve operation to occur.

## EGR VALVES AND CONTROLLERS

There are three types of EGR valves and the system used to control their operation by engine, vehicle, and control module, are listed in the following chart.

## EGR APPLICATION CHART

### Negative Backpressure EGR Valve With Solenoid

4.3L, 5.0L, 5.7L Under 8500 GVW

### Port EGR Valve With EVRV Solenoid

5.7L Above 8500 GVW

### Linear EGR Valve

4.3L (California Emissions)

7.4L All Applications



## 9-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

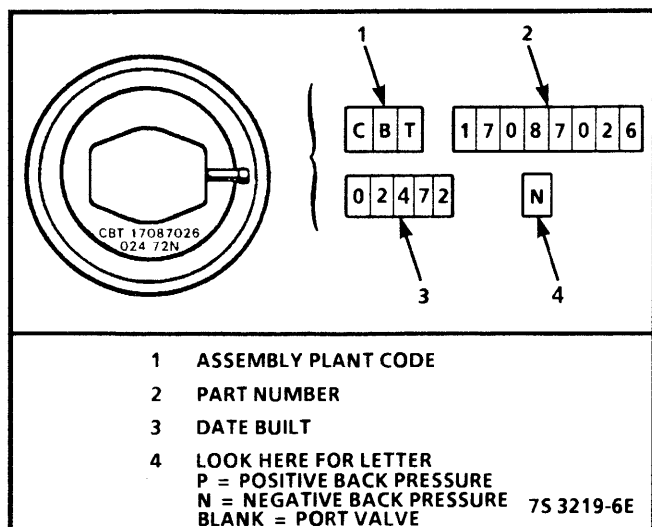


Figure 9-1 - EGR Valve Identification

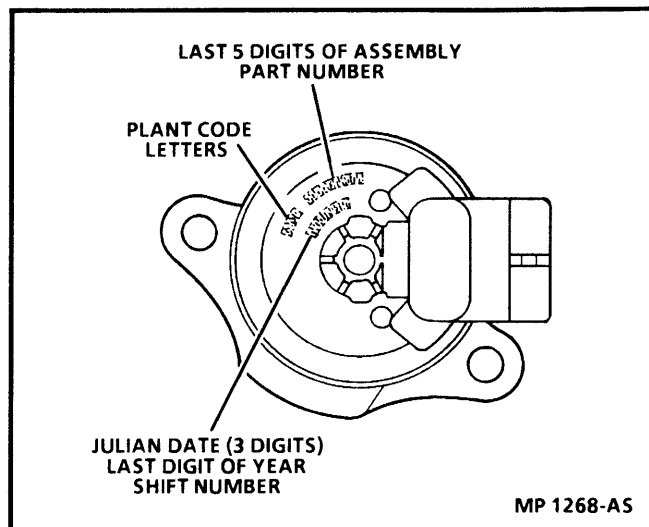


Figure 9-2 - Linear EGR Valve Identification Markings

### EGR VALVE IDENTIFICATION

#### Figures 9-1 through 9-3

1. Positive backpressure EGR valves will have a "P" stamped on the top side of the valve after the part number should not be used.
2. Negative backpressure EGR valves will have a "N" stamped on the top side of the valve after the part number.
3. Port EGR valves have no identification stamped after the part number.
4. Linear EGR valves look like a small motor. Refer to Figures 9-2 and 9-3.

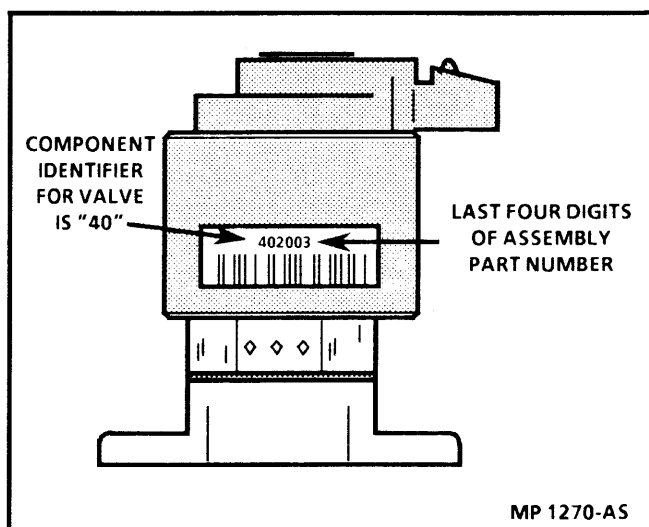


Figure 9-3 - Linear EGR Valve Part Number Label Location

## SECTION 9A

# LINEAR EGR VALVES

### CONTENTS

|                                              |      |                           |      |
|----------------------------------------------|------|---------------------------|------|
| General Description .....                    | 9A-1 | On-Vehicle Service .....  | 9A-6 |
| Diagnosis .....                              | 9A-2 | Linear EGR Valve Assembly |      |
| Results of Incorrect Operation .....         | 9A-2 | Replacement .....         | 9A-6 |
| System Check .....                           | 9A-2 | Parts Information .....   | 9A-6 |
| EGR System Check with Linear EGR Valve ..... | 9A-4 |                           |      |

### GENERAL DESCRIPTION

#### Figures 9A-1 through 9A-4

The linear EGR valve is operated exclusively by control module command. The control module monitors various engine parameters:

- Throttle Position (TP) sensor.
- Manifold Absolute Pressure (MAP).
- Engine Coolant Temperature (ECT) sensor.
- Pintle position sensor.

Output messages are then sent to the EGR system indicating the proper amount of exhaust gas recirculation necessary to lower combustion temperatures. This electronic metering of exhaust gas is ten times faster than vacuum-operated models and offers improved diagnostic capabilities as well.

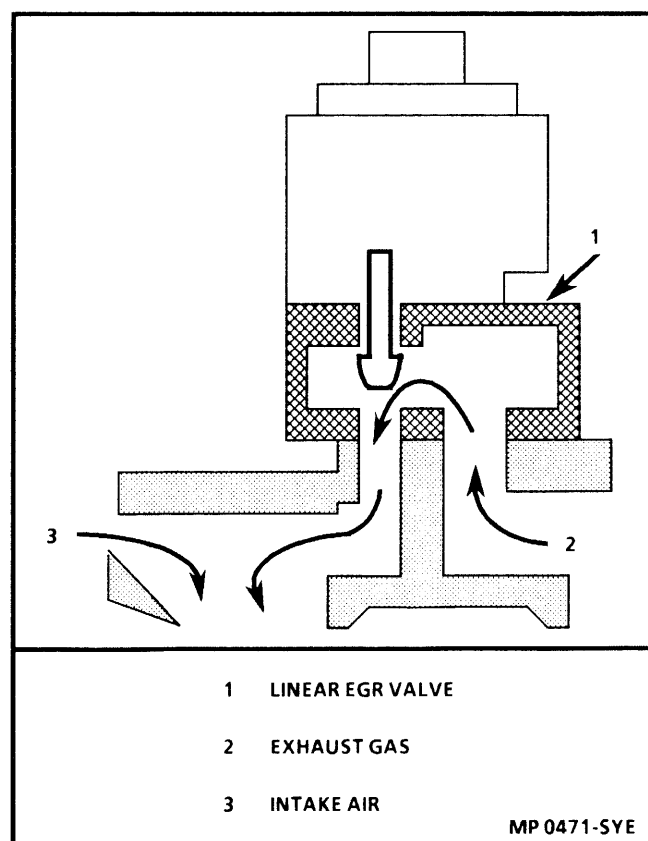


Figure 9A-1 - Exhaust Gas Flow

Positioned at the top of the linear EGR assembly are 5 terminals:

- "A" is the pulse width modulated negative signal from the control module.
- "E" is the positive from ignition.

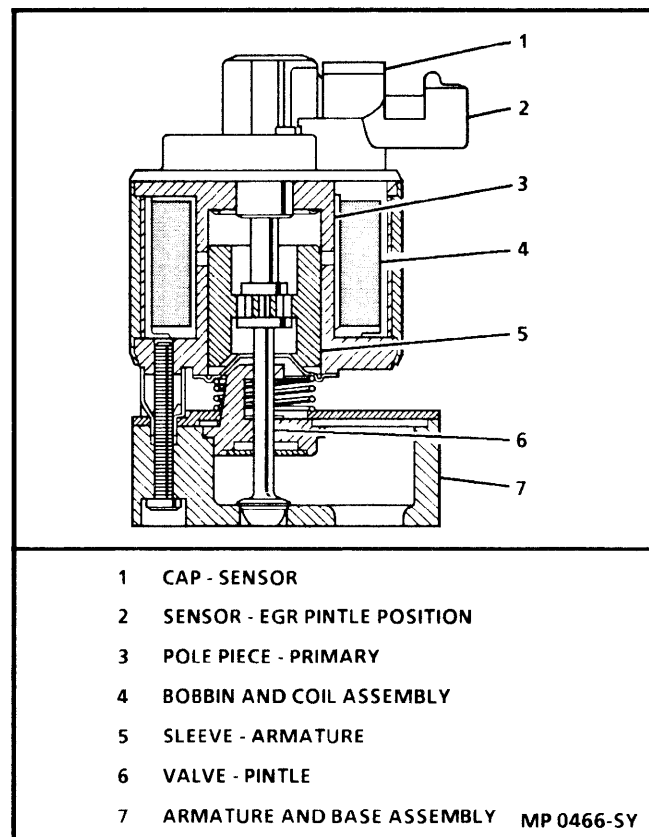


Figure 9A-2 - Linear EGR Valve - Subassemblies

- "B", "C" and "D" are terminals from the control module for the integral pintle position sensor.
  - "B" is sensor ground.
  - "C" is sensor output.
  - "D" is +5 volts supply.

## 9A-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

The solenoid (bobbin and coil) assembly is energized by 12 volt current which enters the valve through an electrical connector (terminal "E"), then flows through the solenoid assembly to the control module and creates an electromagnetic field. This field causes the armature assembly to be pulled upward, lifting the pintle a variable amount off the base.

The exhaust gas then flows from the exhaust manifold (through the orifice) to the intake manifold. The height of the pintle is read by the pintle position sensor, and the control module closes the loop on desired position versus actual position read, changing the pulse width modulated command to the solenoid accordingly, until the actual pintle position equals the desired pintle position.

This results in improved flow accuracy. In most EGR designs, the flow is "Open Loop," in which the system has no feedback mechanism to monitor actual flow and then to correct it.

The linear EGR valve is unique in that the control module continuously monitors pintle height and continuously corrects it in order to obtain accurate flow, making linear EGR a "Closed Loop" system.

When the solenoid is de-energized (control module breaks the circuit), the pintle is sealed against the orifice, blocking exhaust flow to the intake manifold.

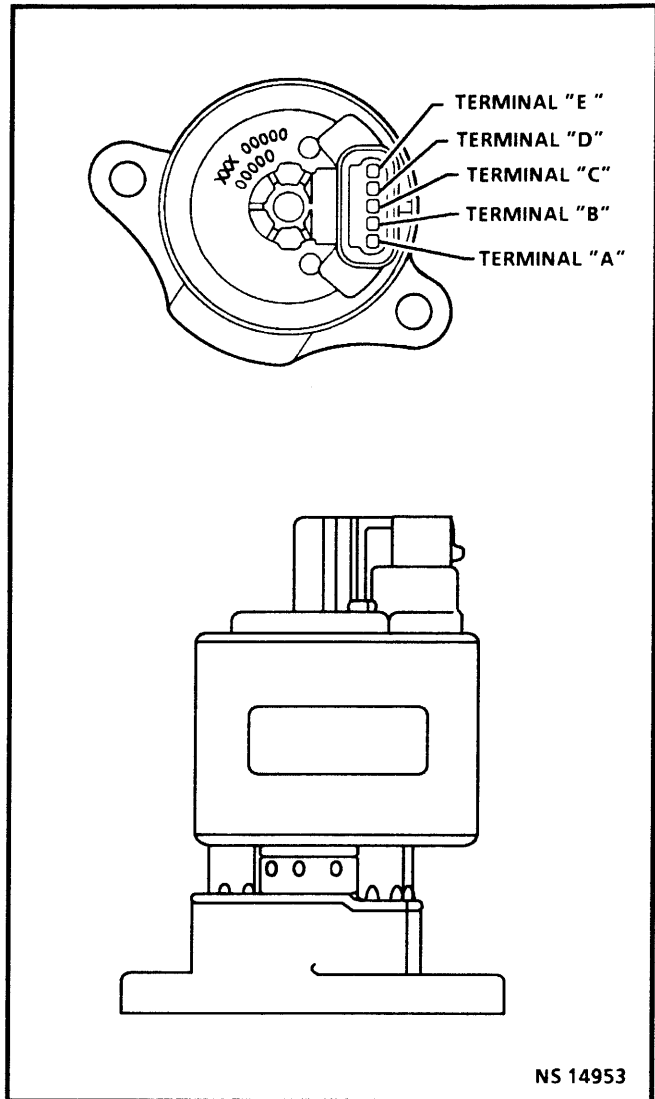


Figure 9A-3 - Electrical Connector

## DIAGNOSIS

### RESULTS OF INCORRECT OPERATION

With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- Engine stops after cold start.
- Engine stops at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

If the EGR valve should stay open all of the time, the engine may not idle.

- DTC 32 may set (refer to SECTION 3A).

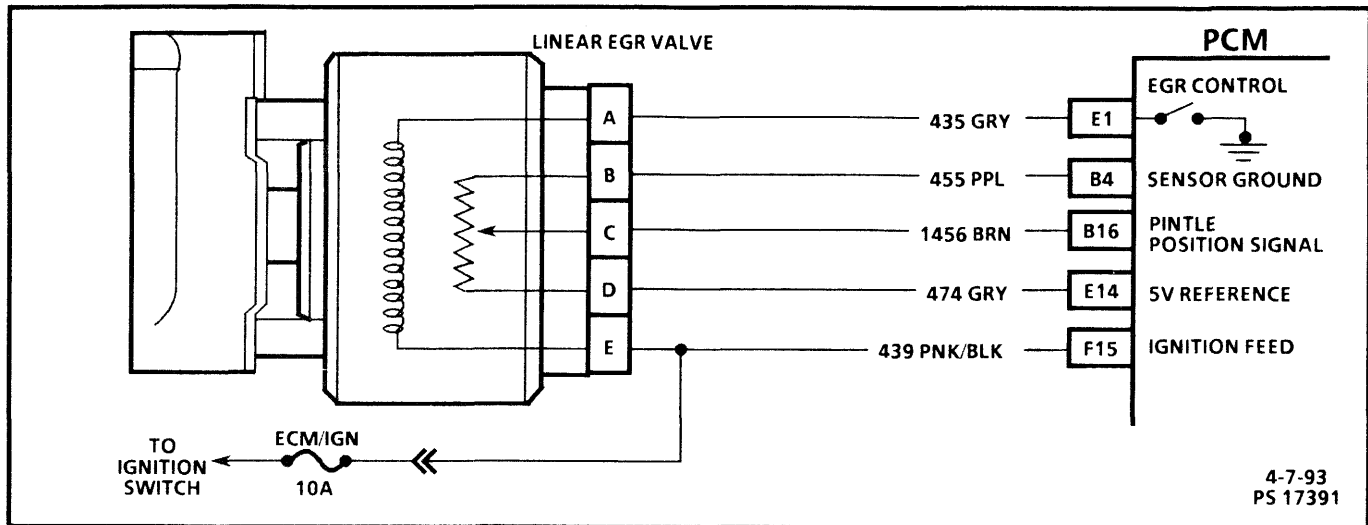
Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause:

- Spark knock (detonation).
- Engine overheating.

### SYSTEM CHECK

Diagnosis of the EGR system is covered in the following charts. These charts begin on Page 9A-4.

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## EGR SYSTEM CHECK WITH LINEAR EGR VALVE

### Circuit Description:

To control Exhaust Gas Recirculation (EGR), the control module operates the linear EGR valve. The linear EGR valve is a small motor with a pintle that is normally closed. By providing a ground path, the control module will open the pintle and allow exhaust gasses to pass through the valve. The control module control of the EGR is based on the following inputs:

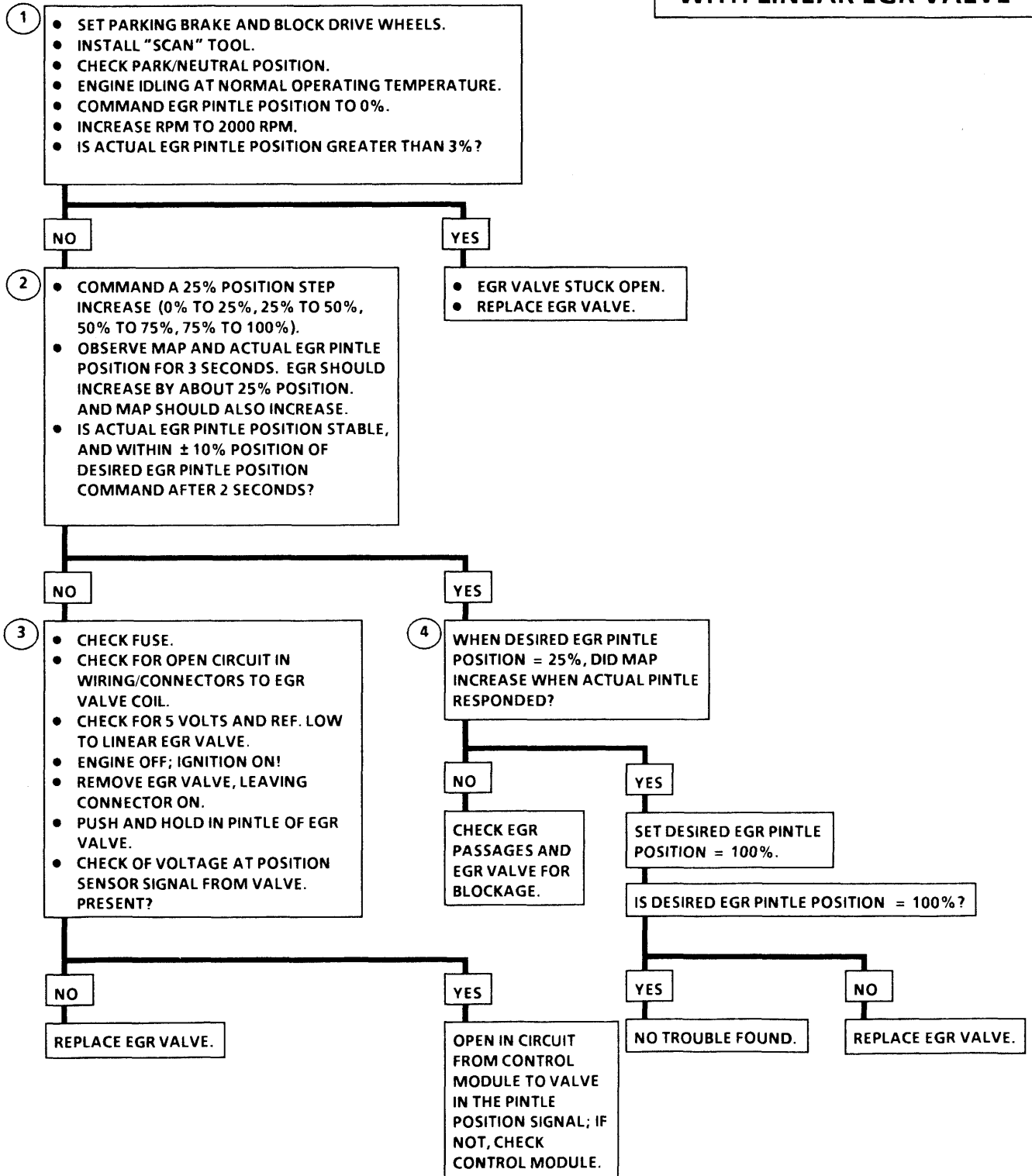
- Engine coolant temperature - above 25°C.
- TP - "OFF" idle.
- MAP.
- BARO.
- Park/neutral position.
- Pintle position sensor.

If DTC 32 is stored, refer to DTC 32 in SECTION 3A. This chart is used for faulty valve, plugged EGR passages, or improper wiring connections.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. At idle, the EGR valve should not be open greater than 3%. A faulty park/neutral position Trans Range (TR) position pressure switch or the EGR valve stuck open will allow exhaust gasses to enter the combustion chamber and create a rough idle condition.
2. Checks the pintle's ability to be manually commanded to the desired positions.
3. Checks the electrical circuit of the EGR valve and connecting components.
4. Checks for plugged EGR passages or a faulty EGR valve.

## EGR SYSTEM CHECK WITH LINEAR EGR VALVE



## ON-VEHICLE SERVICE

### LINEAR EGR VALVE ASSEMBLY REPLACEMENT

Figures 9A-4 and 9A-5

#### Remove or Disconnect

1. Electrical connector.
2. Valve to flange attaching bolts.
3. Linear EGR valve and gasket.

#### Install or Connect

1. EGR valve and new gasket.
2. Valve to flange attaching bolts.

#### Tighten

- Bolts to 2.4 N·m (17 lb. ft.).
3. Electrical connectors.

## PARTS INFORMATION

### PART NAME

### GROUP

|                         |       |
|-------------------------|-------|
| Valve, EGR .....        | 3.670 |
| Gasket, EGR Valve ..... | 3.680 |

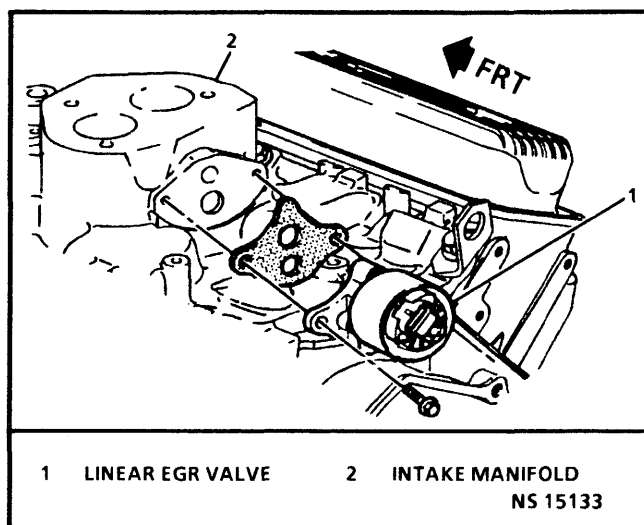


Figure 9A-4 - Linear EGR Valve Removal - 4.3

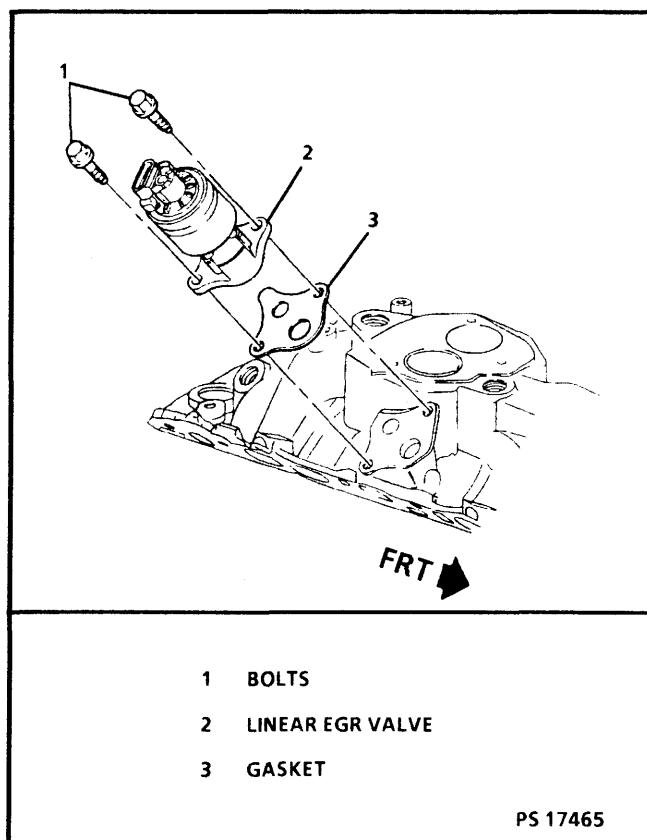


Figure 9A-5 - Linear EGR Valve Removal - 7.4

## SECTION 9B

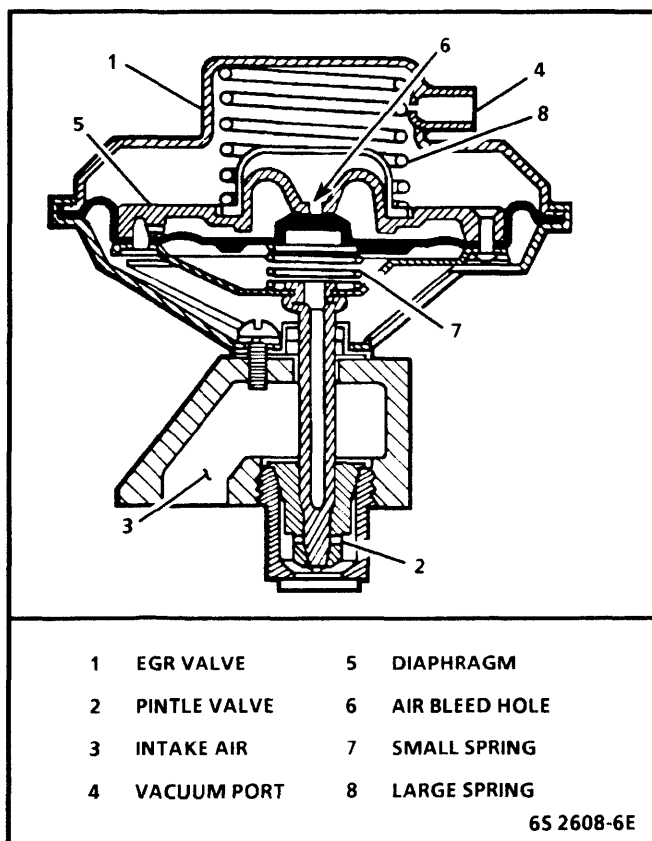
# NEGATIVE BACKPRESSURE EGR VALVE

### CONTENTS

|                                       |      |                                   |      |
|---------------------------------------|------|-----------------------------------|------|
| General Description .....             | 9B-1 | EGR System Check with Negative    |      |
| Negative Backpressure EGR Valve ..... | 9B-1 | Backpressure EGR Valve .....      | 9B-4 |
| EGR Control .....                     | 9B-1 | On-Vehicle Service .....          | 9B-6 |
| Solenoid with Negative Backpressure   |      | EGR Valve .....                   | 9B-6 |
| EGR Valve .....                       | 9B-1 | EGR Manifold Passage .....        | 9B-6 |
| Diagnosis .....                       | 9B-2 | System Hoses .....                | 9B-6 |
| Results of Incorrect Operation .....  | 9B-2 | EGR Vacuum Solenoid with Negative |      |
| System Check .....                    | 9B-2 | Backpressure and EGR Valve .....  | 9B-6 |
|                                       |      | Parts Information .....           | 9B-6 |

### GENERAL DESCRIPTION

The negative backpressure EGR valve in this system is operated by vacuum which is turned "ON" and "OFF" by a control module actuated solenoid.



**Figure 9B-1 - Negative Backpressure EGR Valve**

### NEGATIVE BACKPRESSURE EGR VALVE

**Figure 9B-1**

The negative backpressure EGR valve has the bleed valve spring below the diaphragm, and the valve is normally closed. The negative backpressure valve varies the amount of exhaust gas flow into the manifold depending on manifold vacuum and variations in exhaust backpressure.

The diaphragm on this valve has an internal air bleed hole which is held closed by a small spring when there is no exhaust backpressure.

Engine vacuum opens the EGR valve against the pressure of a large spring. When manifold vacuum combines with negative exhaust backpressure, the vacuum bleed hole opens and the EGR valve closes.

This valve will open if vacuum is applied with the engine not operating.

### EGR CONTROL

#### Solenoid With Negative Backpressure EGR Valve

**Figure 9B-2**

To regulate EGR flow a control module controlled solenoid is used in the vacuum line. This is a normally closed solenoid vacuum valve which is opened when the control module completes the ground. The control module will energize the EGR solenoid (EGR "ON") when the engine is warm and above idle. There is little EGR flow at wide open throttle due to lack of vacuum.



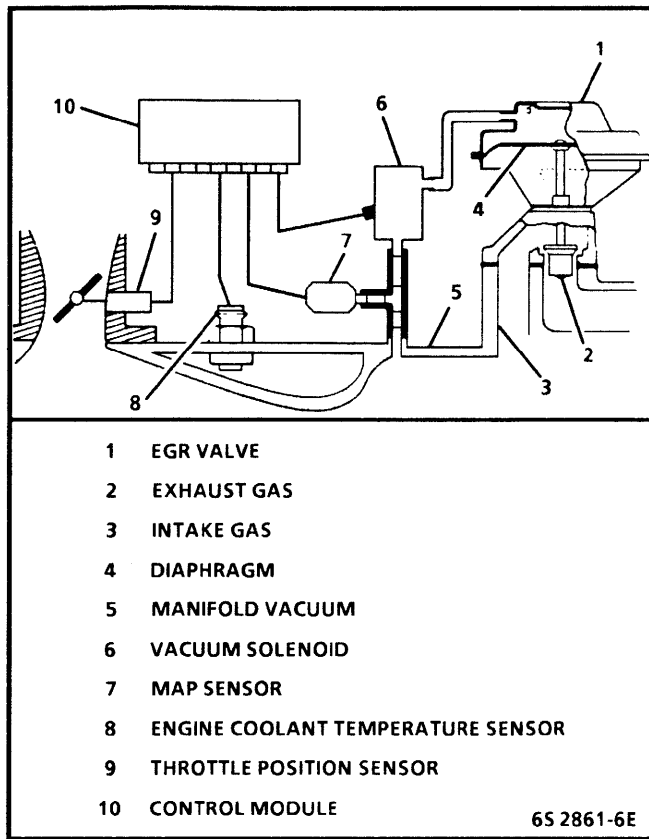


Figure 9B-2 - EGR System - With Solenoid

## DIAGNOSIS

### RESULTS OF INCORRECT OPERATION

With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- Engine stops after cold start.
- Engine stops at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

If the EGR valve should stay open all of the time, the engine may not idle.

- DTC 32 may set (refer to SECTION 3A or 3B).

Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause:

- Spark knock (detonation).
- Engine overheating.

### SYSTEM CHECK

Diagnosis of the EGR system is covered in the following charts.

**BLANK**

### Circuit Description:

- Engine coolant temperature - above 25°C.
- TP - "OFF" idle.
- MAP.

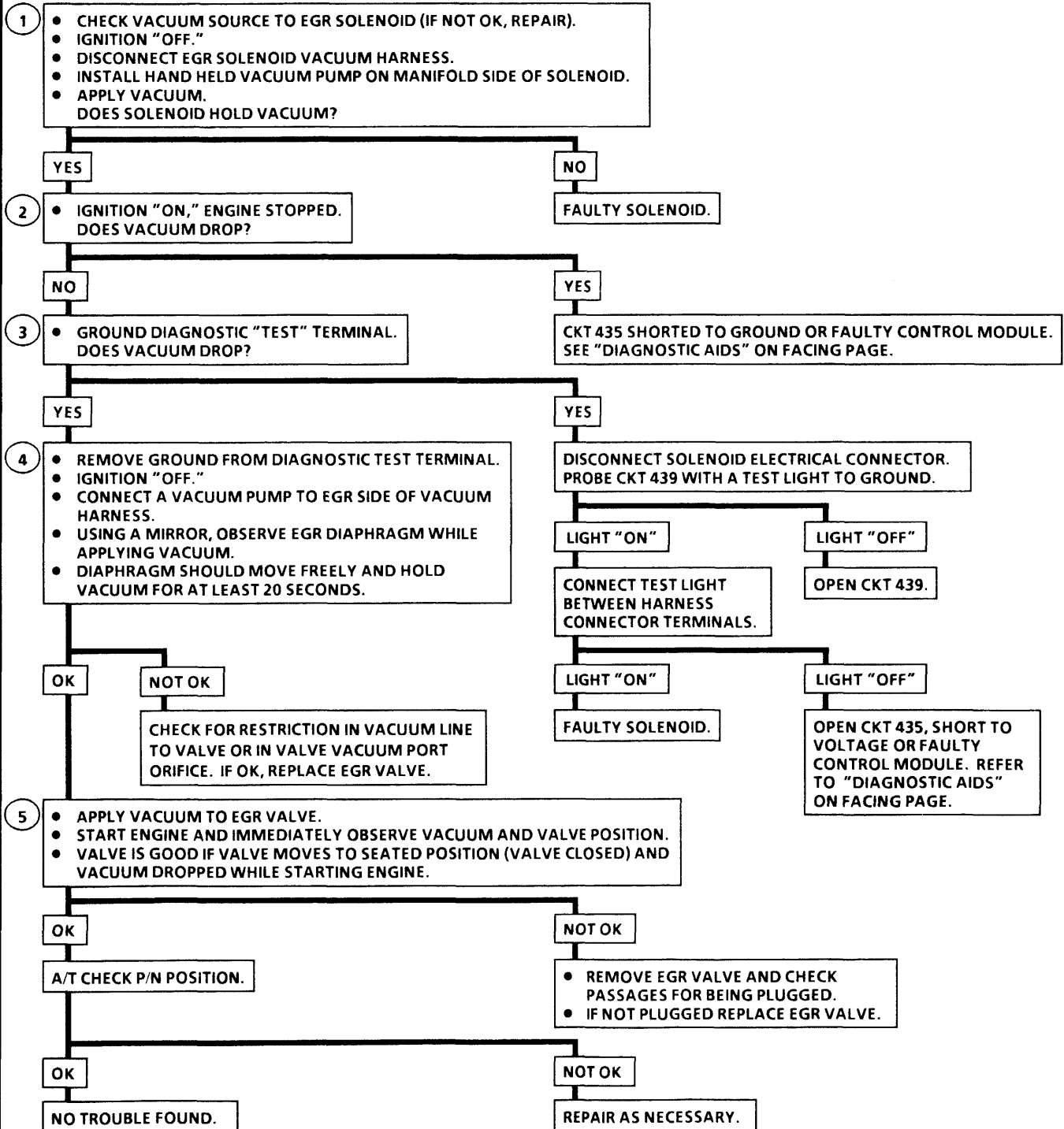
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for solenoid stuck open.
2. Checks for solenoid always being energized.
3. Grounding test terminal should energize solenoid and vacuum should drop.
4. Negative backpressure valve should hold vacuum with engine "OFF."
5. When engine is started, exhaust backpressure should cause vacuum to bleed off and valve to fully close.

## EGR SYSTEM CHECK WITH NEGATIVE BACKPRESSURE EGR VALVE

ASSUMES NO DTC 32 IS STORED

**NOTICE:** DISCONNECT TECH 1 WHEN  
USING THIS CHART.



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

4-15-93  
PS 17463

## ON-VEHICLE SERVICE

### Important

- Do Not wash EGR valve in solvents or degreaser - permanent damage to valve diaphragm may result. Also, sand blasting of the valve is not recommended since this can affect the operation of the valve.

### EGR VALVE

Figure 9B-4

### Remove or Disconnect

- EGR valve vacuum tube at valve.
- Bolts or nuts.
- EGR valve and gasket from manifold. Discard gasket.

### EGR MANIFOLD PASSAGE

### Inspect

- If EGR passage indicates excessive build-up of deposits, the passage should be cleaned. Care should be taken to ensure that all loose particles are completely removed to prevent them from clogging the EGR valve or from being ingested into the engine.

### Clean

- With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.
- Look for exhaust deposits in the valve outlet. Remove deposit build-up with a screwdriver.
- Clean mounting surfaces of intake manifold and valve assembly.

### Install or Connect

- New EGR gasket.
- EGR valve to manifold.
- Bolts or nuts.
- Vacuum tube to valve

### SYSTEM HOSES

Refer to "Vehicle Emission Control Information" label for routing of system hoses.

When replacing hoses, use hose identified with the word "Fluoroelastomer."

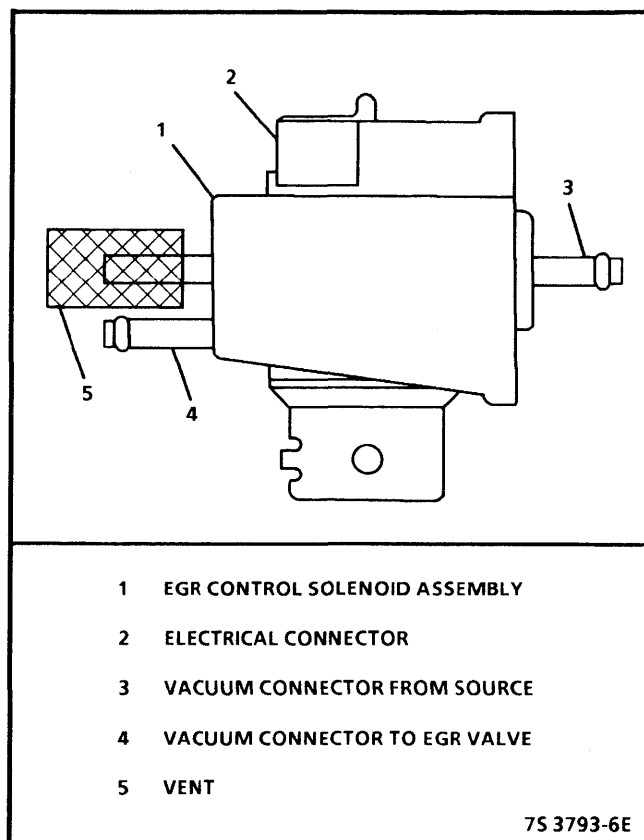


Figure 9B-3 - EGR Control Solenoid

### EGR VACUUM SOLENOID WITH NEGATIVE BACKPRESSURE AND EGR VALVE Figures 9B-3 and 9B-4

### Remove or Disconnect

- Negative battery cable.
- Electrical connector at solenoid.
- Vacuum hoses.
- Bolt(s) and solenoid.

### Install or Connect

- Solenoid.
- Vacuum hoses.
- Electrical connector.
- Negative battery cable.

## PARTS INFORMATION

| PART NAME                | GROUP   |
|--------------------------|---------|
| Valve, EGR .....         | 3.670   |
| Solenoid, EGR Cont ..... | 3.670   |
| Gasket, EGR Valve .....  | 3.6801. |

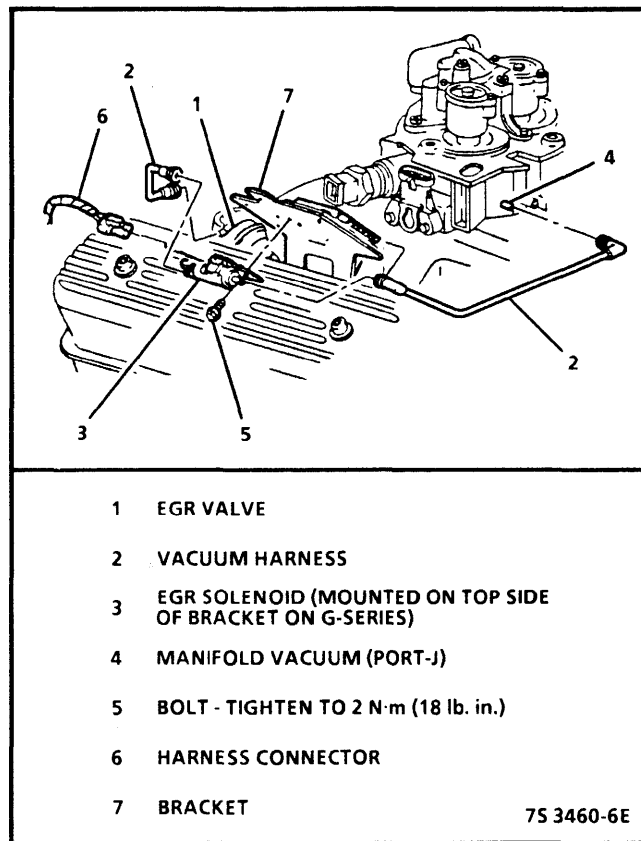


Figure 9B-4 - Backpressure and EGR System

**BLANK**

## SECTION 9C

# PORT EGR VALVE

## CONTENTS

|                                        |      |                                       |      |
|----------------------------------------|------|---------------------------------------|------|
| General Description .....              | 9C-1 | On-Vehicle Service .....              | 9C-6 |
| Port EGR Valve .....                   | 9C-1 | EGR Valve .....                       | 9C-6 |
| EVRV Solenoid with Port EGR Valve .... | 9C-1 | EGR Manifold Passage .....            | 9C-6 |
| Diagnosis .....                        | 9C-2 | System Hoses .....                    | 9C-6 |
| Results of Incorrect Operation .....   | 9C-2 | EGR (EVRV) Solenoid with Port         |      |
| System Check .....                     | 9C-2 | EGR Valve .....                       | 9C-6 |
| EGR System Check with Port EGR Valve . | 9C-4 | EGR Filter Cleaning/Replacement ..... | 9C-7 |
|                                        |      | Parts Information .....               | 9C-7 |

## GENERAL DESCRIPTION

The port EGR valve in this system is operated by vacuum. The vacuum is modulated by the EVRV solenoid which is actuated by the control module.

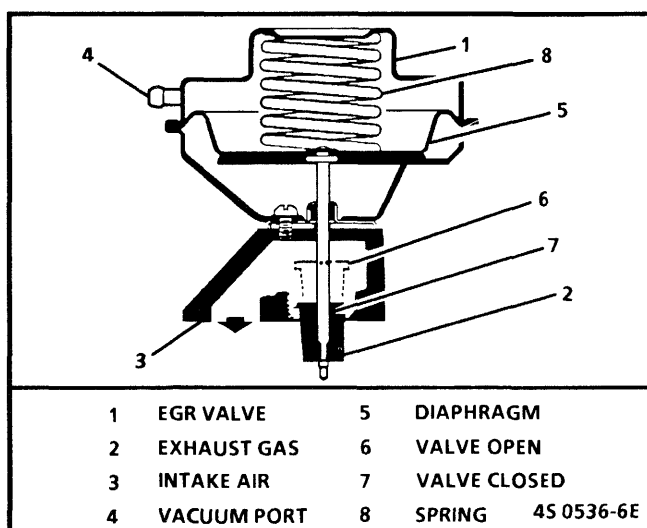


Figure 9C-1 - Port EGR Valve

### PORT EGR VALVE

**Figure 9C-1**

This valve is controlled by a flexible diaphragm which is spring loaded to hold the valve closed. Vacuum applied to the top side of the diaphragm overcomes the spring pressure and opens the valve in the exhaust gas port. This allows exhaust gas to be pulled into the intake manifold and enter the engine cylinders.

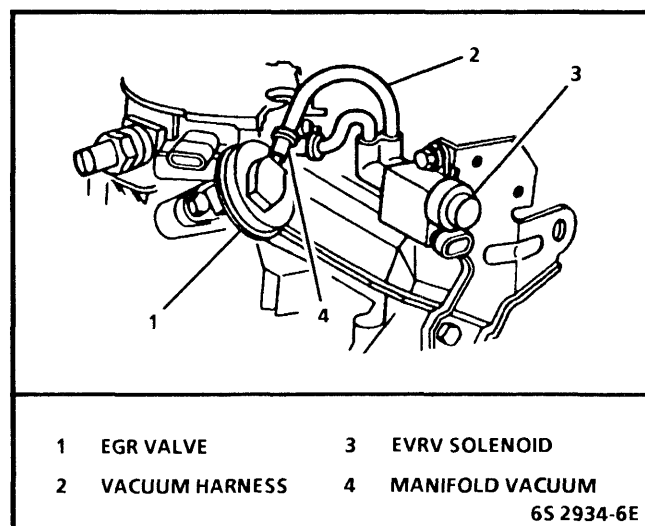


Figure 9C-2 - EGR and EVRV Solenoid

### EVRV SOLENOID WITH PORT EGR VALVE

**Figure 9C-2**

To regulate EGR flow, a control module controlled Electronic Vacuum Regulator Valve (EVRV) solenoid is used in the vacuum line. The control module uses information from the following sensors to regulate the solenoid:

- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- PRNDL position.
- Distributor (RPM signal).

The EGR vacuum control has an EVRV solenoid that uses "pulse width modulation." This means the control module turns the solenoid "ON" and "OFF" many times a second and varies the amount of "ON" time ("pulse width") to vary the amount of EGR.



### DIAGNOSIS

#### RESULTS OF INCORRECT OPERATION

With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- Engine stops after cold start.
- Engine stops at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

If the EGR valve should stay open all of the time, the engine may not idle.

- DTC 32 may set (refer to SECTION 3A).

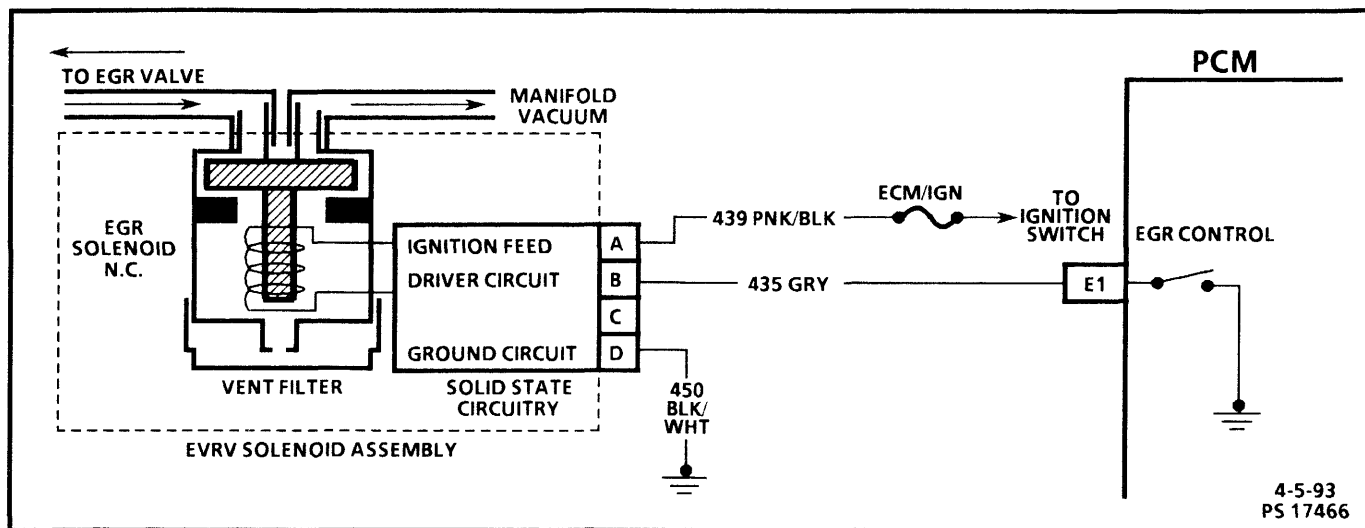
Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause:

- Spark knock (detonation).
- Engine overheating.

#### SYSTEM CHECK

Diagnosis of the EGR system is covered in the following charts. These charts begin on Page 9C-4.

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## EGR SYSTEM CHECK WITH PORT EGR VALVE

### Circuit Description:

The control module operates an EVRV solenoid to control the Exhaust Gas Recirculation (EGR) valve. This EVRV solenoid is normally closed. By providing a ground path, the control module energizes the EVRV solenoid which then allows vacuum to pass the EGR valve.

The control module monitors EGR effectiveness by de-energizing the EVRV solenoid, thereby, shutting "OFF" vacuum to the EGR valve diaphragm. With the EGR valve closed and HO2S fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a DTC 32 will be set.

The control module will check EGR operation when:

- Engine speed is greater than 1600 RPM.
- Engine vacuum is between 20 and 60 kPa (6" and 18" Hg).
- No change in throttle position while test is being performed.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

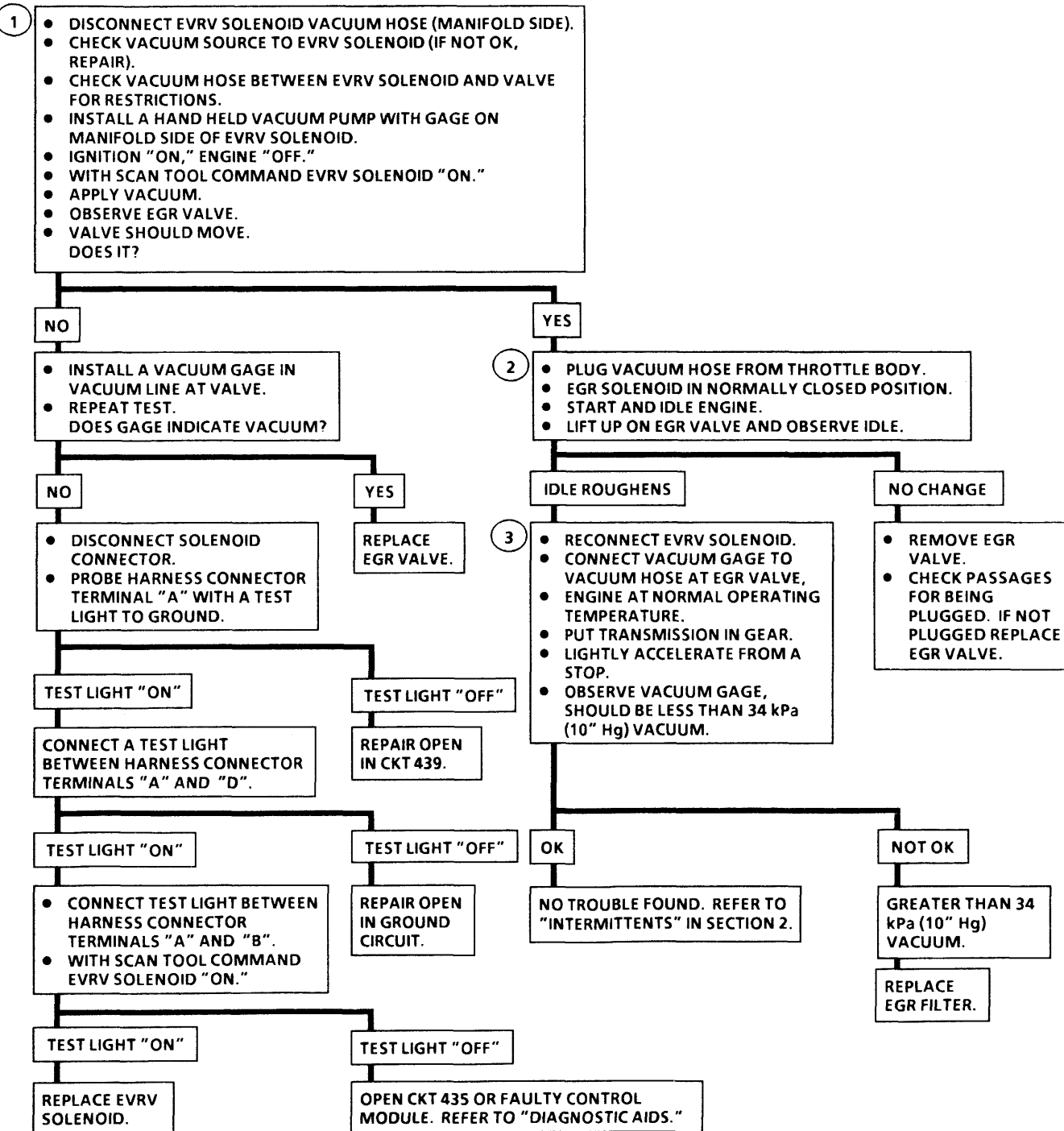
1. With the ignition "ON," engine stopped, the EVRV solenoid should not be energized and vacuum should not pass to the EGR valve. The EVRV solenoid will allow vacuum to pass to the energizing valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the control module is commanding the system "ON."

**Diagnostic Aids:** Before replacing control module, use ohmmeter and check resistance of each control module controlled relay and solenoid coil.

Refer to "Control Module Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked. Replace any relay or solenoid if the coil resistance measures less than 20 ohms.

## EGR SYSTEM CHECK WITH PORT EGR VALVE

IF ANY DTCs ARE STORED, DIAGNOSE THEM FIRST.  
IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR  
IDLE COMPLAINT FIRST. REFER TO SECTION 2.



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO MIL (SERVICE ENGINE SOON).

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PS 17467

## ON-VEHICLE SERVICE

### ! Important

- Do Not wash EGR valve in solvents or degreaser - permanent damage to valve diaphragm may result. Also, sand blasting of the valve is not recommended since this can affect the operation of the valve.

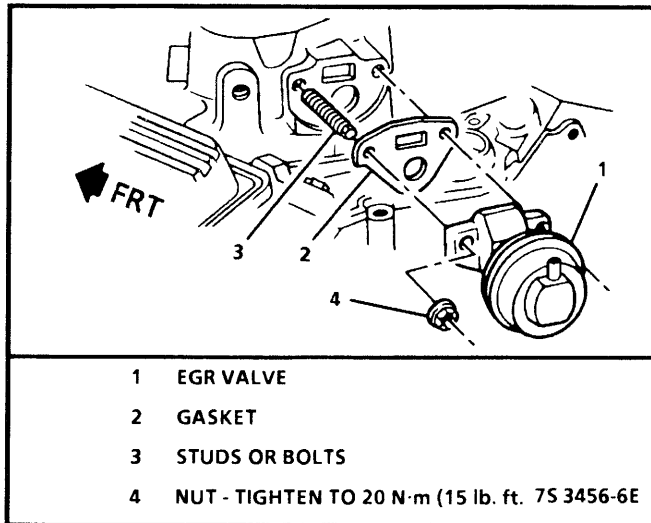


Figure 9C-3 - EGR Valve

### EGR VALVE

Figures 9C-3 through 9C-8

### ↔ Remove or Disconnect

- Air cleaner.
- EGR valve vacuum tube at valve.
- Bolts or nuts.
- EGR valve and gasket from manifold. Discard gasket.

### EGR MANIFOLD PASSAGE

### 🔍 Inspect

- If EGR passage indicates excessive build-up of deposits, the passage should be cleaned. Care should be taken to ensure that all loose particles are completely removed to prevent them from clogging the EGR valve or from being ingested into the engine.

### 🧼 Clean

- With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.
- Look for exhaust deposits in the valve outlet. Remove deposit build-up with a screwdriver.
- Clean mounting surfaces of intake manifold and valve assembly.

### ↔ Install or Connect

- New EGR gasket.
- EGR valve to manifold.
- Bolts or nuts.
- Vacuum tube to valve.
- Air cleaner.

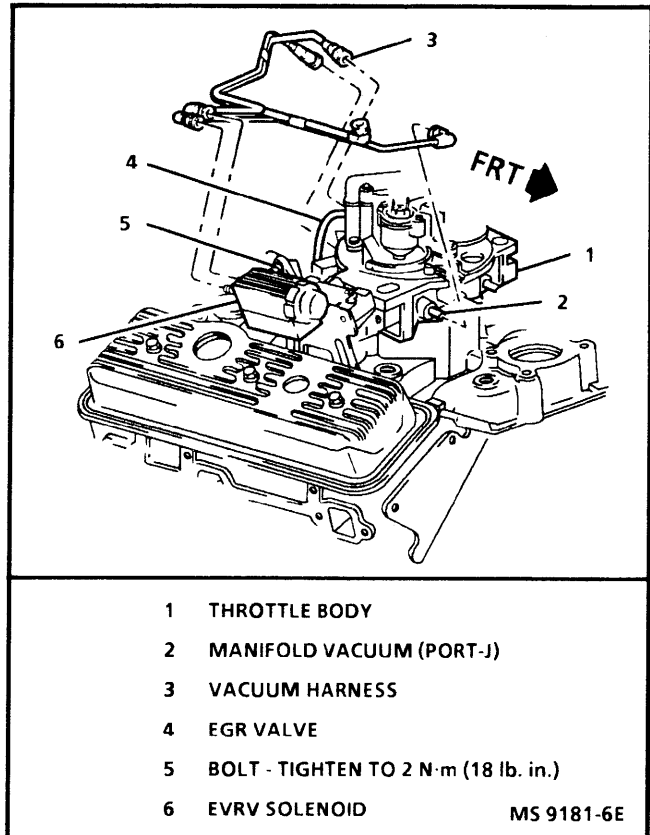


Figure 9C-4 - EGR and EVRV Solenoid

### SYSTEM HOSES

Refer to "Vehicle Emission Control Information" label for routing of system hoses.

When replacing hoses, use hose identified with the word "Fluoroelastomer."

### EGR (EVRV) SOLENOID WITH PORT EGR VALVE

Figure 9C-4 and 9C-5

### ↔ Remove or Disconnect

- Negative battery cable.
- Air cleaner, if necessary.
- Electrical connector at solenoid.
- Vacuum hoses.
- Bolt(s) and solenoid.
- Filter, if required.

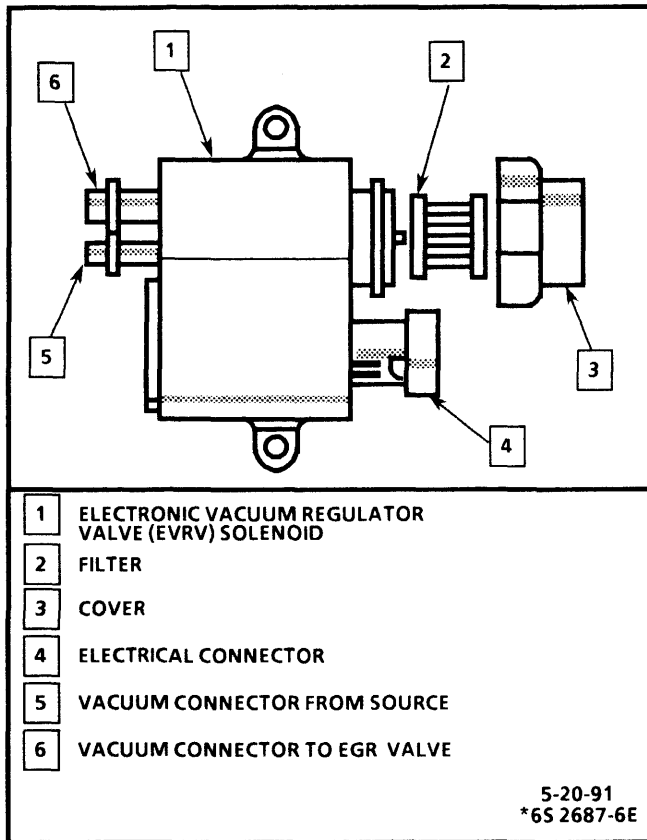


Figure 9C-5 - EGR Control Solenoid (EVRV)

### Install or Connect

1. Filter, if required.
2. Solenoid. Tighten bolts to 24 N·m (17 lb. ft.).
3. Vacuum hoses.
4. Electrical connector.
5. Air cleaner, if removed.
6. Negative battery cable.

### EGR FILTER CLEANING/REPLACEMENT

1. Grasp and pull filter off with a rocking motion.
2. Push new filter on making sure cut-out for wires is properly aligned.

### PARTS INFORMATION

| PART NAME                  | GROUP |
|----------------------------|-------|
| Valve, EGR .....           | 3.670 |
| Valve, Elect Vac Reg ..... | 3.670 |
| Gasket, EGR Valve .....    | 3.680 |

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# SECTION 10

## TRANSMISSION CONTROLS

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### GENERAL DESCRIPTION

#### AUTOMATIC TRANSMISSION

##### 4L60E

All 4L60E Diagnostic Trouble Codes (DTCs) will be in SECTION "10A".

All 4L60E hydraulic diagnosis will be in SECTION 7A14A of the appropriate service manual.

All 4L60E unit repair will be in SECTION 7A14B of the appropriate unit repair manual.

##### 4L80E

All 4L80E Diagnostic Trouble Codes (DTCs) will be in SECTION "10B".

All 4L80E hydraulic diagnosis will be in SECTION 7A17A of the appropriate service manual.

All 4L80E unit repair will be in SECTION 7A17B of the appropriate unit repair manual.

#### MANUAL TRANSMISSION

All manual transmission controls information will be found in SECTION 10C.



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# SECTION 10A

## 4L60E DIAGNOSTIC TROUBLE CODES

### (WITH TECH 1 SCAN TOOL DIAGNOSTICS)

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## GENERAL DESCRIPTION

POWERTRAIN CONTROL MODULE  
(PCM)

Figure 10A-1

The Powertrain Control Module (PCM) is an electronic device which monitors various inputs to control various transmission functions including shift quality and transmission diagnostics. The PCM receives various input information from sensors, switches, and components to process for use within its control program. Based on this input information, the PCM controls various transmission output functions and devices. The PCM is located within the passenger compartment, underneath the right hand side of the dash.

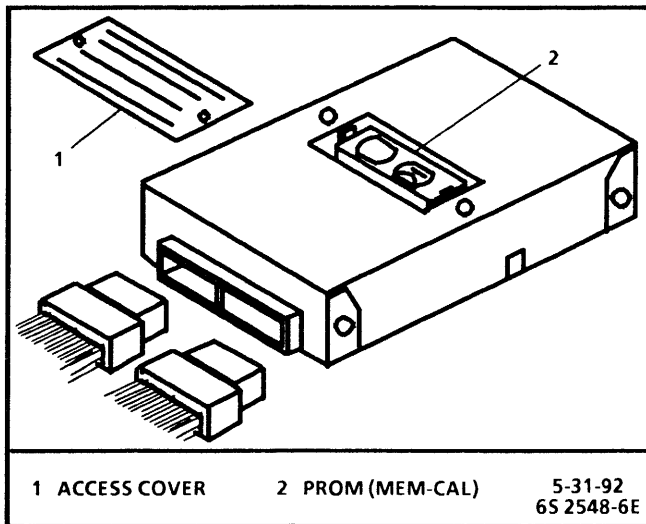


Figure 10A-1 - Powertrain Control Module

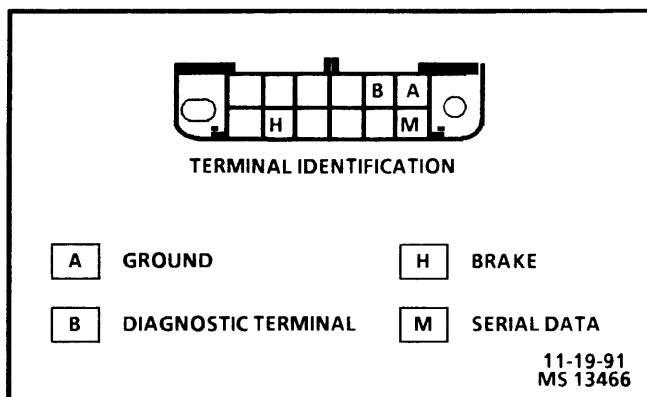


Figure 10A-2 - Data Link Connector (DLC)

## WIRING HARNESS AND CONNECTORS

A wiring harness electrically connects the PCM to various sensors, solenoids, and relays within the system. Many of the connectors used are environmentally protected because of the system low voltages and current levels.

## DATA LINK CONNECTOR (DLC)

Figure 10A-2

This connector is a multiple cavity connector. The DLC provides the technician a means of accessing serial data for aid in diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display DTC(s). The DLC connector is located within the driver's compartment, normally on the left side near the steering column.

## INPUT INFORMATION

## INFORMATION SENSORS AND SWITCHES

The PCM uses the following information sensors to gather data for electronically controlling transmission functions.

- Transmission Fluid Temperature (TFT) sensor.
- Transmission Range (TR) pressure switch assembly.
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Transmission or transfer case Vehicle Speed Sensor (VSS).
- Brake switch.

TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR

The TFT sensor is a thermistor (a device that changes resistance according to changes in temperature) used to indicate transmission fluid temperature. High sensor resistance produces high signal input voltage which corresponds to low fluid temperature. Low sensor resistance produces low signal input voltage which corresponds to high fluid temperature. The PCM uses the TFT sensor signal input to determine the following:

- TCC apply and release schedules.
- Hot mode determination.
- Shift quality.

The TFT sensor is part of the transmission range fluid pressure switch assembly and is attached to the control valve body within the transmission.

TRANSMISSION RANGE (TR) PRESSURE  
SWITCH ASSEMBLY

Figure 10A-6

This device is a set of five pressure switches (two normally closed and three normally open), that detect fluid pressure within the valve body passages. The five pressure switches are connected to three signal circuits referred to as range signals A, B, C.

## TRANSMISSION ELECTRICAL CONNECTOR

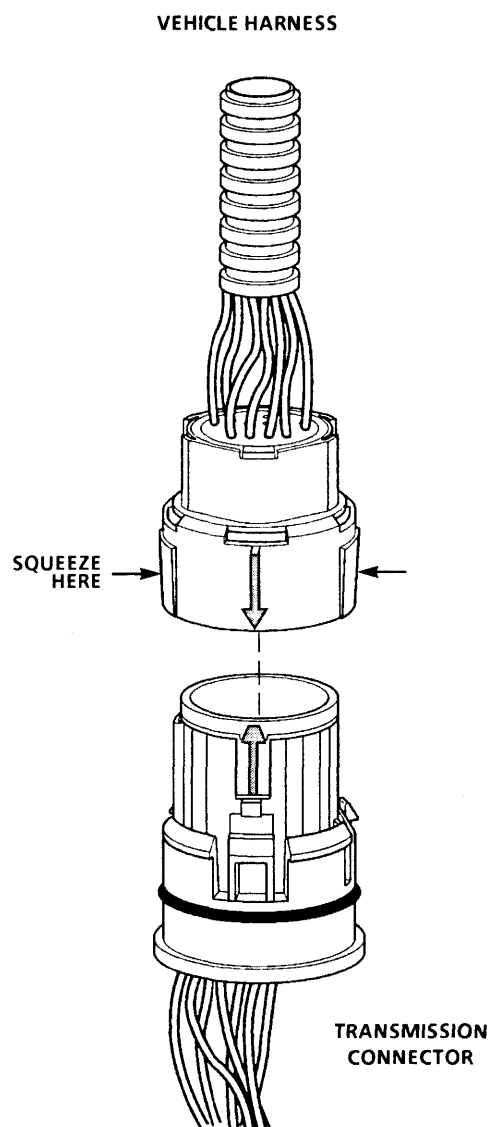
THE TRANSMISSION WIRING CONNECTOR IS A VERY IMPORTANT PART OF THE TRANSMISSION OPERATING SYSTEM. ANY INTERFERENCE WITH THE ELECTRICAL CONNECTION CAN CAUSE THE TRANSMISSION TO SET DIAGNOSTIC TROUBLE CODES (DTC)s AND/OR AFFECT PROPER OPERATION.

THE FOLLOWING ITEMS CAN AFFECT THE ELECTRICAL CONNECTION:

- BENT PINS IN THE CONNECTOR FROM ROUGH HANDLING DURING CONNECTION AND DISCONNECTION.
  - WIRES BACKING AWAY FROM THE PINS OR COMING UNCRIMPED (IN EITHER INTERNAL OR EXTERNAL WIRING HARNESS).
  - DIRT CONTAMINATION ENTERING THE CONNECTOR WHEN DISCONNECTED.
  - PINS IN THE INTERNAL WIRING CONNECTOR BACKING OUT OF THE CONNECTOR OR PUSHED OUT DURING RECONNECTION.
  - EXCESSIVE TRANSMISSION FLUID LEAKING INTO THE CONNECTOR, WICKING UP INTO THE EXTERNAL WIRING HARNESS, AND DEGRADING OF THE WIRE INSULATION. \*
  - WATER/MOISTURE INTRUSION IN THE CONNECTOR.
  - LOW PIN RETENTION IN THE EXTERNAL CONNECTOR FROM EXCESSIVE CONNECTION AND DISCONNECTION OF THE WIRING CONNECTOR ASSEMBLY.
  - PIN CORROSION FROM CONTAMINATION.
- \* THE PRESENCE OF TRANSMISSION FLUID IN THE TRANSMISSION CONNECTOR IS NOT HARMFUL IN ITSELF. THE FLUID ONLY AFFECTS THE EXTERNAL HARNESS WIRING INSULATION IF THE FLUID WICKS UP TO THE HARNESS.

POINTS TO REMEMBER WHEN WORKING WITH THE TRANSMISSION WIRING CONNECTOR ASSEMBLY:

- TO REMOVE THE CONNECTOR, SQUEEZE THE TWO TABS TOWARDS EACH OTHER AND PULL STRAIGHT UP (REFER TO THE ILLUSTRATION).
- CAREFULLY LIMIT TWISTING OR WIGGLING THE CONNECTOR DURING REMOVAL. BENT PINS CAN OCCUR.
- **DO NOT** PRY THE CONNECTOR OFF WITH A SCREWDRIVER OR OTHER TOOL.
- TO REINSTALL THE EXTERNAL WIRING CONNECTOR, FIRST ORIENT THE PINS BY LINING UP THE ARROWS ON EACH HALF OF THE CONNECTOR. PUSH THE CONNECTOR STRAIGHT DOWN INTO THE TRANSMISSION WITHOUT TWISTING OR ANGLING THE MATING PARTS.
- THE CONNECTOR SHOULD CLICK INTO PLACE WITH A POSITIVE FEEL AND/OR NOISE.
- WHENEVER THE TRANSMISSION EXTERNAL WIRING CONNECTOR IS DISCONNECTED FROM THE INTERNAL HARNESS AND THE ENGINE IS OPERATING DTC(s) WILL SET. CLEAR THESE DTC(s) AFTER RECONNECTING THE EXTERNAL CONNECTOR.



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Figure 10A-3 - Transmission Electrical Connector

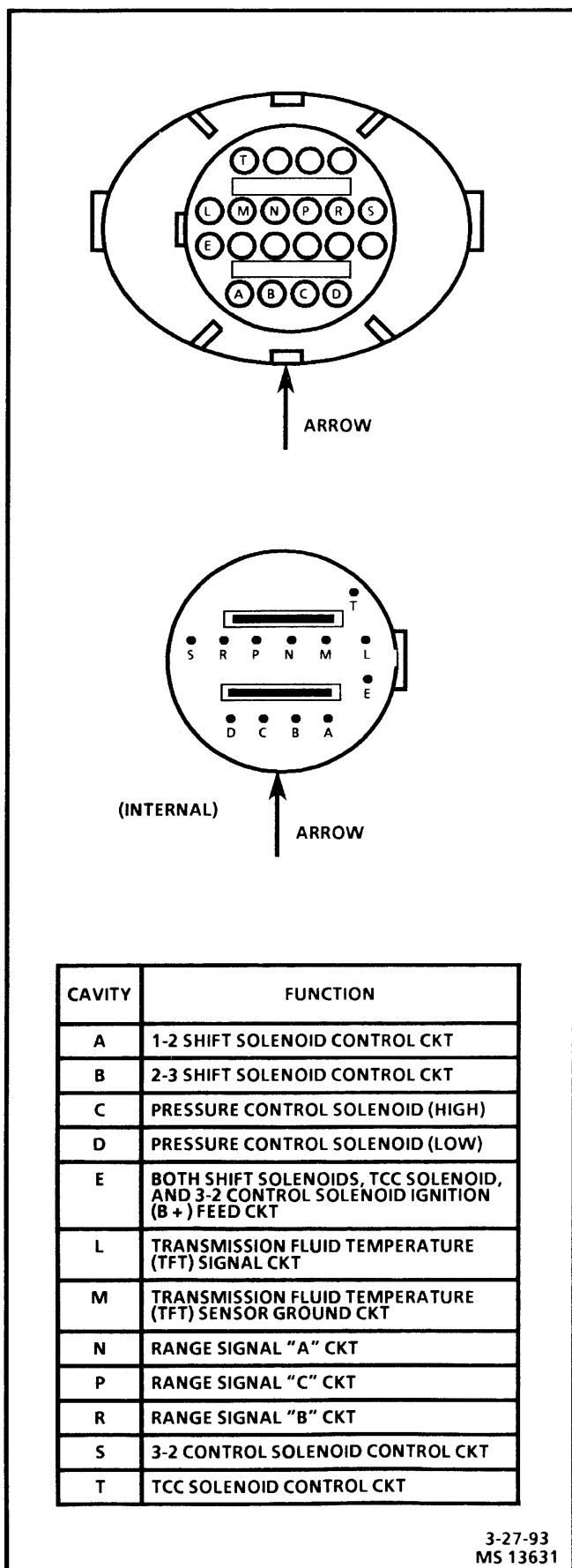


Figure 10A-4 - Harness Connector

Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

The combination of pressure switch states determine the voltage signal (B+ or 0) on each range signal to the PCM. These three range signals are then interpreted by the PCM to indicate the transmission range selected. The transmission range fluid pressure switch assembly contains the trans fluid temperature sensor and attached to the control valve body within the transmission.

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Figure 10A-5

The Engine Coolant Temperature (ECT) sensor is a thermistor (a device that changes resistance according to change in temperature) used to indicate engine coolant temperature. High sensor resistance produces signal input voltage which corresponds to low engine temperature. Low sensor resistance produces low signal input voltage which corresponds to high engine coolant temperature. The PCM uses the ECT sensor signal to determine the TCC apply and release schedules. The ECT sensor is attached to the engine assembly.

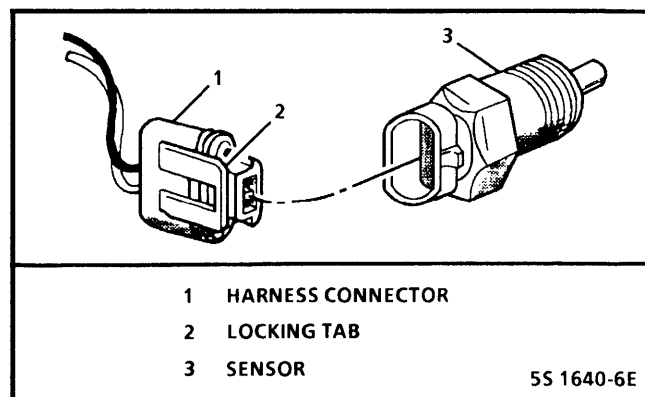


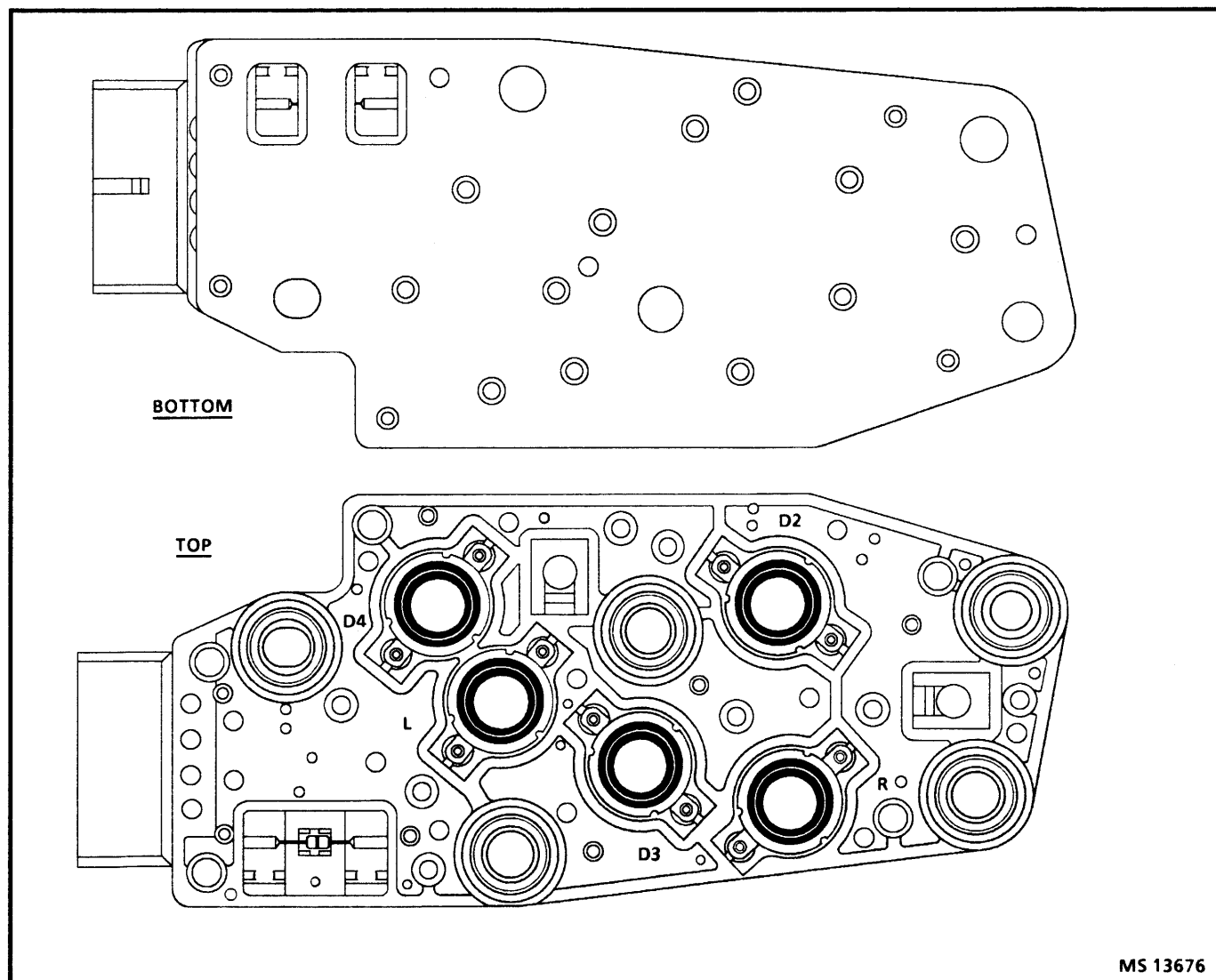
Figure 10A-5 - Engine Coolant Temperature (ECT) Sensor

**THROTTLE POSITION (TP) SENSOR**

The Throttle Position (TP) sensor is a potentiometer (a device for measuring an unknown voltage or potential difference by comparison to a standard voltage). The TP sensor sends a voltage to the control module, varying from approximately .5 volts to approximately 5 volts. This voltage signal to the control module represents throttle shaft angle. At closed throttle, the signal voltage to the control module is approximately .5 volts as the throttle shaft angle increases the signal voltage increases to greater than 4.5 volts at wide open throttle. The TP sensor is attached to the throttle body assembly.

**TRANSFER CASE SWITCH ASSEMBLY**

This switch assembly is used to indicate the position of the transfer case select lever. When four wheel drive (4WD) low is selected a ground path is provided, changing 4WD low input signal from B+ to 0 voltage. The 4WD low signal input is used to correct the transmission output speed signal from the VSS buffer module to the PCM, to compensate for the transfer case gear reduction. This switch is attached to the transfer case.



MS 13676

Figure 10A-6 - Transmission Range (TR) Pressure Switch Assembly

## VEHICLE SPEED SENSOR (VSS)

**Figure 10A-7 (2WD) 10A-8 (4WD)**

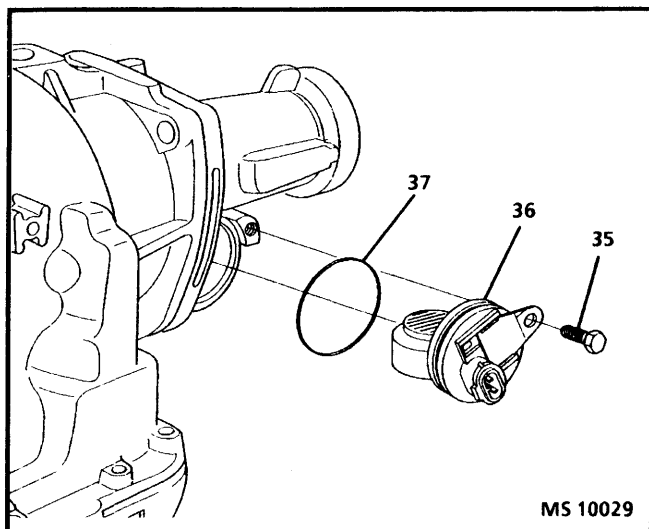
This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth pressed on an output shaft. As the rotor interrupts the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an output shaft speed signal to the control module. The control module uses the vehicle speed sensor signal input to:

- Calculate vehicle speed, trans output speed, TCC slip speed.
- Control shift quality.

The VSS is attached to the output shaft housing.

## VEHICLE SPEED SIGNAL (VSS) BUFFER MODULE

The vehicle speed signal buffer module (VSS buffer module) is an electronic device. The VSS buffer module processes inputs from the vehicle speed sensor and outputs various signals. The VSS buffer module outputs a 40 pulse per revolution (PPR) signal. This 40 ppr signal is used by the control module to determine transmission output speed. The VSS buffer module also outputs a 2002 pulses per mile signal to the control module to control various other functions. The VSS buffer module is matched to the vehicle based on transmission, final drive ratio and tire size. The VSS buffer module is located on the right hand side of the instrument panel attached to the PCM bracket.



**Figure 10A-7 - Vehicle Speed Sensor (2WD)**

**CHART**

| Gear | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
|------|--------------------|--------------------|
| 1    | ON                 | ON                 |
| 2    | OFF                | ON                 |
| 3    | OFF                | OFF                |
| 4    | ON                 | OFF                |

## BRAKE SWITCH

This electrical switch is used to indicate brake pedal status. This switch is normally closed when the brake pedal is not applied. When the brake pedal is applied the switch will open, changing the signal to the PCM. The PCM uses this signal to de-energize the TCC solenoid when brake pedal is applied. The brake switch is located on the brake pedal mounting bracket.

## OUTPUT INFORMATION

Based on input information, the PCM controls various transmission output functions and devices.

- 1-2 shift solenoid.
- 2-3 shift solenoid.
- 3-2 control solenoid.
- Pressure Control Solenoid (PCS).
- Torque Converter Clutch (TCC) solenoid.

## 1-2 SHIFT SOLENOID

**Figure 10A-9**

This electrical device is used to control fluid flow acting on the 1-2 and 3-4 shift valves. The solenoid is a normally open exhaust valve that is used with the 2-3 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

## 2-3 SHIFT SOLENOID

**Figure 10A-9**

This electrical device is used to control fluid flow acting on the 2-3 shift valves. The solenoid is a normally open exhaust valve that is used with the 1-2 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

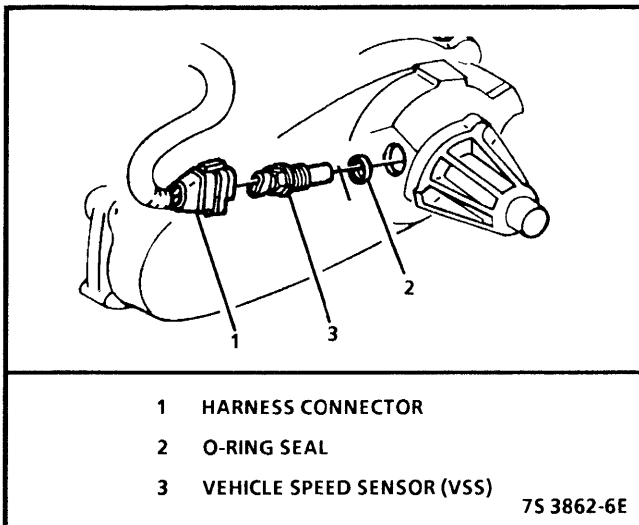


Figure 10A-8 - Vehicle Speed Sensor (4WD)

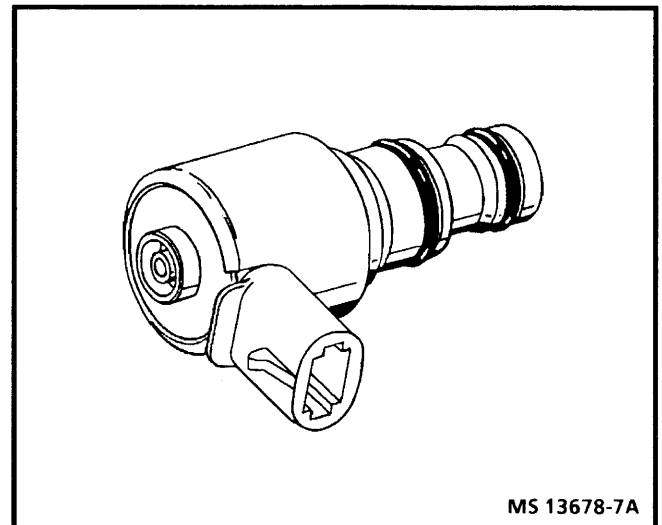


Figure 10A-10 - 3-2 Control Solenoid

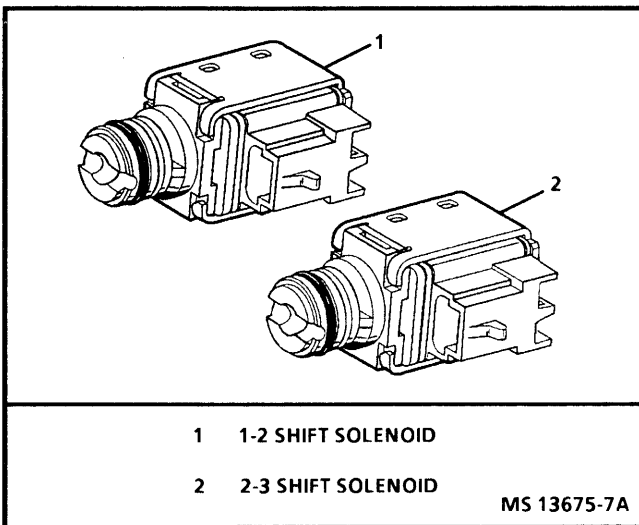


Figure 10A-9 - 1-2 Shift Solenoid or 2-3 Shift Solenoid

### 3-2 CONTROL SOLENOID

Figure 10A-10

This electrical device is used to control fluid flow acting on the 3-2 shift valve, which then controls the 2-4 band apply rate and 3-4 clutch release rate. It is a pulse width modulated solenoid that operates on a negative duty cycle. This solenoid controls the 3-2 downshift feel and is attached to the control valve body within the transmission.

### PRESSURE CONTROL SOLENOID (PCS)

Figure 10A-11

This electrical device is used to control fluid line pressure by controlling actuator feed limit fluid flow acting on an internal spool valve and spring pressure. The solenoid is a normally closed solenoid valve that controls fluid pressure when operating on a duty cycle. The solenoid is attached to the control valve body within the transmission.

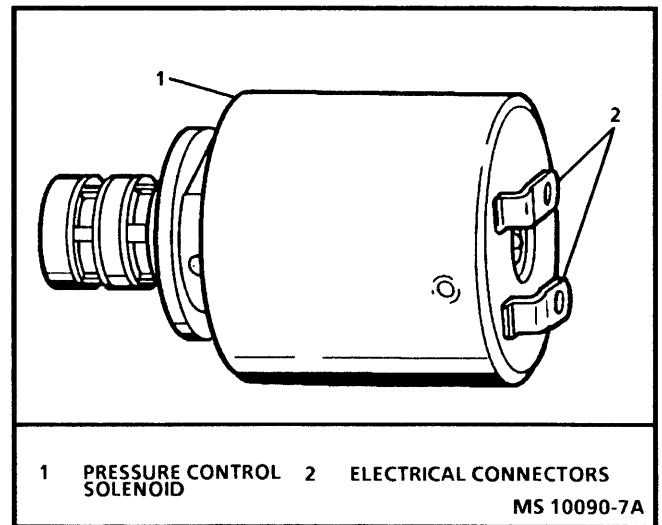


Figure 10A-11 - Pressure Control Solenoid (PCS)

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID

Figure 10A-12

This electrical device is used to control fluid acting on the TCC converter clutch valve, which then controls TCC apply and release. This solenoid is attached to the transmission case assembly extending into the pump cover.



## 10A-8 DRIVEABILITY AND EMISSIONS (GASOLINE)

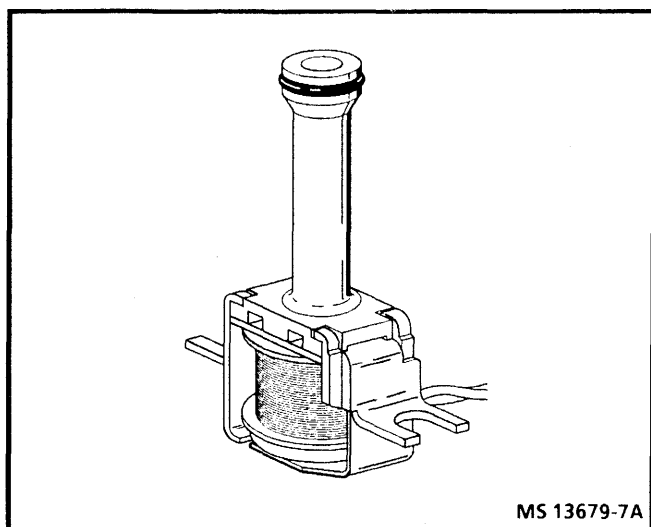
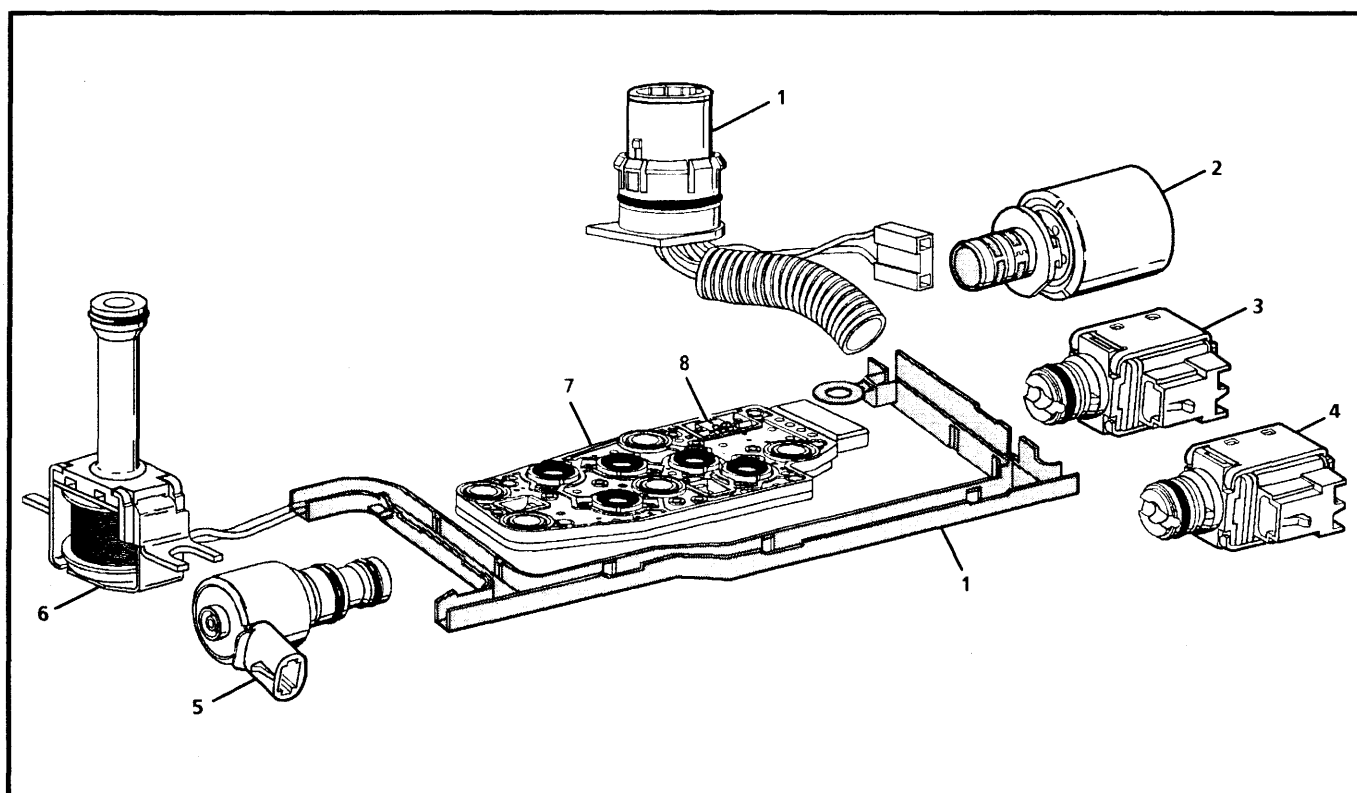


Figure 10A-12 - Torque Converter Clutch (TCC) Solenoid



- |   |                           |   |                                                                                |
|---|---------------------------|---|--------------------------------------------------------------------------------|
| 1 | WIRING HARNESS ASSEMBLY   | 5 | 3-2 CONTROL SOLENOID                                                           |
| 2 | PRESSURE CONTROL SOLENOID | 6 | TORQUE CONVERTER CLUTCH SOLENOID                                               |
| 3 | 1-2 SHIFT SOLENOID        | 7 | TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY                               |
| 4 | 2-3 SHIFT SOLENOID        | 8 | TRANSMISSION FLUID TEMPERATURE SENSOR<br>(PART OF TR PRESSURE SWITCH ASSEMBLY) |

MS 13680

Figure 10A-13 - Electrical Components

## DIAGNOSIS

The PCM is equipped with a self diagnostic feature that detects system failures and aids the technician in locating a faulty circuit. The PCM has memory for comparing the various input information to programmed information. These conditions are described on the facing page of each Diagnostic Trouble Code (DTC) chart. If a value is not within the PCM parameters, a DTC will set and default values will be used.

The PCM will continually perform a self diagnosis check. The PCM can be requested to display any stored DTC by using a scan tool or manually grounding the diagnostic test terminal. When the diagnostic test terminal of the Data Link Connector (DLC) is grounded, the PCM will check the engine speed circuit input, if the voltage is zero, the PCM will flash DTC 12 and any other DTC(s) stored. If DTC 12 will not flash, refer to CHART A-1 or CHART A-2 in SECTION 3 for further diagnostic information.

### Important

- Always refer to the "On-Board Diagnosis (OBD) System Check" before proceeding to diagnose the system.

The scan tool will display all stored DTC(s) in current or history status. A DTC 12 is not a fault condition with the ignition "ON," engine "OFF." When the manual grounding procedure is used, the MIL will flash all DTC(s) stored in the PCM memory (current and history). The DTC charts assume the DTC is in current status. If the DTC is in history status, the fault may be an intermittent. An "intermittent" DTC is one which will not reset during the current ignition cycle. The facing page of a DTC chart will contain "DIAGNOSTIC AIDS" to help locate intermittent conditions.

If a visual (physical) check does not locate the cause of the fault, J 39200 DVM can be used to test the suspected circuit. The J 39200 DVM can be used to check for opens or shorts:

- **SHORT TO VOLTAGE** - Connect J 39200 to a known good ground on the DC voltage scale.
- **SHORT TO GROUND** - Connect J 39200 to a known good B+ on the DC voltage scale.
- **OPEN CIRCUIT** - Connect J 39200 to each end of the circuit on the ohms scale with voltage removed from the circuit.

## PCM INTERMITTENT DIAGNOSTIC TROUBLE CODES OR PERFORMANCE

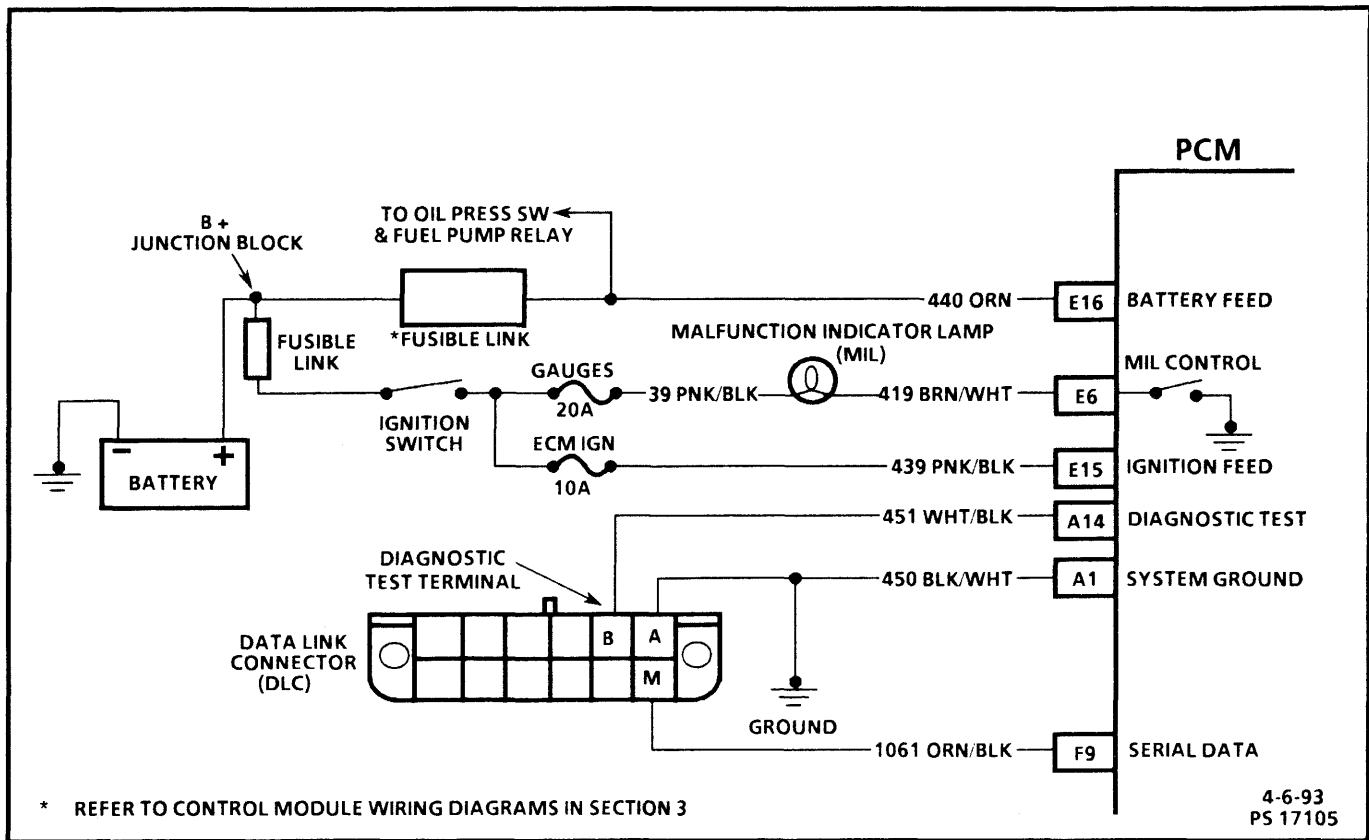
The DTC charts in this section determine if there is a fault within the circuit. The fault must be present to locate the problem. If an intermittent condition occurs, a DTC will be stored in history status, but the circuit check will indicate a normal condition. Most intermittent conditions are usually a faulty connection or component. When diagnosing intermittents, thoroughly check the suspected circuits for:

- Poor terminal tension.
- Poor seating of connector halves.
- Poor terminal to wire connection.
- Improperly formed or damaged terminals.
- Improperly installed electrical options.
- Faulty PCM power or ground connection.
- Intermittent short or open.
- Electrical system surges caused by a defective relay, solenoid, or switch. Normally these conditions will occur when the faulty component is operated.

## CLEARING HISTORY DTC(s)

All history DTC(s) can be cleared after all repairs have been completed in the following ways:

1. With a scan tool.
2. By removing voltage from the PCM.
3. Fifty ignition cycles with fault removed.



## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)

### Circuit Description:

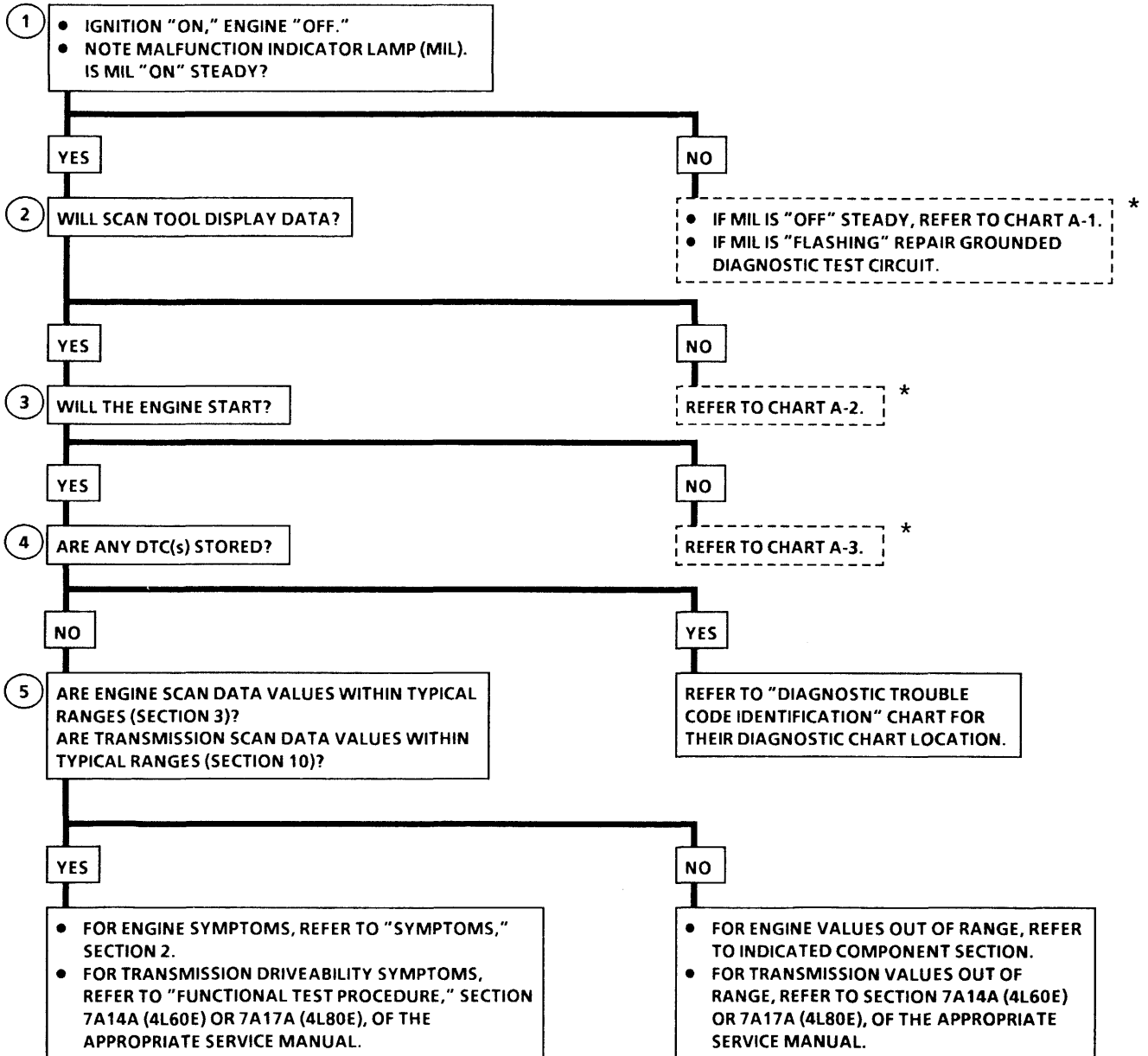
The on-board diagnostic system check is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, because it directs the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it correctly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step is a check for the proper operation of the MIL (Service Engine Soon). The MIL should be "ON" steady.
2. Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
3. Although the PCM is powered up, a "Crankes But Will Not Run" symptom could exist because of a PCM or system problem.
4. This step will isolate if the customer complaint is a MIL or a driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM (MEM-CAL) or PCM.
5. Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. Keep in mind that a base engine problem (i.e., advanced cam timing) may substantially alter sensor values.

# ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

(WITH TECH 1 SCAN TOOL)



\* IN SECTION 3

3-17-93  
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## 10A-12 DRIVEABILITY AND EMISSIONS (GASOLINE)

If after completing the On-Board Diagnostic (OBD) system check and finding the Tech 1 diagnostics functioning properly and no DTC(s) displayed, the "Transmission Tech 1 Values" may be used for comparison with values obtained on the vehicle being diagnosed. The "Transmission Tech 1 Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosing. For further description on the values and use of the Tech 1 to diagnosis PCM inputs, refer to "General Description." If all values are within the range illustrated, refer to SECTION 7A14A (4L60E) or 7A17A (4L80E) "Functional Test Procedure."

### TRANSMISSION TECH 1 DATA

Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Closed Loop / Accessories Off

| <u>SCAN Position</u>   | <u>Units Displayed</u>                               | <u>Typical Data Value</u>    | <u>Refer To Section</u> |
|------------------------|------------------------------------------------------|------------------------------|-------------------------|
| Engine Speed           | RPM                                                  | ± 50 RPM From desired        | 3                       |
| Trans Output Spd       | RPM                                                  | 0 RPM                        | 10A/10B                 |
| Eng Cool Temp          | C°/F°                                                | 85°C - 105°C (185°F - 221°F) | 3                       |
| Trans Fluid Temp       | C°/F°                                                | 82°C - 94°C (180°F - 200°F)  | 10A/10B                 |
| Throt Position         | Volts                                                | 0.3 - 0.9V                   | 3                       |
| Throttle Angle         | Percentage                                           | 0%                           | 3                       |
| # A/B/C RNG            | Off/On                                               | Off/On/Off                   | 10A                     |
| * A/B/C RNG            | Off/On                                               | On/Off/On                    | 10B                     |
| Trans Range Sw         | Invalid, Rev,<br>Drive 4, 3,<br>2, Low,<br>Park/Neut | Park/Neut                    | 10A/10B                 |
| Commanded Gear         | 1-4                                                  | 1                            | 10A/10B                 |
| Adaptable Shift        | No, Yes                                              | No                           | 10A/10B                 |
| 1-2 Sol 2-3 Sol        | Off/On                                               | On/On                        | 10A/10B                 |
| CTR FDBK 1/2 2/3       | Off/On                                               | On/On                        | 10A/10B                 |
| * Trans Input Speed    | RPM                                                  | ± 50 RPM of Engine Speed     | 10B                     |
| # 3-2 Control Sol      | Percentage                                           | 0%                           | 10A/10B                 |
| # 3-2 Control FDBK     | Off/On                                               | Off                          | 10A                     |
| Hot Mode               | No, Yes                                              | No                           | 10A/10B                 |
| * TCC PWM Solenoid     | Percentage                                           | 0%                           | 10B                     |
| TCC Slip Speed         | RPM                                                  | ± 50 RPM From Engine Speed   | 10A/10B                 |
| # TCC Solenoid         | Off/On                                               | Off                          | 10A                     |
| # CTR FDBK TCC Sol     | Off/On                                               | Off                          |                         |
| Desired PCS            | Amps                                                 | 1.01 Amps                    | 10A/10B                 |
| Actual PCS             | Amps                                                 | 1.01 Amps                    | 10A/10B                 |
| PCS Duty Cycle         | Percentage                                           | 40% - 60%                    | 10A/10B                 |
| MPH Km/h               | 0-255                                                | 0                            | 10A/10B                 |
| 4WD Low Switch         | No, Yes                                              | No                           | 10A/10B                 |
| Cruise Engaged         | No, Yes                                              | No                           | 9B                      |
| TCC Brake Switch       | Open/Closed                                          | Closed                       | 10A/10B                 |
| Kickdown Enabled       | No, Yes                                              | No                           | 10A/10B                 |
| * Trans Gear Ratio     | Ratio                                                | 0.00                         | 10B                     |
| * Turbine Speed        | RPM                                                  | ± 50 RPM Of Engine Speed     | 10B                     |
| 1-2 Shift Time         | Seconds                                              | 0                            | 10A/10B                 |
| 2-3 Shift Time         | Seconds                                              | 0                            | 10A/10B                 |
| # 1-2 Shift Time Error | Seconds                                              | 0                            | 10A                     |
| # Curr Adapt Cell      | % TP                                                 | Not Used                     | 10A                     |
| Trans Calib ID         | 0-65535                                              | Internal ID                  | 10A/10B                 |
| System Voltage         | Volts                                                | 12.0 - 14.5V                 | 10A/10B                 |

# 4L60E Only

\* 4L80E Only

## TRANSMISSION TECH 1 DATA DEFINITIONS

**ENGINE SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

**TRANS OUTPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

**ENGINE (ENG) COOLANT (COOL) TEMPERATURE (TEMP)** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the engine coolant temperature sensor. Engine coolant temperature is high (151°C) when signal voltage is low (0 volt), and engine coolant temperature is low (-40°C) when signal voltage is high (5 volts).

**TRANS FLUID TEMP** - Scan tool displays a range of -40°C to 151°C, -40°F to 304°F. - This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high (151°C) when signal voltage is low (0 volt), and transmission fluid temperature is low (-40°C) when signal voltage is high (5 volts).

**THROTTLE (THROT) POSITION** - Scan tool displays a range of 0.00 volt to 5.10 volts. - This parameter indicates the signal input of the throttle position sensor circuit. Low voltage (approximately .3V to 1.3V) indicates closed throttle, high voltage (approximately greater than 4.5V) indicates wide open throttle.

**THROTTLE ANGLE** - Scan tool displays a range of 0% to 100%. - This parameter indicates the signal input of the throttle position sensor circuit. 0% throttle angle (low voltage) indicates closed throttle, 100% throttle angle (high voltage) indicates wide open throttle.

**A/B/C RANGE (RNG)** - Scan tool displays "ON"/"OFF," "ON"/"OFF," "ON"/"OFF." - These parameters are the three inputs from the transmission range pressure switch assembly. "ON" represents a B+ voltage signal, "OFF" represents a 0 voltage signal.

**TRANS RANGE SWITCH (SW)** - Scan tool displays a range of invalid, Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, and Low. - This parameter is the decoded status of the three A/B/C range inputs from the transmission range pressure switch assembly and represents the position of the transmission manual valve.

**COMMANDED GEAR** - Scan tool displays a range of 1, 2, 3, or 4. - This parameter is the decoded commanded state of the 1-2 and 2-3 shift solenoids.

Gear 1 = "ON," "ON." Gear 2 = "OFF," "ON." Gear 3 = "OFF," "OFF." Gear 4 = "ON," "OFF."

**ADAPTABLE SHIFT** - This value indicates if the current shift will update the 1-2 adapt tables. The adapt tables are used to modify line pressure. The following items cause a shift not to be adaptable:

- Braking pressure (manual gear ranges).
- Long shift delay (shift delay is the time the solenoid changes state until the shift starts).
- Long shift time.
- Throttle range.
- Significant throttle angle change.
- Hot mode.
- Transmission fluid temperature range.
- Manual gear ranges (D1, D2).
- If shift starts too soon after the solenoid state change.
- Diagnostic failures - 21, 22, 24, 28, 53, 58, 59, 72, 73, 75, 79, 81, or 82.
- Time since last shift.
- Time since the last range change.
- Significant vehicle speed change.

**1-2 SOLENOID (SOL)/2-3 SOLENOID (SOL)** - Scan tool displays "ON"/"OFF." - These parameters are the commanded status of the 1-2 and 2-3 shift solenoids. "ON" represents a commanded energized state (current flowing through solenoid). "OFF" represents a commanded non-energized state (current not flowing through solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) 1/2 2/3** - Scan tool displays "ON"/"OFF." - These parameters are the actual states of the 1-2 and 2-3 shift solenoid driver control circuits. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage.

**3-2 CONTROL SOLENOID (SOL)** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded percentage of "ON" time of the 3-2 control solenoid. 0% represents a completely "OFF" (non-energized) commanded state. 100% represents an "ON" (energized) commanded state.

**3-2 CONTROL (CTR) FEEDBACK (FDBK)** - Scan tool displays "ON/OFF." - This parameter is the actual state of the 3-2 control solenoid driver control circuit. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage. The 3-2 control solenoid feedback will normally vary "ON"/"OFF" under normal operating conditions.

## 10A-14 DRIVEABILITY AND EMISSIONS (GASOLINE)

**HOT MODE** - The scan tool will display this value either "ON" or "OFF." When displayed "ON," the transmission fluid temperature has become greater than 135°C and the following actions will occur:

1. The TCC will engage in fourth gear, except when the brakes are applied, low TP signal, or a DTC is stored.
2. When the fluid temperature obtains 150°C but, less than 154°C for 15 minutes, DTC 79 will set. When DTC 79 is set, TCC application will still occur in the same criteria as when hot mode started.
3. When fluid temperature increases from 150°C for 1 second, in a time period less than 15 minutes, DTC 79 will not set. DTC 58 will set when transmission fluid temperature is greater than 154°C for 1 second.
4. When DTC 58 is set and in hot mode, the vehicle will retain hot mode criteria until the next ignition cycle.
5. If fluid temperature cools from 135°C down to less than 125°C, hot mode criteria will discontinue.

**TCC SLIP SPEED** - Scan tool displays a range of -4096 RPM to + 4095 RPM. - This parameter is the difference between transmission input speed (derived from the distributor reference pulses, or crankshaft/camshaft position sensors) and transmission output speed (derived from the vehicle speed sensor). A negative value indicates input speed is less than output speed (deceleration). A positive value indicates input speed is greater than output speed (acceleration). A value of zero indicates input speed is equal to output speed (TCC applied).

**TCC SOLENOID** - Scan tool displays "ON"/"OFF." - This parameter is the commanded state of the TCC solenoid. "ON" indicates a commanded energized state (current flowing through the solenoid). "OFF" indicates a commanded non-energized state (current not flowing through the solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) TCC SOL** - Scan tool displays "ON"/"OFF." - This parameter is the actual state of the TCC solenoid driver control circuit. "ON" indicates a driver control signal at 0 voltage. "OFF" indicates a driver control signal at B+ voltage.

**DESIRED PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the commanded current of the pressure control solenoid circuit. 0.00 amps (no current flow) indicates commanded higher line pressure. 1.10 amps (high current flow) indicates commanded lower line pressure.

**ACTUAL PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the actual current of the pressure control solenoid circuit at the control module. 0.00 amps (no current flow) indicates actual lower line pressure.

**PRESSURE CONTROL SOLENOID (PCS) DUTY CYCLE** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded state of the pressure control solenoid expressed as a percent of energized on time. 0% indicates zero on time (non-energized) or no current flow. 100% indicates maximum on time (energized) or high current flow. Normal operations range is 0%-60%.

**MPH Km/h** - Scan tool displays a range of 0 mph to 255 mph. - This parameter is input signal from the vehicle speed sensor.

**FOUR WHEEL DRIVE (4WD) LOW SWITCH** - Scan tool displays NO/YES. - This parameter is the signal state of the four wheel drive low circuit. NO indicates a B+ voltage signal (4WD low not requested), YES indicates a 0 voltage signal (4WD low requested).

**CRUISE ENGAGED** - Scan tool displays NO/YES. - This parameter is the signal state of the cruise control "ON"/"OFF" switch. NO indicates a 0 voltage signal (cruise control not requested). YES indicates a B+ voltage (cruise control requested).

**TCC BRAKE SWITCH** - Scan tool displays OPEN/CLOSED. - This parameter indicates the state of the TCC brake switch circuit input. Open indicates a 0 voltage input (brake switch open, brake pedal applied). Closed indicates a B+ voltage input (brake switch closed, brake pedal released).

**KICKDOWN ENABLED - (Above approximately 75% TPS)** Scan tool displays NO/YES. - This parameter indicates whether enabling conditions exist for an acceleration mode downshift. NO indicates enabling conditions (throttle position, vehicle speed, input speed, etc.) do not exist for an acceleration mode downshift. YES indicates enabling conditions exist for an acceleration mode downshift.

**1-2 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 1-2 shift. These are accurate unless adaptable indicates YES.

**2-3 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 2-3 shift. Please refer to road test procedure in section 7A14A to achieve accurate 2-3 shift time. 2-3 shift time is normally between 0.3 sec and 1.35 sec.

**1-2 SHIFT ERROR** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the difference between the desired 1-2 shift time and the actual 1-2 shift time.

**CURRENT (CURR) ADAPT CELL** - Scan tool displays a range of NOT USED, 25% TP CELL, 40% TP CELL and 70% TP CELL. - This parameter indicates the current throttle position cell used for fluid line pressure modification (adaptation). N/A represents 0% to 25% throttle angle. 25% TP CELL represents 25% to 39% throttle cell. 40% TP CELL represents 40% to 70% throttle angle. 70% TP CELL represents 70% to 100% throttle angle.

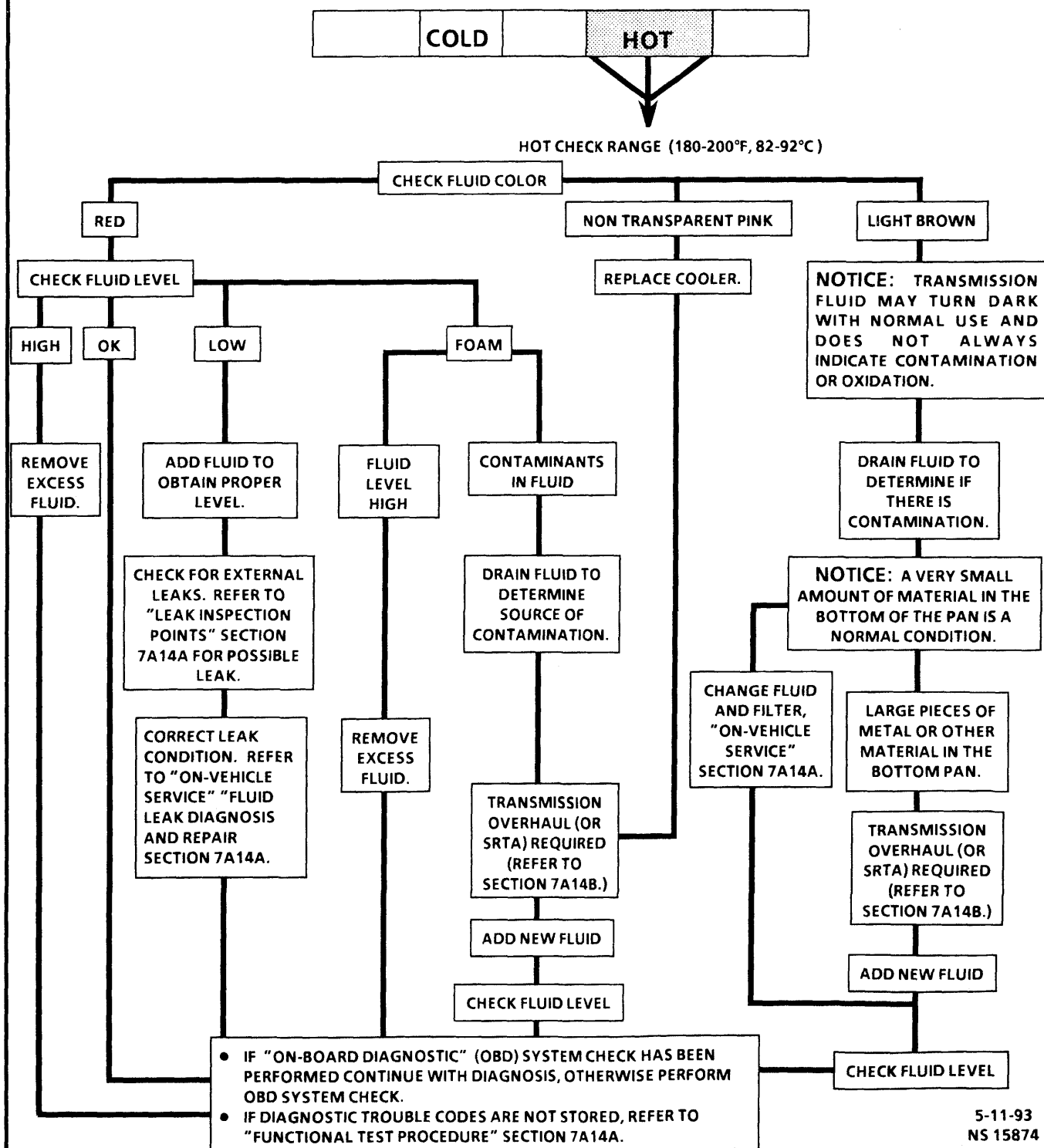
**TRANS CALIBRATION (CALIB) ID** - Scan tool displays a range of 0000 to 9999. - This parameter is the four digit identification of the transmission software calibration.

**SYSTEM VOLTAGE** - Scan tool displays 0.00 volt to 25.5 volts. - This parameter is the battery ignition voltage input to the control module.



## 4L60E TRANSMISSION FLUID CHECKING PROCEDURE

1. Warm the transmission to normal operating temperature by driving the vehicle about 15 miles (24 km). Operating temperature is 180-200°F (82-94°C).
  2. Park vehicle on a level surface, place shift lever in "P" park and apply the parking brake.
  3. Check fluid level on the dipstick (read the lower level).
  4. If fluid level is low, add only enough DEXRON®. IIE to bring the fluid level into the hot area.
- \* It is important to check fluid level when the transmission has reached operating temperature. The hot range is calibrated correspond to the correct fluid level range for fluid between 180 and 200°F (82-94°C).



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Figure 10A-14 - 4L60E Transmission Fluid Checking Procedure

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.



### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION | DTC NUMBER AND NAME                                                        | SECTION |
|-------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------|---------|
| DTC 13 - Oxygen O2S Sensor Circuit (Open Circuit)                                         | 3A      | DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit High (Low Vacuum) | 3A      |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3A      | DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit Low (High Vacuum) | 3A      |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3A      | DTC 35 - IAC Error                                                         | 3A      |
| DTC 16 - VSS Buffer Fault                                                                 | 3A      | *DTC 37 - Brake Switch Stuck "ON"                                          | 10A/10B |
| DTC 21 - Throttle Position (TP) Sensor Circuit High (Signal Voltage High)                 | 3A      | *DTC 38 - Brake Switch Stuck "OFF"                                         | 10A/10B |
| DTC 22 - Throttle Position (TP) Sensor Circuit Low (Signal Voltage Low)                   | 3A      | *DTC 39 - Torque Converter Clutch (TCC) Stuck OFF                          | 10/B    |
| DTC 23 - Intake Air Temperature (IAT) Sensor Circuit High (Low Temperature Indicated)     | 3A      | DTC 42 - Ignition Control (IC) Error                                       | 3A      |
| *DTC 24 - Vehicle Speed Sensor (VSS) Circuit Low (Trans Output Speed Signal)              | 10A/10B | DTC 43 - Knock Sensor (KS) Circuit                                         | 3A      |
| DTC 25 - Intake Air Temperature (IAT) Sensor Circuit Low (High Temperature Indicated)     | 3A      | DTC 44 - Lean Exhaust                                                      | 3A      |
| *DTC 28 - Transmission Range (TR) Pressure Switch Assembly                                | 10A/10B | DTC 45 - Rich Exhaust                                                      | 3A      |
| DTC 32 - Exhaust Gas Recirculation (EGR) Error                                            | 3A      | DTC 51 - PROM (MEM-CAL) Error                                              | 3A      |
|                                                                                           |         | *DTC 52 - System Voltage High Long                                         | 10A/10B |
|                                                                                           |         | *DTC 53 - System Voltage High                                              | 10A/10B |
|                                                                                           |         | DTC 54 - Fuel Pump Relay Circuit (Low Voltage)                             | 3A      |
|                                                                                           |         | DTC 55 - Faulty PCM                                                        | 3A      |

Figure 10A-15 - Diagnostic Trouble Code Identification (1 of 2)

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go out and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical DTC first, when diagnosing some engine DTCs other transmission symptoms can occur.

| DTC NUMBER AND NAME,                                                                           | SECTION | DTC NUMBER AND NAME                                                                  | SECTION |
|------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------|---------|
| *DTC 58 - Transmission Fluid Temperature (TFT) Sensor Circuit Low (High Temperature Indicated) | 10A/10B | *DTC 81 - 2-3 Shift Solenoid Circuit Fault                                           | 10A/10B |
| *DTC 59 - Transmission Fluid Temperature (TFT) Sensor Circuit High (Low Temperature Indicated) | 10A/10B | *DTC 82 - 1-2 Shift Solenoid Circuit Fault                                           | 10A/10B |
| *DTC 66 - 3-2 Control Solenoid Circuit Fault                                                   | 10A     | *DTC 83 - Torque Converter Clutch (TCC) Pulse Width Modulated (PWM) Solenoid Circuit | 10B     |
| *DTC 67 Torque Converter Clutch (TCC) Solenoid Circuit Fault                                   | 10A     | *DTC 85 - Undefined Ratio Error                                                      | 10B     |
| *DTC 68 - Trans Component Slipping                                                             | 10B     | *DTC 86 - Low Ratio Error                                                            | 10B     |
| *DTC 69 - Torque Converter Clutch (TCC) Stuck "ON"                                             | 10A/10B | *DTC 87 - High Ratio Error                                                           | 10B     |
| *DTC 72 - Vehicle Speed Sensor (VSS) Circuit Loss (Trans Output Speed Signal)                  | 10A/10B |                                                                                      |         |
| *DTC 73 - Pressure Control Solenoid (PCS) Fault (Current Error)                                | 10A/10B |                                                                                      |         |
| *DTC 74 - Transmission Input Speed (TIS) Sensor Circuit                                        | 10B     |                                                                                      |         |
| *DTC 75 - System Voltage Low                                                                   | 10A/10B |                                                                                      |         |
| *DTC 79 - Transmission Fluid Over temp                                                         | 10A/10B |                                                                                      |         |

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Figure 10A-16 - Diagnostic Trouble Code Identification (2 of 2)

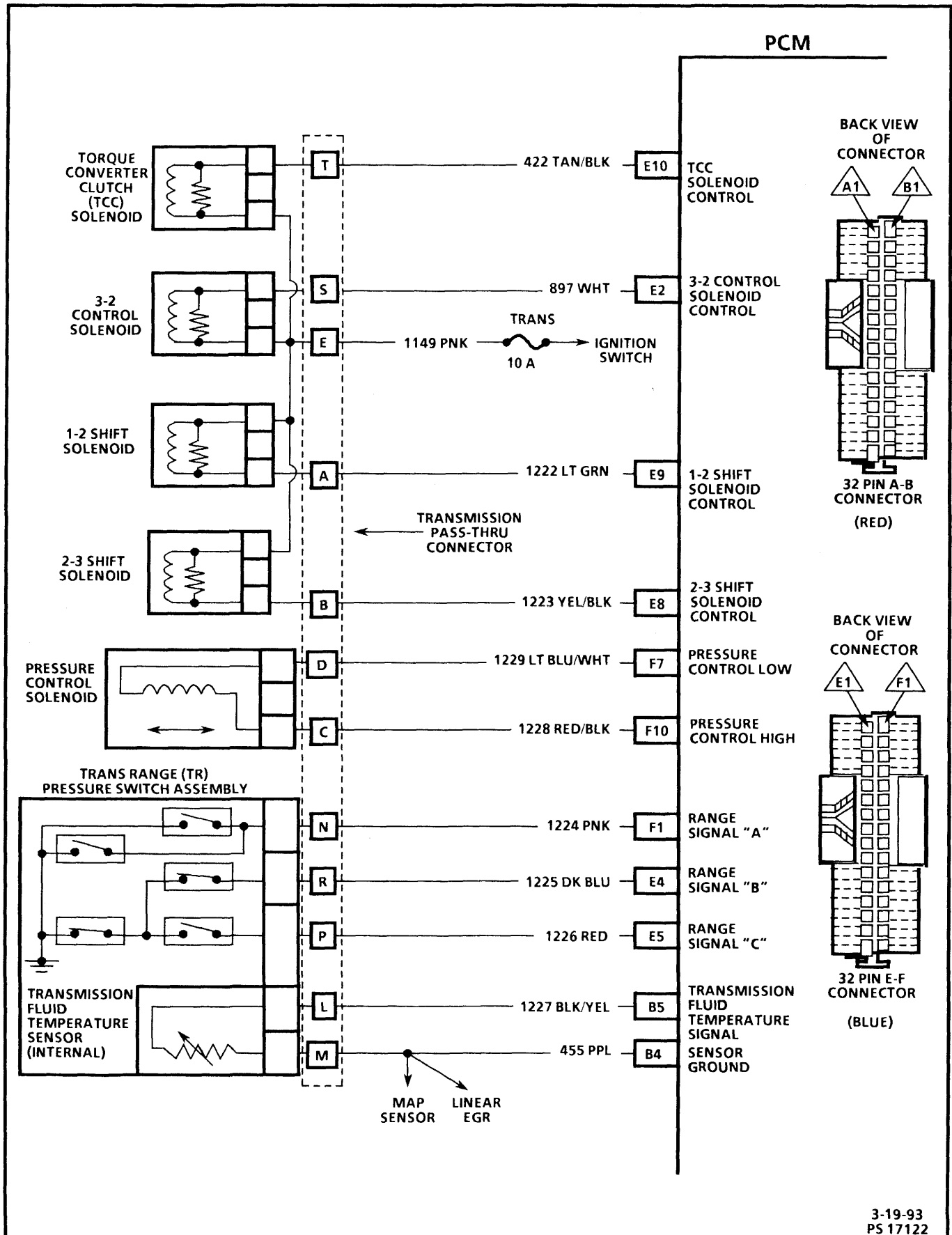
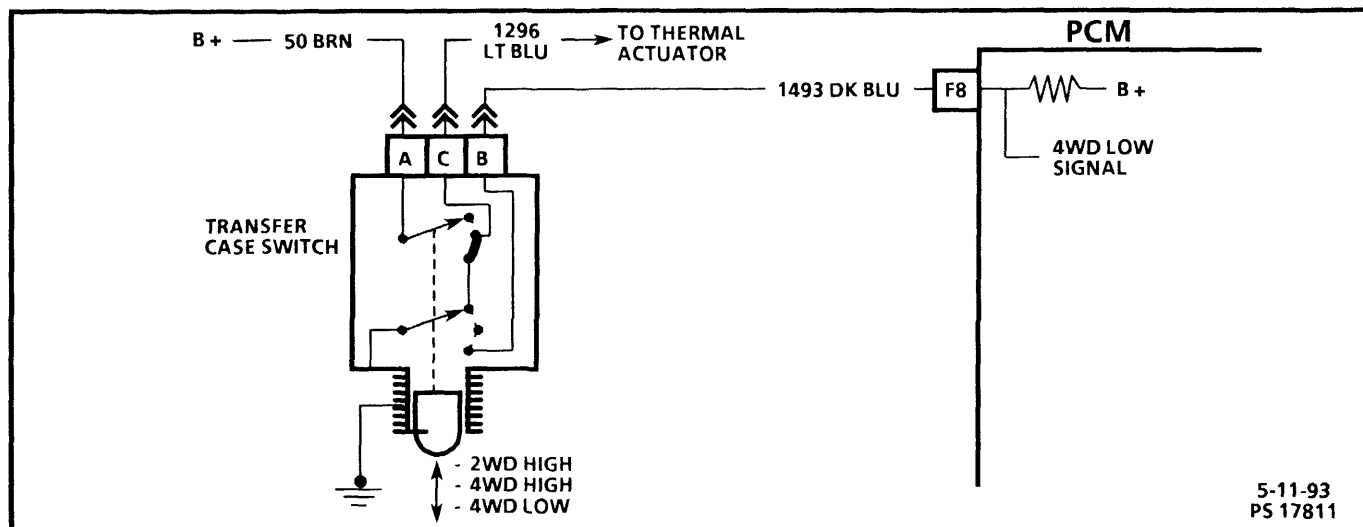


Figure 10A-17 - PCM Wiring Diagram 4.3L, 5.0L, 5.7L (C/K) 4L60E Transmission



## 4WD LOW SWITCH CHECK

### Circuit Description:

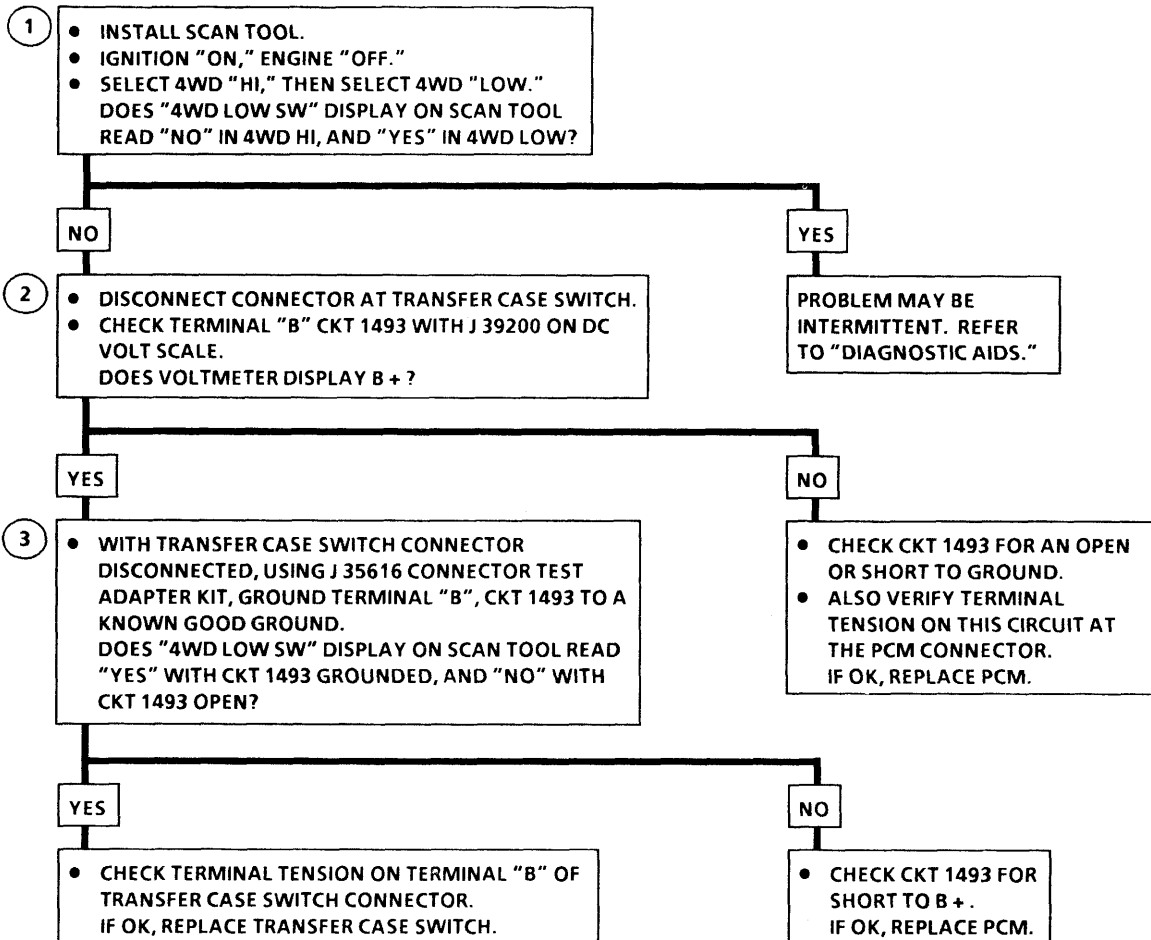
The 4WD low circuit consists of a transfer case switch, front axle actuator, and wiring. The PCM supplies a B+ voltage signal to the transfer case switch on CKT 1493. With 2WD or 4WD HI selected, no ground path is provided for CKT 1493, and the voltage signal at the PCM will be B+. When 4WD low is selected, the transfer case switch provides a ground for CKT 1493, and the PCM 4WD low signal CKT 1493 will change from B+ to zero volts. The transfer case switch also completes CKT 50 (B+) to CKT 1296 to provide B+ to the front axle actuator.

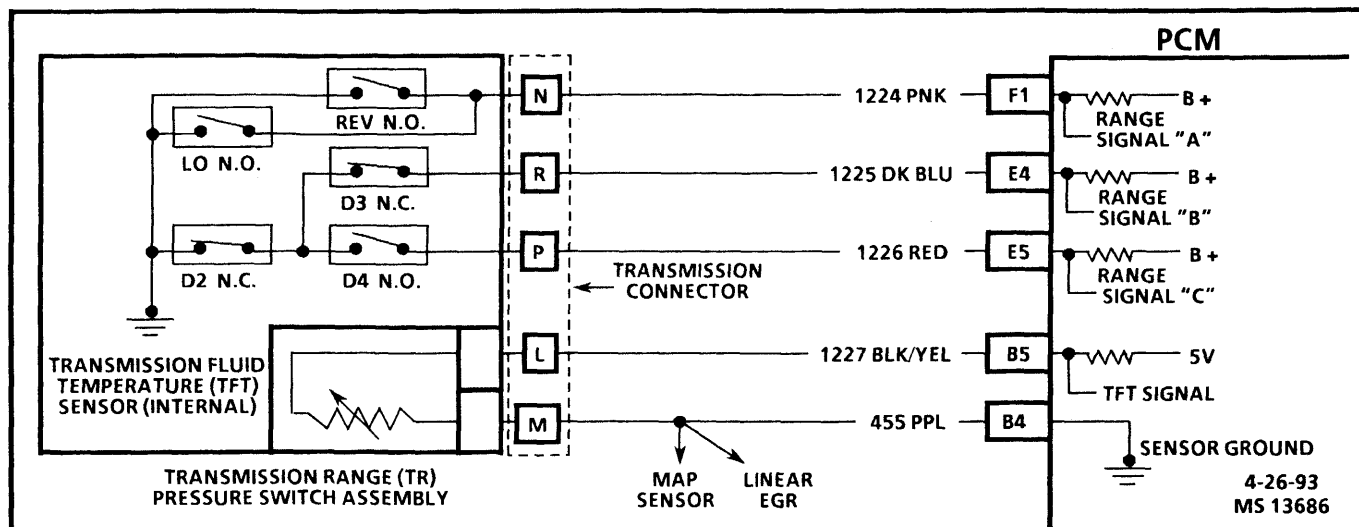
**Action Taken (PCM will default to):** No DTC(s) will be set, however, failures of the 4WD low circuit can cause many types of complaints such as: early/late shifts, erratic shifts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for proper circuit operation.
2. This test checks for a proper reference signal from the PCM.
3. This test checks the ability of the transfer case switch to ground the reference signal from the PCM.

**Diagnostic Aids:** For further information, refer to SECTION 7D of the appropriate service manual.

**4WD LOW SWITCH CHECK**



## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

### Circuit Description:

The Transmission Range (TR) switch assembly consists of five pressure switches (two normally closed and three normally open), and a TFT sensor combined into one unit and mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** Refer to accompanying chart for various A/B/C range combinations. Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A of the appropriate service manual for further information.

"ON" = 0 volts/"OFF" = B +

**Valid Combination Chart**

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings

## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

- 1
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO

- 3
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

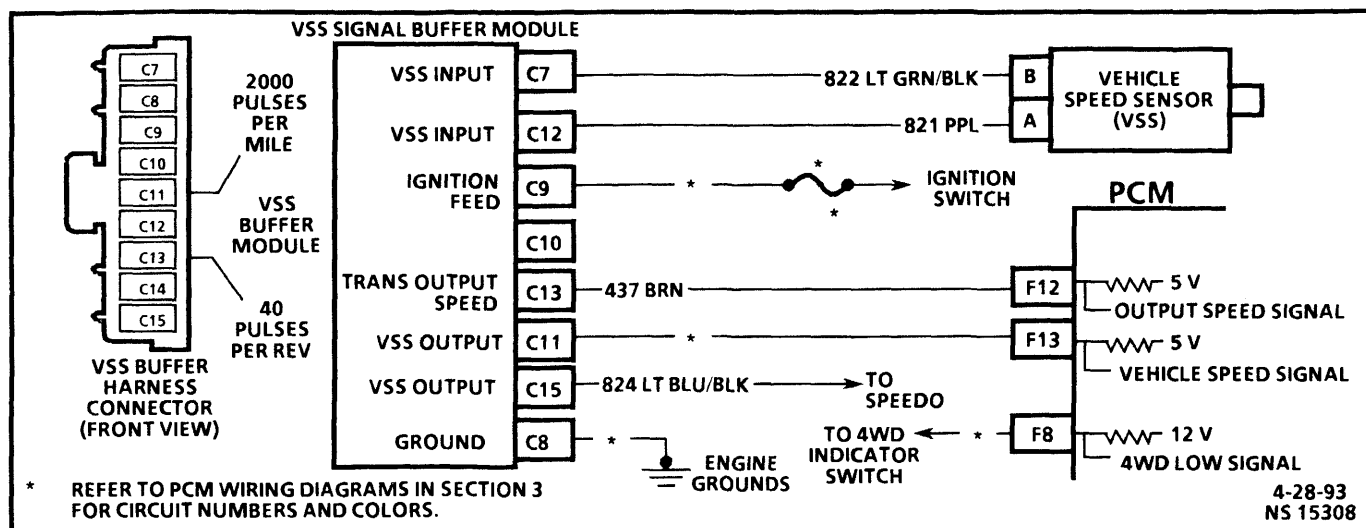
YES

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

YES

- 2
- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.





## DTC 24

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

#### DTC 24 Will Set When:

- No DTC(s) 21, 22, 28, 33, or 34.
- Not in P/N.
- CKT 437 voltage is constant.
- Engine speed is greater than 3000 RPM.
- Output speed is less than 250 RPM.
- MAP is greater than 100 kPa.
- TP is between 10% and 100%.
- All conditions met for 3 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- Second gear only.

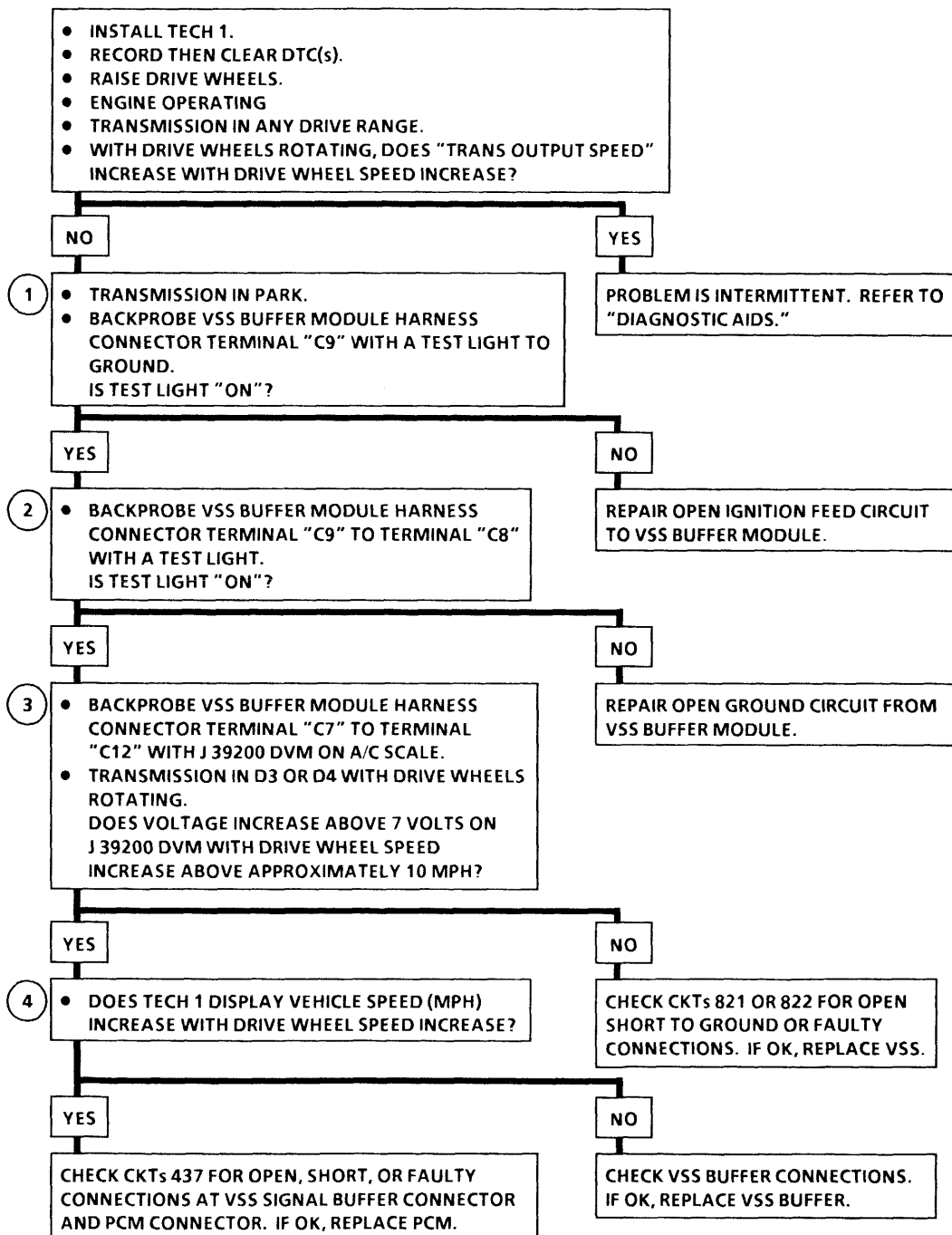
**DTC 24 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

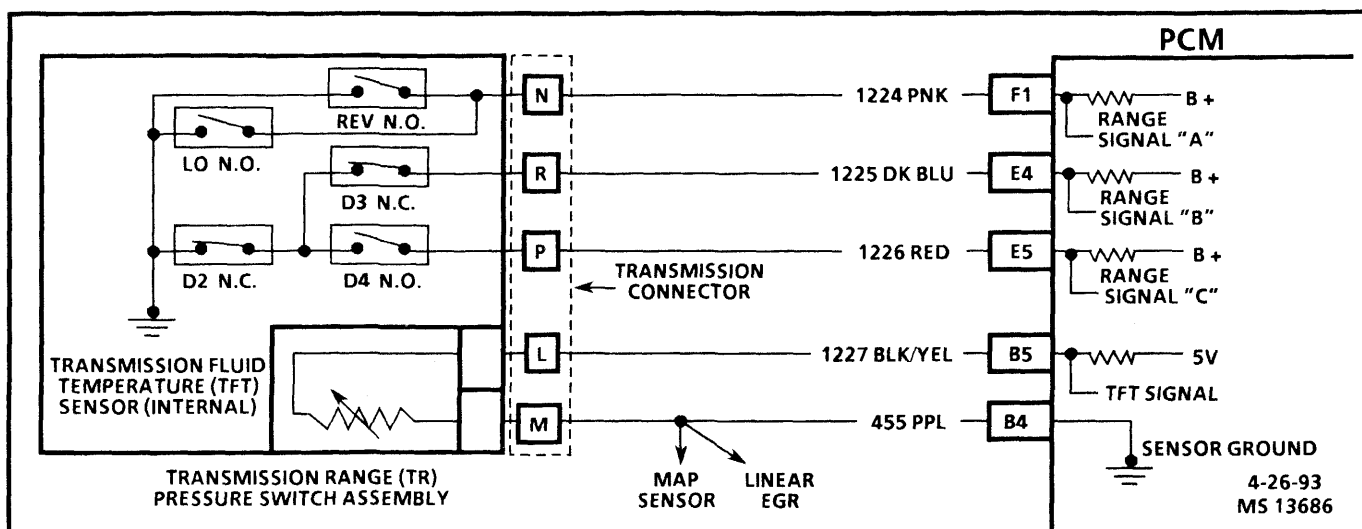
#### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

**DTC 24****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697



## DTC 28

### TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT

#### Circuit Description:

The Transmission Range (TR) switch assembly consists of five pressure switches (two normally closed and three normally open), and a TFT sensor combined into one unit and mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

#### DTC 28 Will Set When:

- Range signals "A" and "C" are both zero volts "ON."
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Harsh shifts.
- Drive 4 shift control.
- Disable manual mode.
- No fourth gear in hot mode.

**DTC 28 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled from "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

#### Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings

**Diagnostic Aids:** DTC 28 will set if the PCM detects one of two "Illegal" combinations.

Refer to accompanying chart for various A/B/C range combinations.

Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A of the appropriate service manual for further information.

"ON" = 0 volts/"OFF" = B +

**DTC 28****TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT**

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

①

- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

YES

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

NO

YES

③

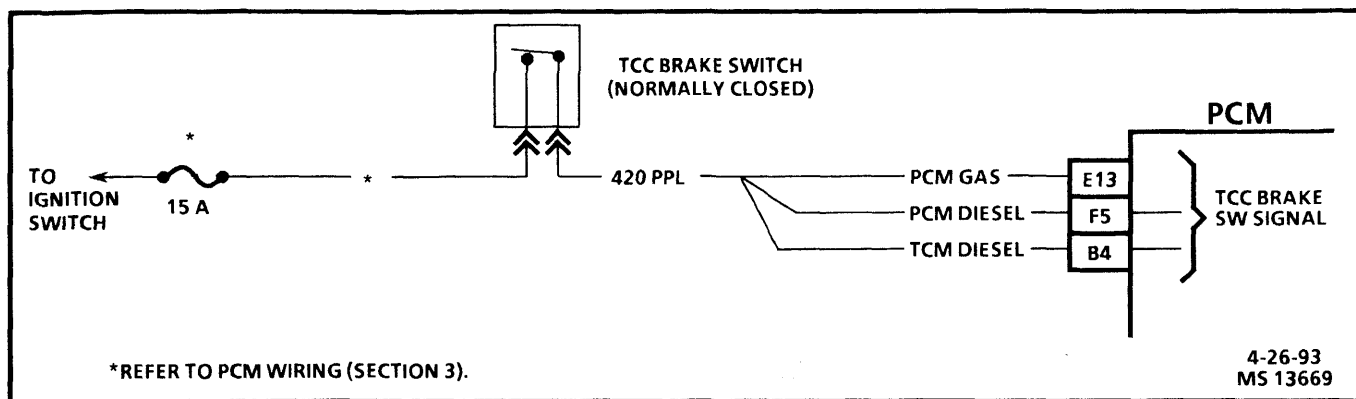
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

②

- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-27-93  
PS 17065



## DTC 37

### BRAKE SWITCH STUCK "ON"

#### Circuit Description:

The normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The signal voltage is opened when the brakes are applied.

#### DTC 37 Will Set When:

- CKT 420 is open.
  - Vehicle speed is less than 5 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - Then vehicle speed is greater than 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

**Action Taken (PCM will default to):** No fourth gear in hot mode.

**DTC 37 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

## DTC 37

### BRAKE SWITCH STUCK "ON"

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

YES

①

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

YES

NO

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

YES

NO

②

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

YES

NO

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

YES

NO

③

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

YES

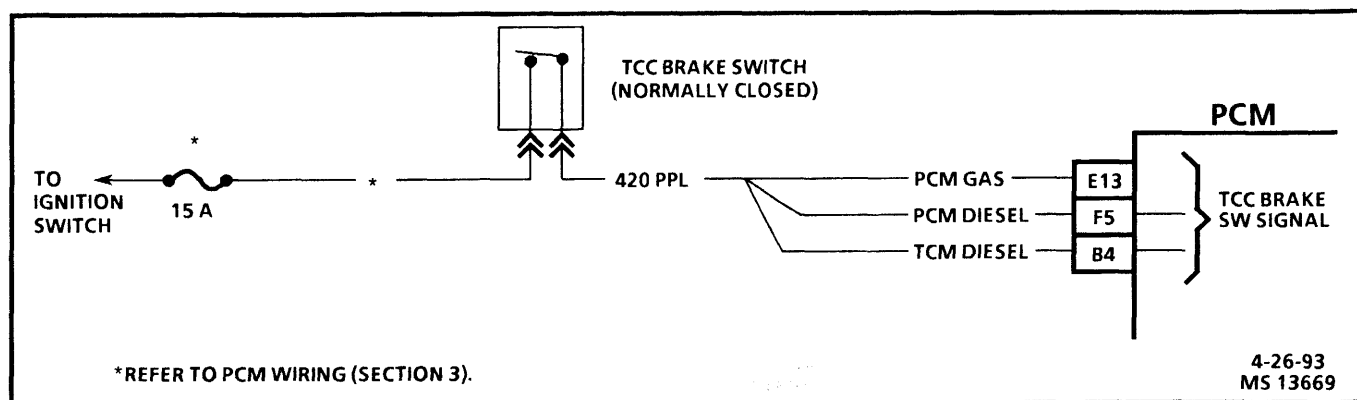
NO

ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-3-93  
PS 17053



## DTC 38

### BRAKE SWITCH STUCK "OFF"

#### Circuit Description:

The normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The signal voltage is opened when the brakes are applied.

#### DTC 38 Will Set When:

- CKT 420 has constant voltage.
  - Vehicle speed is greater than 20 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

#### Action Taken (PCM will default to):

- No TCC.
- No fourth gear in hot mode.

**DTC 38 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

# **DTC 38** **BRAKE SWITCH STUCK "OFF"**

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

YES

1

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

YES

NO

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

YES

NO

2

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

YES

NO

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

YES

NO

3

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

YES

NO

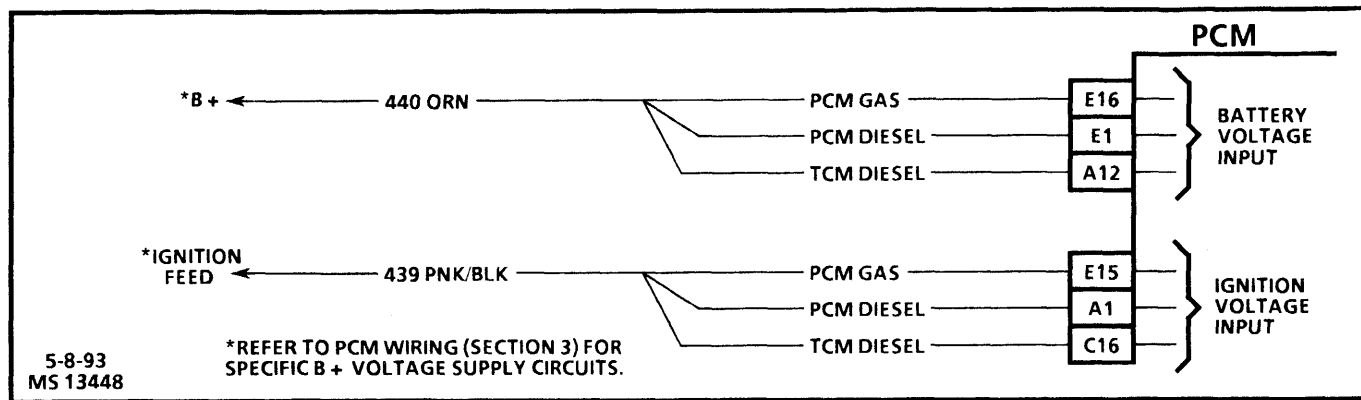
ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-3-93  
PS 17053





## DTC 52

### SYSTEM VOLTAGE HIGH LONG

#### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

#### DTC 52 Will Set When:

- The PCM ignition feed voltage is greater than 16 volts.
- All conditions met for 109 minutes.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Third gear only.

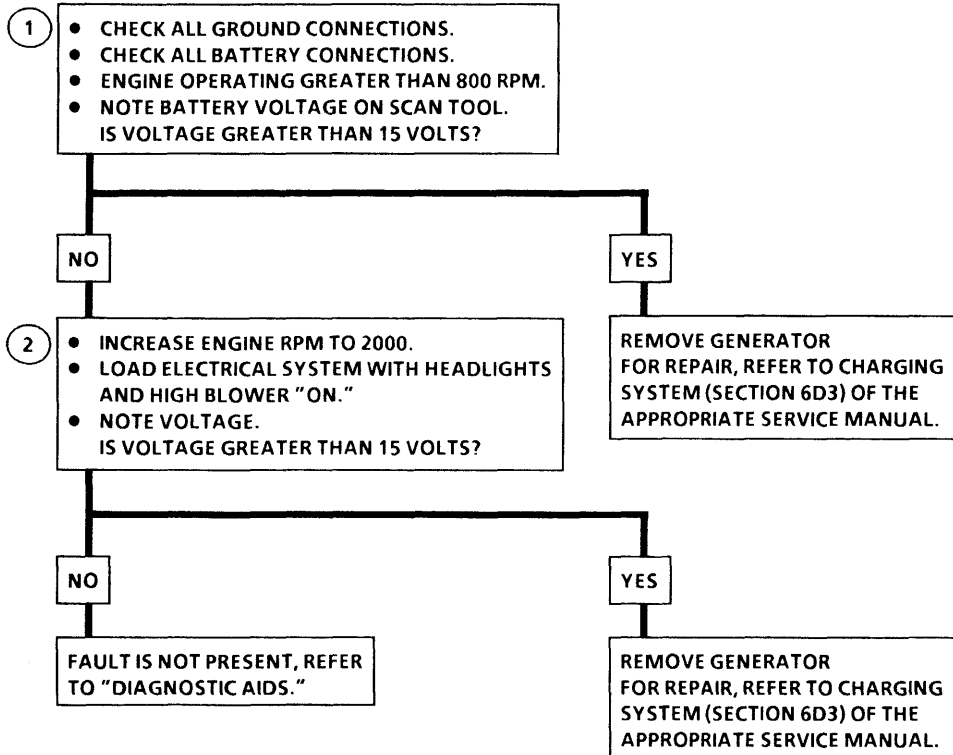
**DTC 52 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

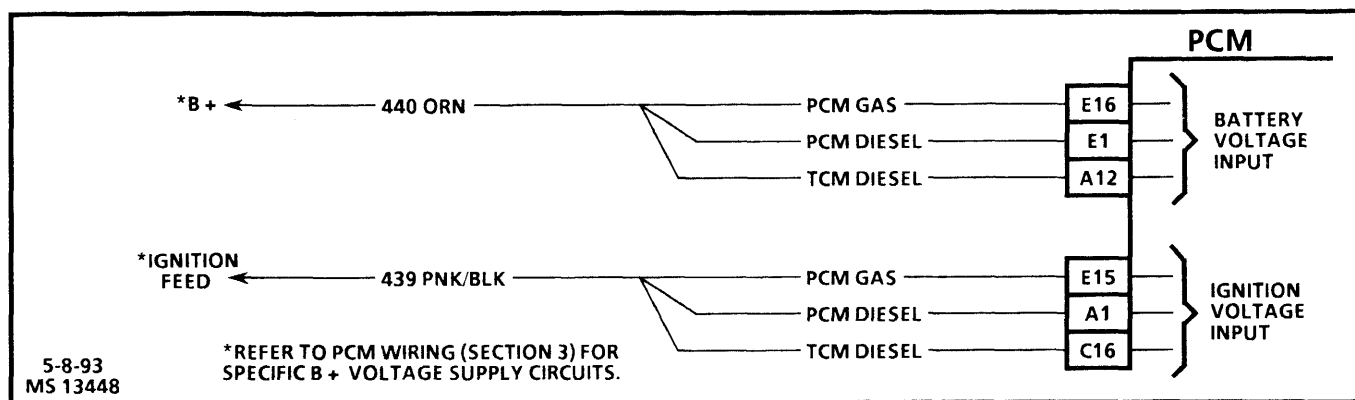
#### Diagnostic Aids:

- CKT 440 supplies battery voltage to the PCM.
- Charging the battery with a battery charger and jump-starting an engine may set DTC 52. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 52**  
**SYSTEM VOLTAGE HIGH LONG**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067



## DTC 53

### SYSTEM VOLTAGE HIGH

#### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

#### DTC 53 Will Set When:

- The ignition is "ON."
- The PCM ignition feed voltage is greater than 19.5 volts.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Third gear only.

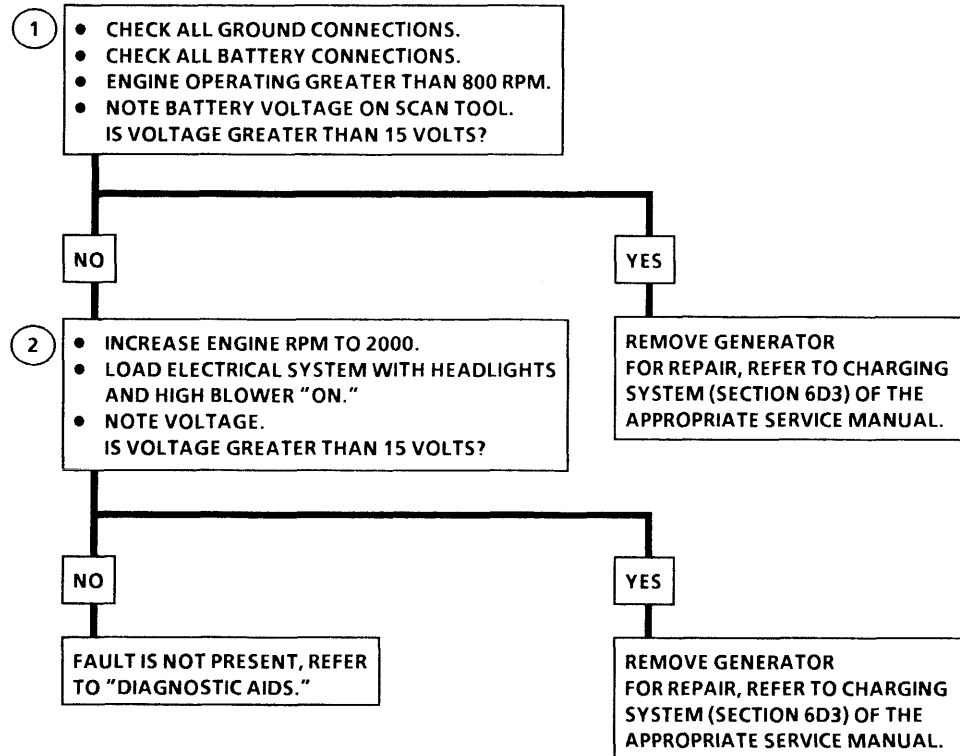
**DTC 53 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

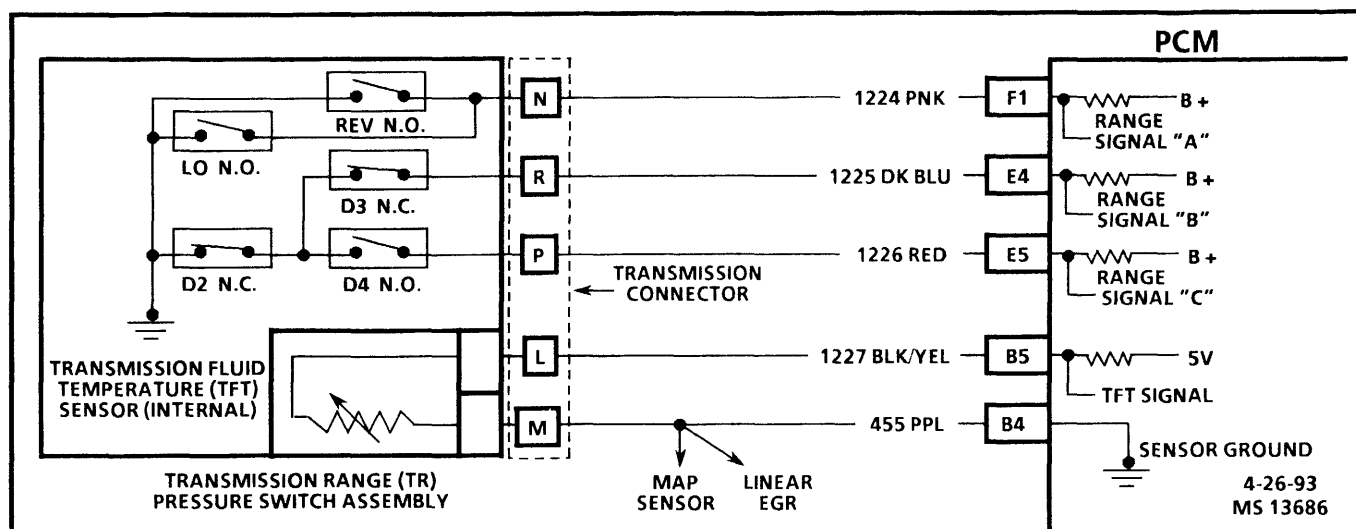
#### Diagnostic Aids:

- CKT 440 supplies battery voltage to the PCM.
- Charging the battery with a battery charger and jump-starting an engine may set DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 53**  
**SYSTEM VOLTAGE HIGH**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067



## DTC 58

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts. With a DTC 79 also set, check the transmission cooling system.

#### DTC 58 Will Set When:

- Signal voltage indicates TFT greater than 151°C (306°F).
- All conditions met for 1 second.

**Action Taken (PCM will default to):** The transmission will use a warm value for operation, but the scan tool will display the actual fluid temperature.

**DTC 58 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

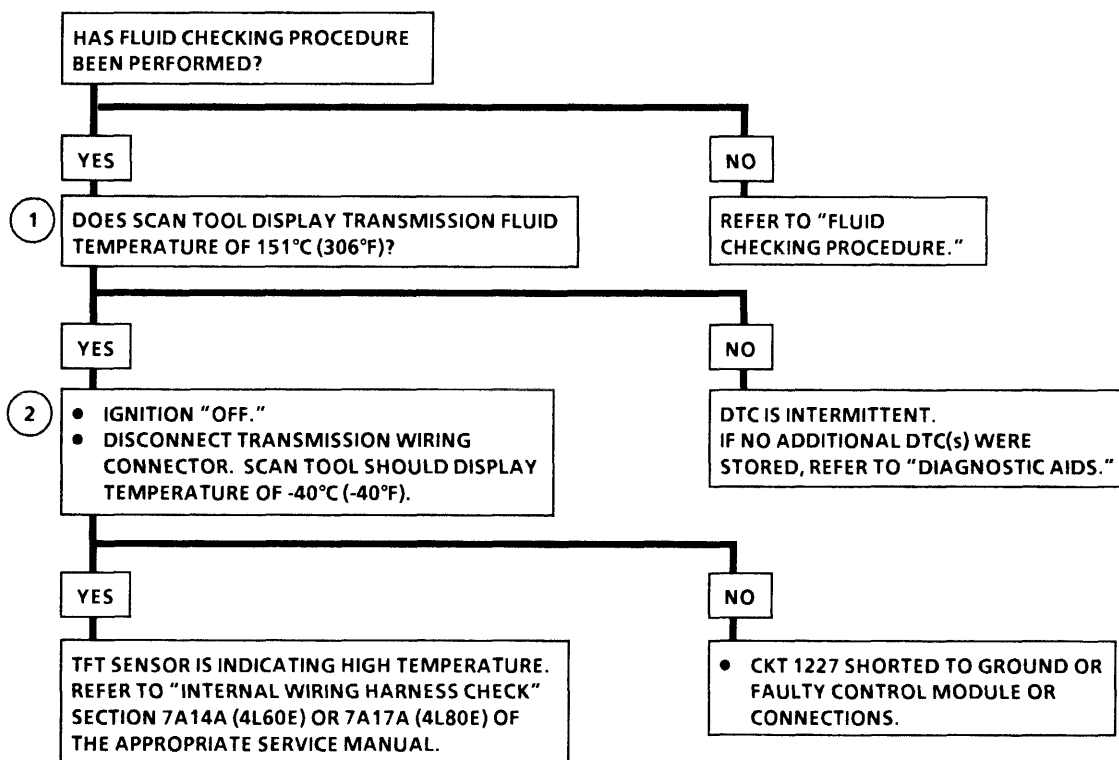
1. This test checks for a short to ground or a "skewed" sensor.
2. This test checks for an internal fault within the transmission by creating an open.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C (212°F) then stabilize.

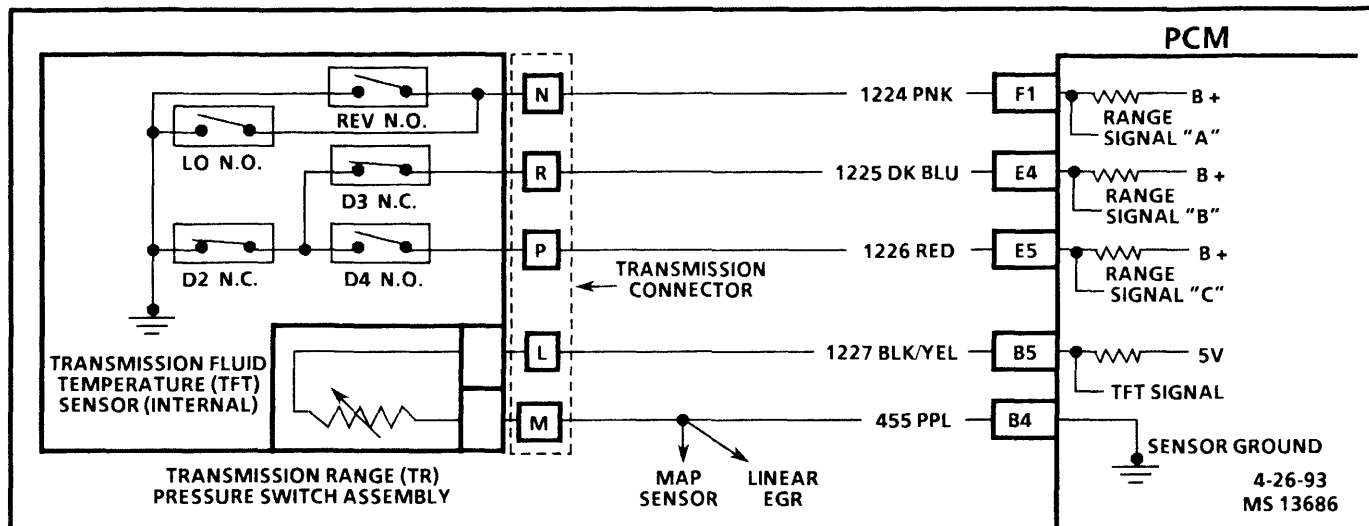
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A14A may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" (mis-scaled) sensor could result in delayed garage shifts or TCC complaints.

**DTC 58****TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-29-93  
MS 13671



## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies 5 volts to the sensor on CKT 1227. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases at about 1.5 to 2.0 volts.

#### DTC 59 Will Set When:

- Signal voltage indicates TFT less than -40°C (-40°F).
- All conditions met for 1 second.

**Action Taken (PCM will default to):** The transmission will use a warm value for operation, but the scan tool will display the actual fluid temperature.

**DTC 59 Will Clear When:** The fault condition(s) no longer exist.

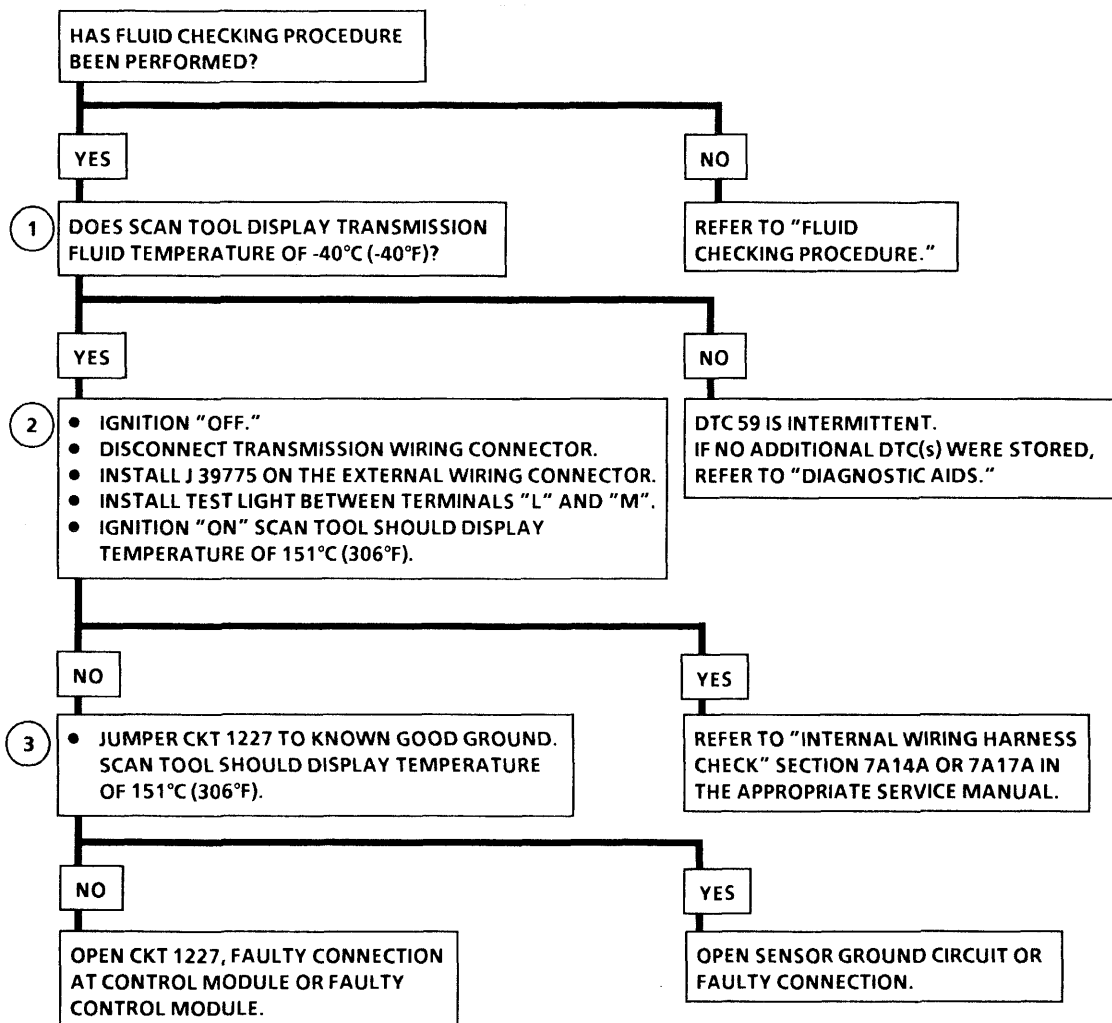
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for a skewed sensor.
2. This test simulates a DTC 58. If the PCM recognizes the low signal voltage (high temperature), and the scan displays 146°C (295°F) or greater, the PCM and wiring are OK.
3. This test checks if CKT 1227 is open. There should be 5 volts present at the sensor connector if measured with J 39200.

**Diagnostic Aids:** Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100°C (212°F) then stabilize.

A faulty connection or an open in CKT 455 or CKT 1227 can result in a DTC 59.

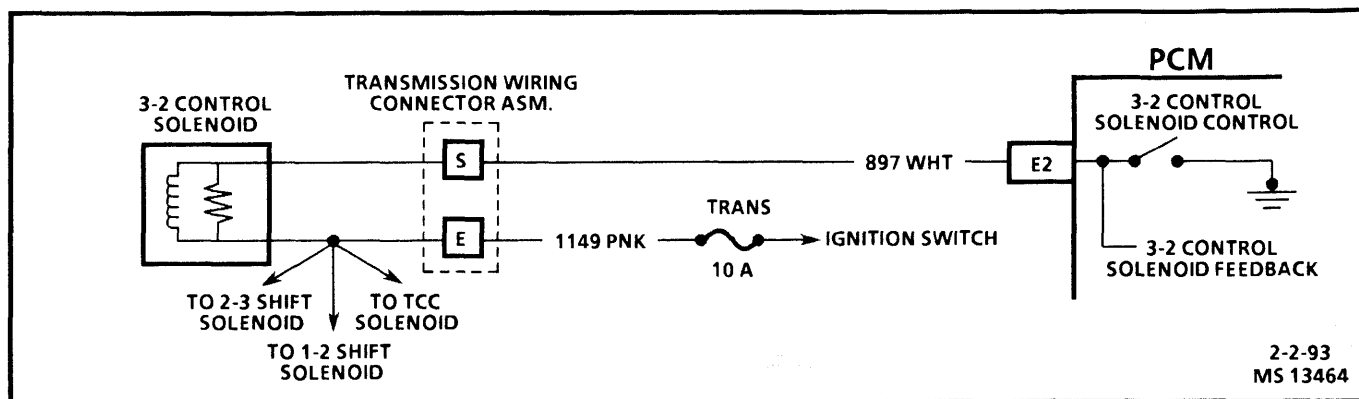
The "Temperature to Resistance Value" scale in SECTION 7A14A may be used to check the TFT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor can result in firm shifts, or TCC complaints.

**DTC 59****TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13451





## DTC 66

### 3-2 CONTROL SOLENOID CIRCUIT FAULT

#### Circuit Description:

Hydraulically, the 3-2 control solenoid coordinates the apply rate of the 2-4 band with hydraulic release of the 3-4 clutch during a 3-2 downshift.

The PCM continually monitors the 3-2 circuit duty cycle depending on the commanded state of the circuit. When the transmission is in first gear the duty cycle of the solenoid is equal to 0. When the transmission is in second gear or higher the duty cycle of the solenoid will be about 90%. When the transmission downshifts, 3-2, the duty cycle of the solenoid will drop.

#### DTC 66 Will Set When:

- The PCM commands the solenoid "ON," and the voltage remains high (B+).
- OR
- The PCM commands the solenoid "OFF," and the voltage drops to zero volts.
- All conditions met for 4 seconds.

#### Action Taken (PCM will default to):

- A delayed (soft) landing to third gear.
- Maximum line pressure.

**DTC 66 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the function of the 3-2 control solenoid and the internal transmission harness.
2. This test checks for power to the 3-2 control solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections at the transmission connector.

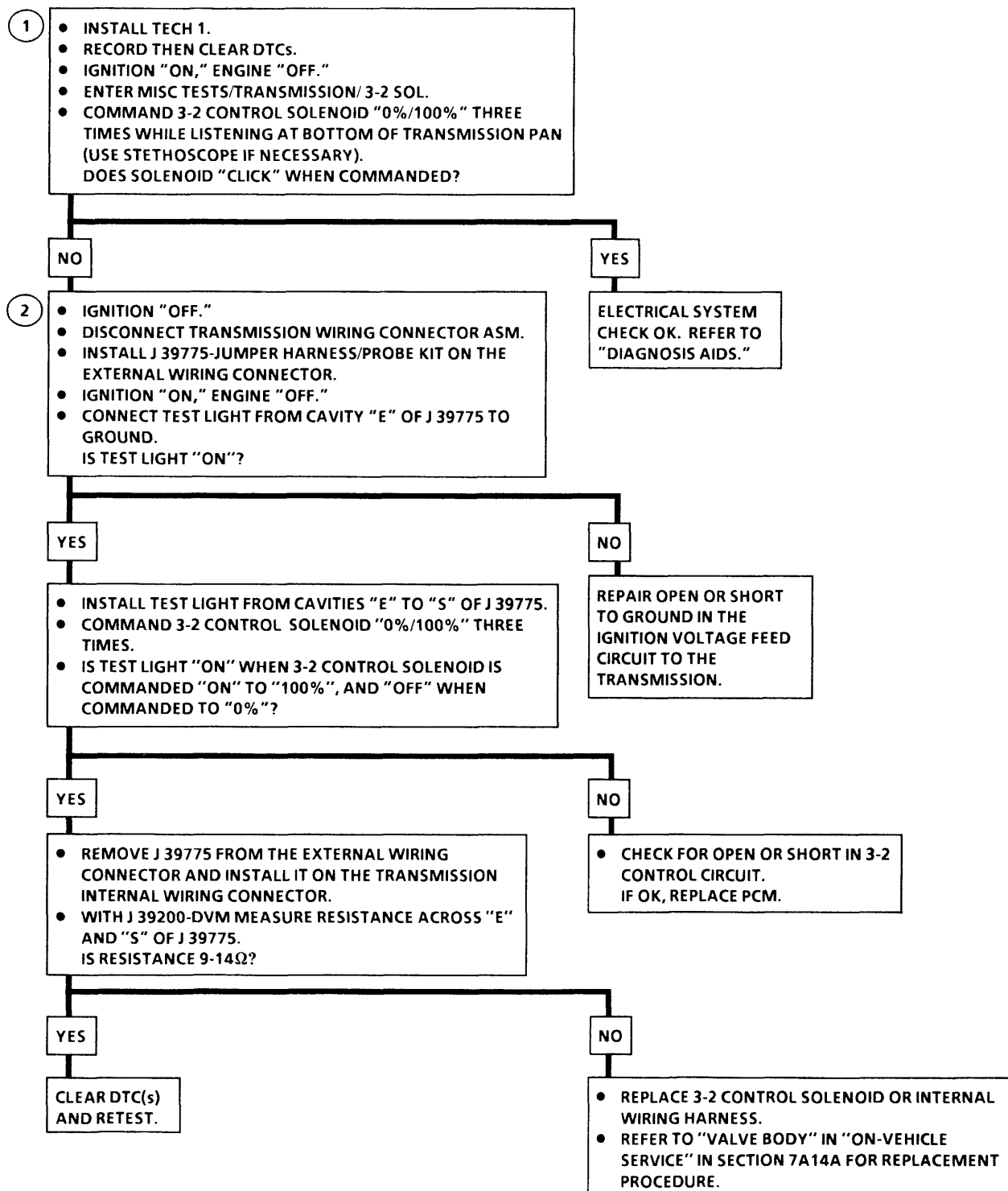
If OK, refer to "PCM Intermittent Diagnostic Trouble Codes or Performance" or "Symptom Diagnosis" in SECTION 7A14A.

The 3-2 control solenoid feedback normally oscillate "ON"/"OFF" when the duty cycle is applied.

An open in the ignition feed circuit will cause multiple DTC(s) to set.

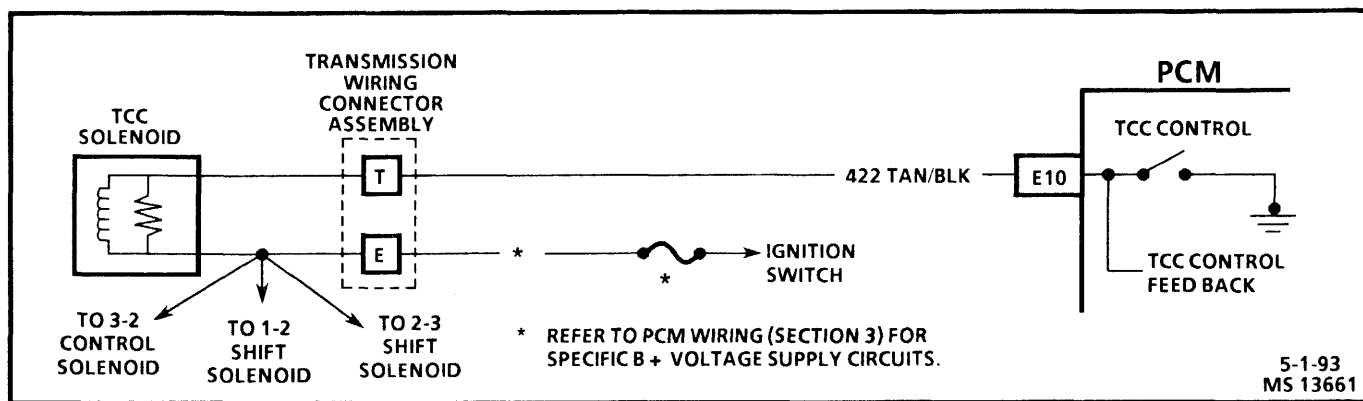
## DTC 66

### 3-2 CONTROL SOLENOID CIRCUIT FAULT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
MS 13465



## DTC 67

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the TCC solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 422.

#### DTC 67 Will Set When:

- The PCM commands the TCC solenoid "ON," and the voltage stays high (B+).
- OR
- The PCM commands the solenoid "OFF," and the voltage drops to zero volts.
- All condition met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- No fourth gear in hot mode.

**DTC 67 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the PCM's ability to control the solenoid.
2. This test checks power supply to the TCC solenoid.

**Diagnostic Aids:** Check all connections at the transmission wiring connector ASM.

If OK refer to "PCM Intermittent Diagnostic Trouble Codes or Performance" or "Symptom Diagnosis" in SECTION 7A14A.

Some slight TCC slip is normal.

An open in the ignition feed circuit will cause multiple DTC(s) to set.

A short to ground in the TCC circuit may also cause a DTC 69 to set. If the TCC circuit is shorted to ground, the TCC will hydraulically engage in D2.

**YES**

**ELECTRICAL SYSTEM  
CHECK OK. REFER TO  
"DIAGNOSTIC AIDS."**

**YES**

- **INSTALL TEST LIGHT FROM CAVITIES "E" TO "T" (4L60E) OR "E" TO "S" (4L80E) OF J 39775.**
- **COMMAND TCC SOLENOID "ON"/"OFF" THREE TIMES.**
- **IS TEST LIGHT "ON" WHEN COMMANDED "ON" AND "OFF" WHEN COMMANDED "OFF"?**

**NO**

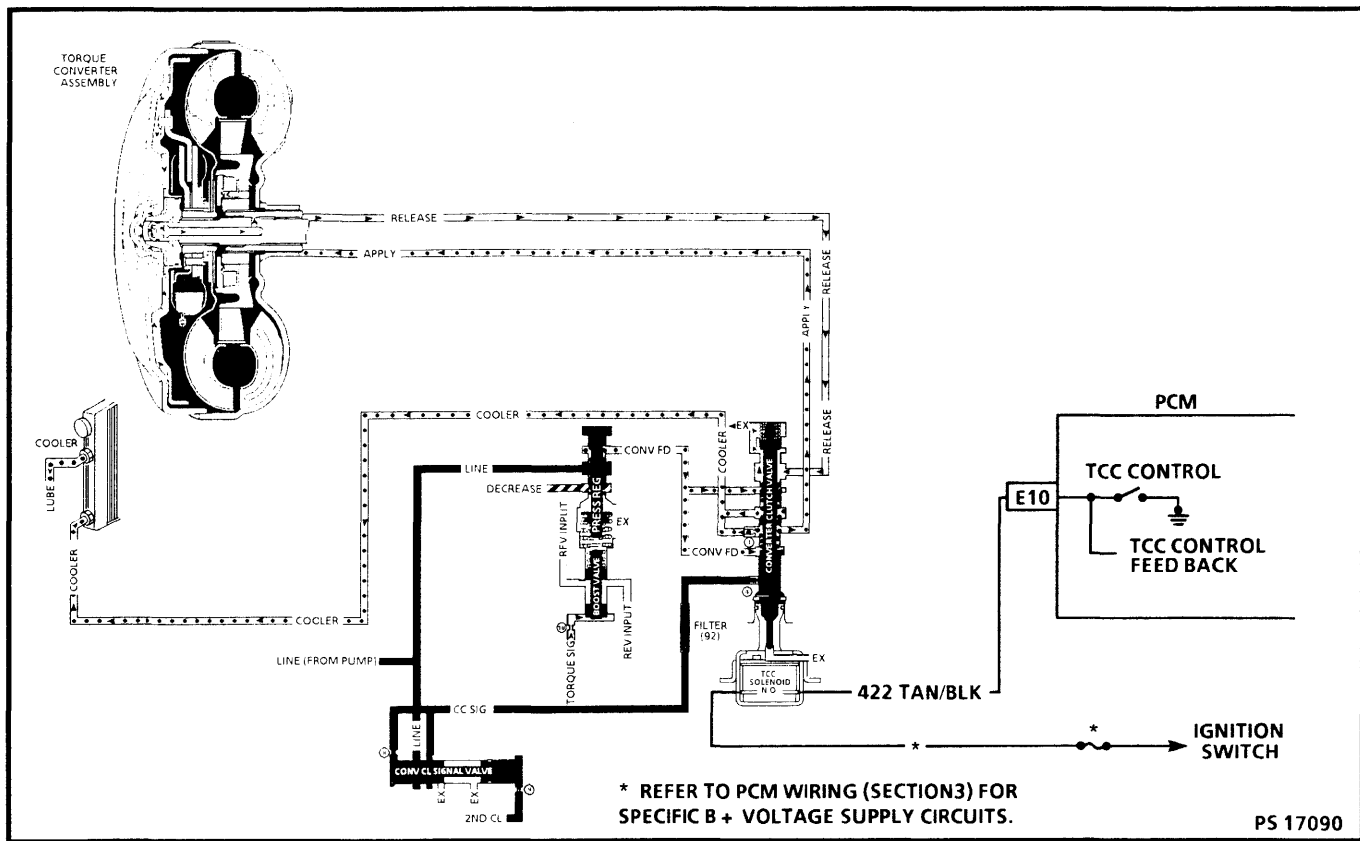
**REPAIR OPEN OR SHORT TO GROUND IN THE IGNITION VOLTAGE FEED CIRCUIT TO THE TRANSMISSION. IF THE FUSE IS OPEN, CHECK THE TRANSMISSION INTERNAL WIRING HARNESS OR SOLENOID FOR SHORT TO GROUND.**

**NO**

- CHECK CKT 422 (4L60E) OR CKT 1350 (4L80E) FOR AN OPEN OR SHORT FROM THE CONTROL MODULE TO THE TRANSMISSION WIRING CONNECTOR. IF OKAY, REPLACE CONTROL MODULE.

**YES**

**EXTERNAL TRANSMISSION WIRING  
CHECKS OKAY. REFER TO "INTERNAL  
WIRING HARNESS CHECK" IN  
SECTION 7A14A (4L60E) OR 7A17A (4L80E).**



## DTC 69

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID STUCK "ON"

#### Circuit Description:

The PCM energizes the Torque Converter Clutch (TCC) solenoid by grounding CKT 422 with an internal quad-driver. The TCC solenoid allows converter release fluid to exhaust past the #9 check ball, applying the TCC. The TCC solenoid will de-energize when the quad-driver no longer provides a ground. When the TCC solenoid is de-energized, this will block exhaust fluid, and release the TCC.

#### DTC 69 Will Set When:

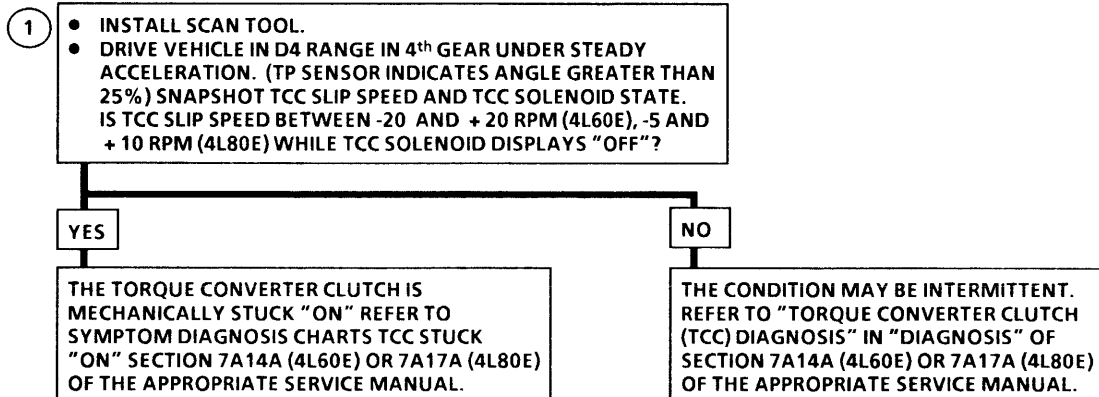
- No DTC(s) 21, 22, or 28 are set.
- TCC slip speed RPM indicates between -20 and +20.
- TCC solenoid is commanded "OFF."
- TP sensor signal is greater than 25%.
- Trans range switch indicates D3 or D4.
- Commanded gear indicates 3<sup>rd</sup> or 4<sup>th</sup> gear.
- Engine speed is greater than 300 RPM.
- All conditions are met for 4 seconds.

**DTC 69 Will Clear When:** Fault condition no longer exists and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

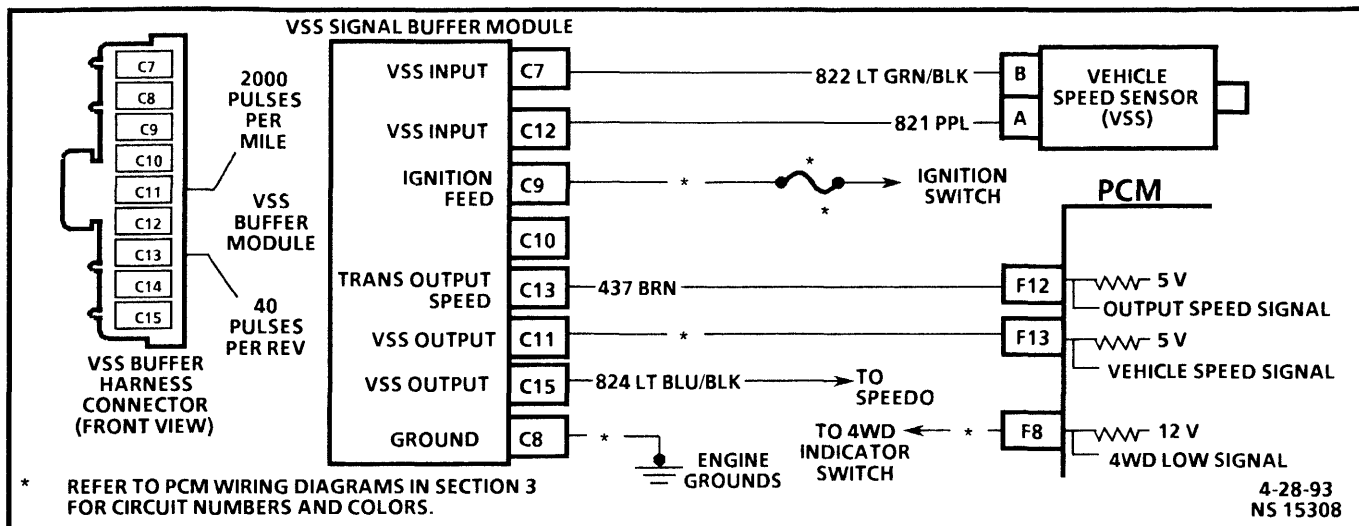
1. This test checks the mechanical state of the TCC. When the PCM commands the TCC solenoid "OFF," TCC slip speed should increase.

**Diagnostic Aids:** If the TCC is mechanically stuck "ON," vehicle speed is zero, brakes are applied, and D2 is selected, the TCC fluid will mechanically apply the TCC causing an engine stall.

**DTC 69****TORQUE CONVERTER CLUTCH (TCC) SOLENOID STUCK "ON"**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17052



## DTC 72

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 pulse per revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

#### DTC 72 Will Set When:

- No DTC 28 set.
- Not in P/N.
- Transmission output speed change is greater than 1000 RPM.
- Engine speed is greater than 200 RPM.
- Conditions met for 2 seconds.
- No DTC 28 set.
- In P/N.
- Transmission output speed change is greater than 2050 RPM.
- Engine speed is greater than 200 RPM.
- Conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- A (soft) delayed landing to second gear.
- Maximum line pressure.

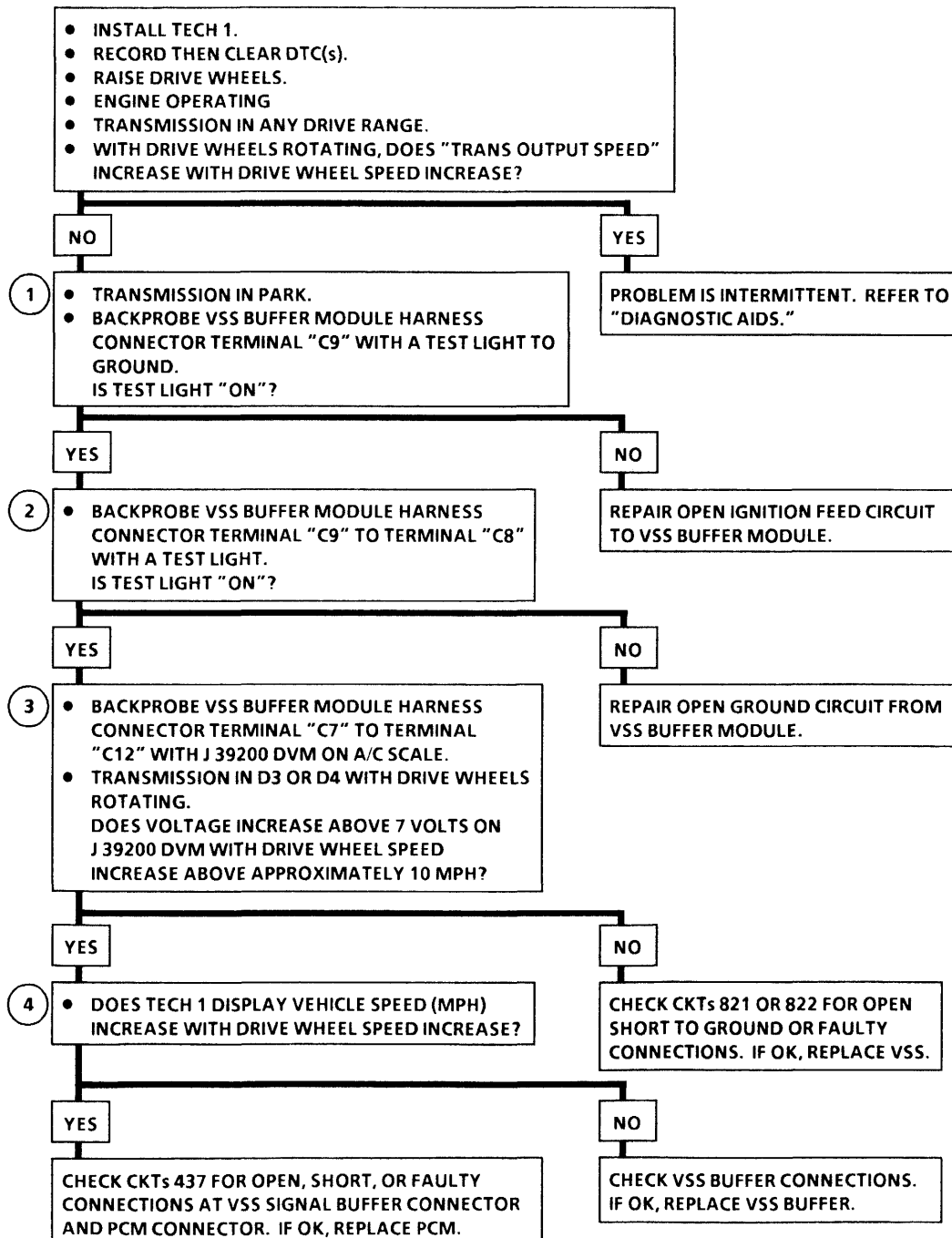
**DTC 72 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

#### Diagnostic Aids:

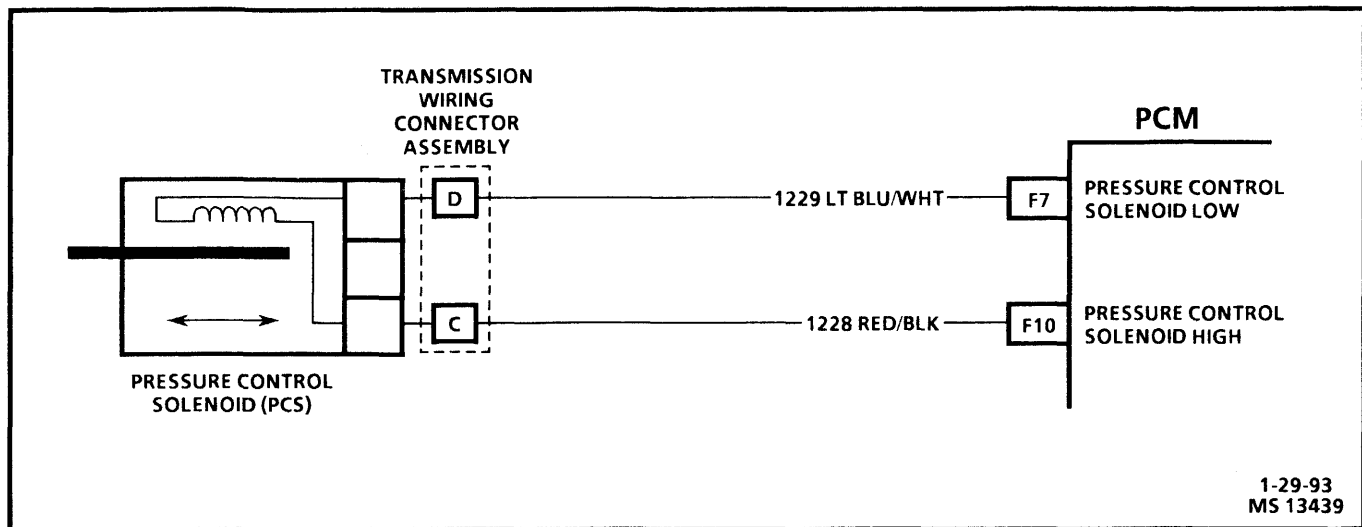
- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

**DTC 72****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697





## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)

#### Circuit Description:

The pressure control solenoid is a PCM controlled device used to regulate transmission line pressure. The PCM compares TP voltage, engine RPM and other inputs to determine the appropriate line pressure for a given load. The PCM will regulate the pressure by applying a varying amperage to the pressure control solenoid. The applied amperage can vary from 0.1 to 1.1 amp. The PCM then monitors the amperage at the return line.

#### DTC 73 Will Set When:

- No DTC 75.
- The return amperage varies greater than 0.16 amp from the commanded amperage.
- All conditions met for one second.

#### Action Taken (PCM will default to):

- Harsh shifts.
- Maximum line pressure.

**DTC 73 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

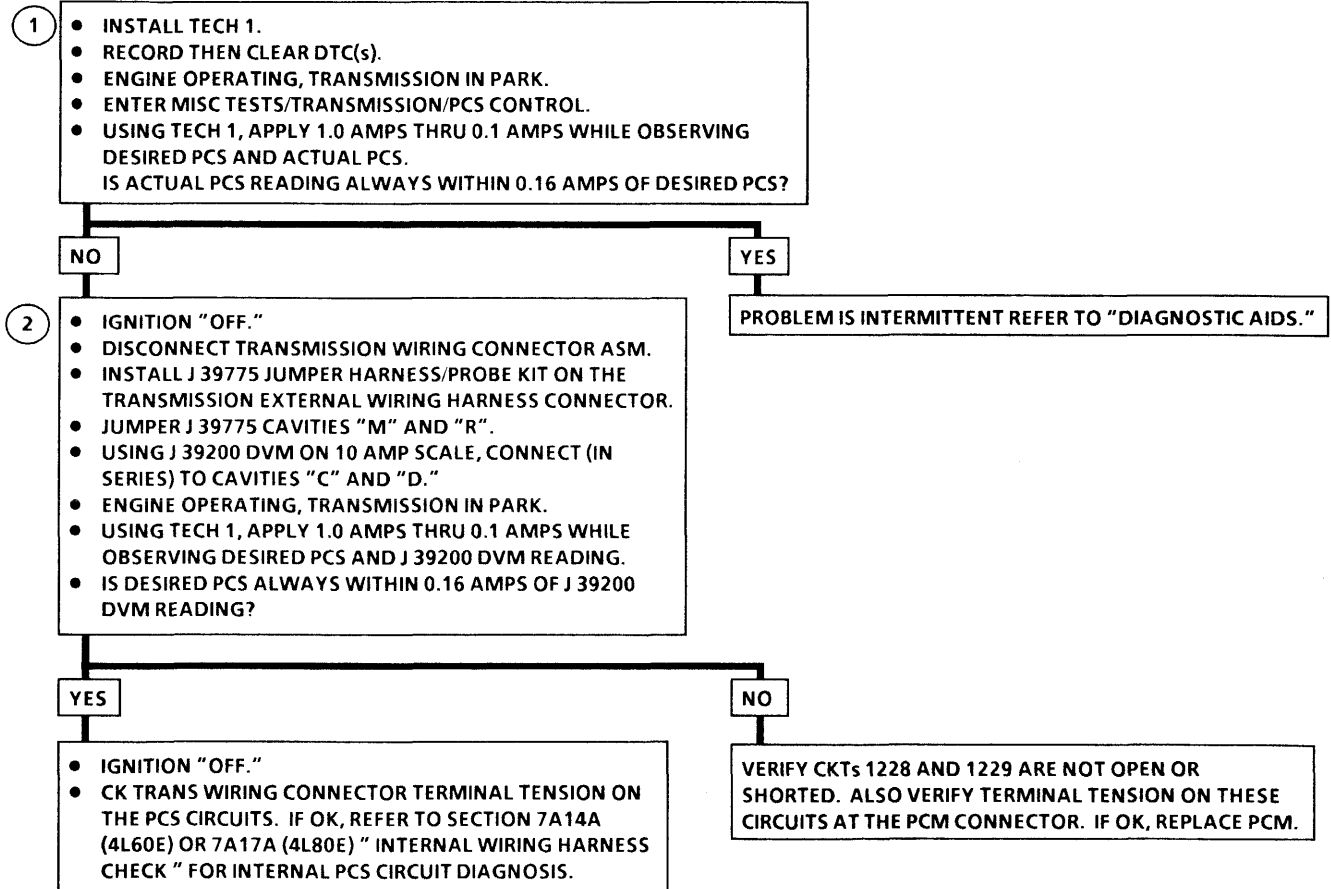
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the pressure control solenoid.
2. This test checks internal transmission harness and the pressure control solenoid for incorrect resistance.

**Diagnostic Aids:** Check for poor connections at PCM and at transmission connector.

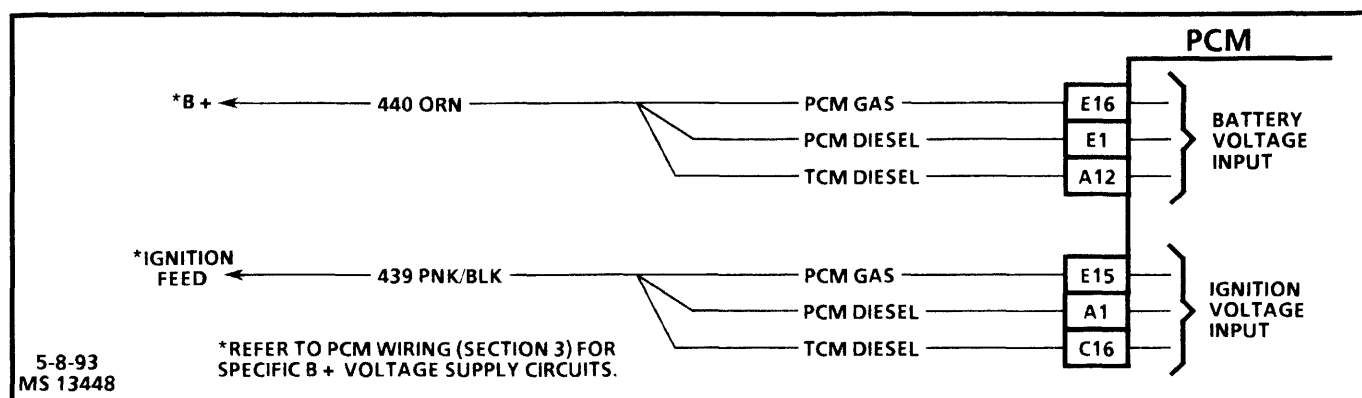
## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
PS 16751



## DTC 75

### SYSTEM VOLTAGE LOW

#### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

#### DTC 75 Will Set When:

- The ignition is "ON."
- Ignition feed voltage to the control module is less than the graduated scale of :
  - $-40^{\circ}\text{C} (-40^{\circ}\text{F}) = 7.3$  volts.
  - $90^{\circ}\text{C} (194^{\circ}\text{F}) = 10.3$  volts.
  - $150^{\circ}\text{C} (304^{\circ}\text{F}) = 11.7$  volts.
- Engine speed greater than 1000 RPM.
- All conditions met for 4 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Soft landing to default gear.

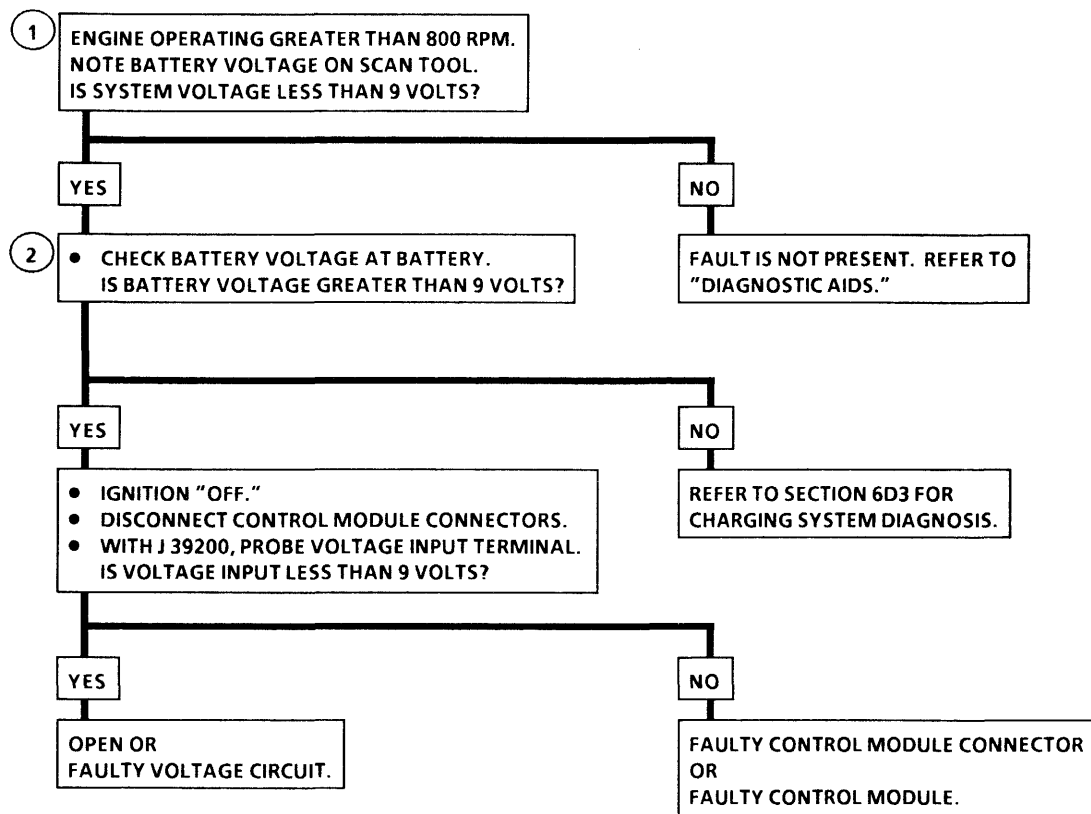
**DTC 75 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for normal battery voltage between 9-15 volts.
2. This test checks if the low voltage display is due to the generator, CKT 439 or PCM, with engine operating checks voltage at the battery. If the voltage is less than 8.6 volts, the PCM is OK.

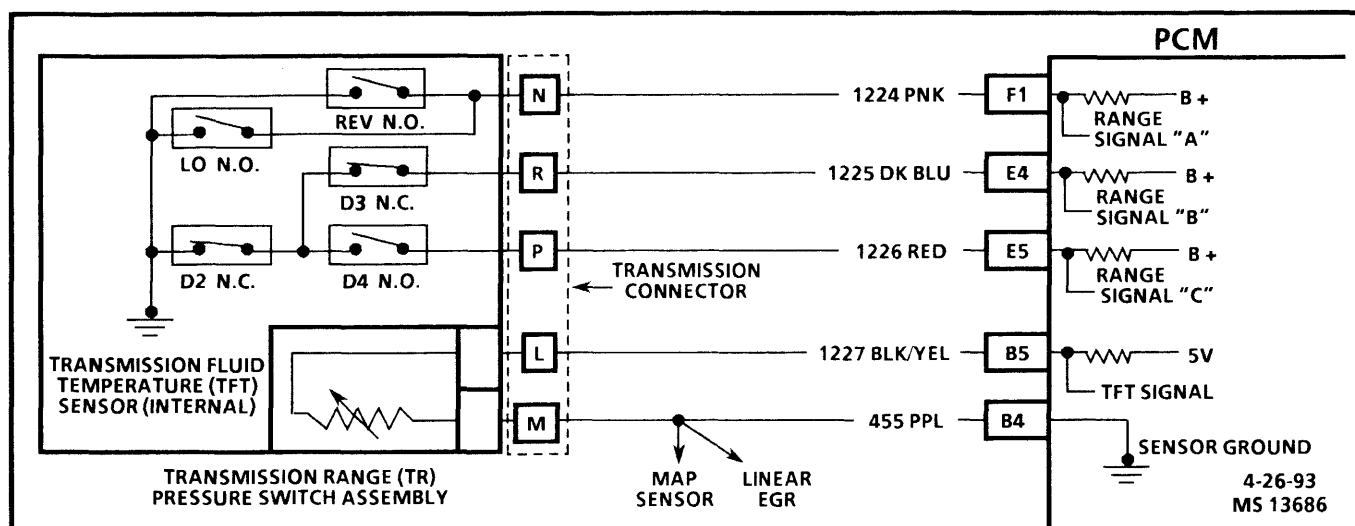
**Diagnostic Aids:** Charging battery with a battery charger and jump-starting engine may set DTC 53. If diagnostic trouble code sets when an accessory is operated, check for poor connections or excessive current draw. Refer to SECTION 6D3 of appropriate service manual for circuit details. Also, check for poor connections at starter solenoid or fusible link.

- 4L60E transmission default gear is 3<sup>rd</sup>.
- 4L80E transmission default gear is 2<sup>nd</sup>.

**DTC 75**  
**SYSTEM VOLTAGE LOW**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17066



## DTC 79

### TRANSMISSION FLUID OVERTEMP

#### Circuit Description:

The Transmission Fluid Temperature (TFT) sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.

#### DTC 79 Will Set When:

- No DTC 58 or 59 set.
- Signal voltage indicates a transmission fluid temperature greater than 146°C (295°F) and has not cooled to less than 137°C (295°F).
- All conditions met for 30 minutes.

**DTC 79 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for skewed sensor or shorted circuit.
2. This test simulates a DTC 59.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

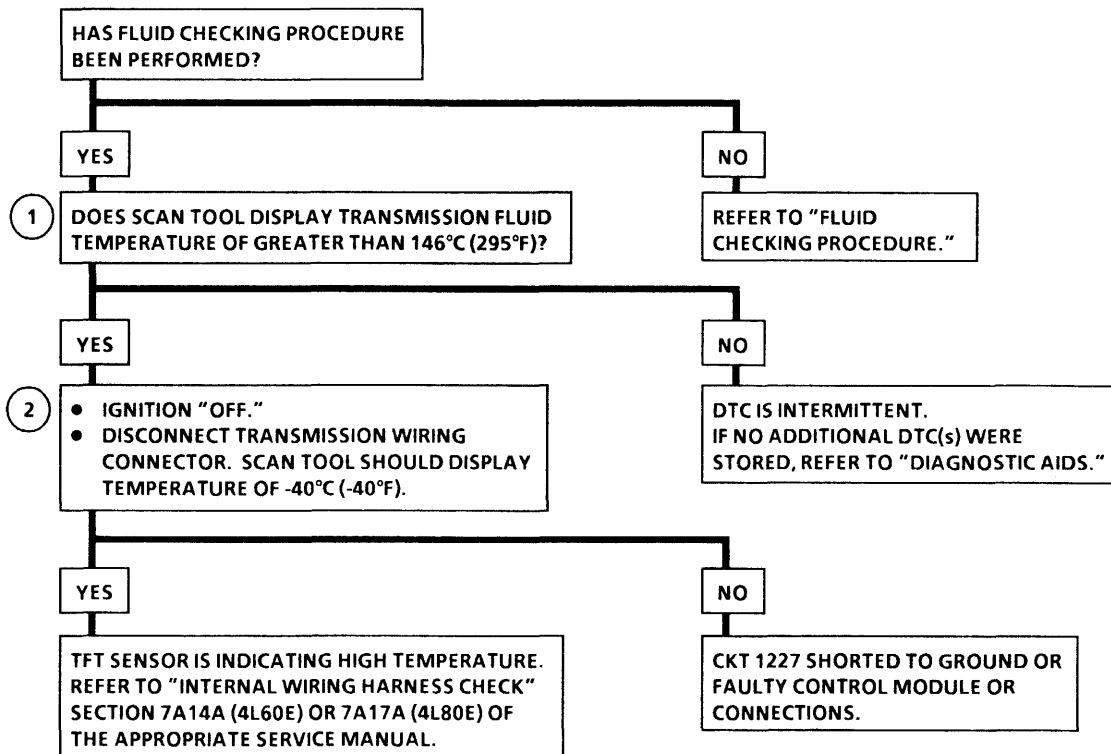
Scan tool TFT displays should rise steadily to about 100°C then stabilize.

Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A14A may be used to test the transmission sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" sensor could result in delayed garage shifts or TCC complaints.

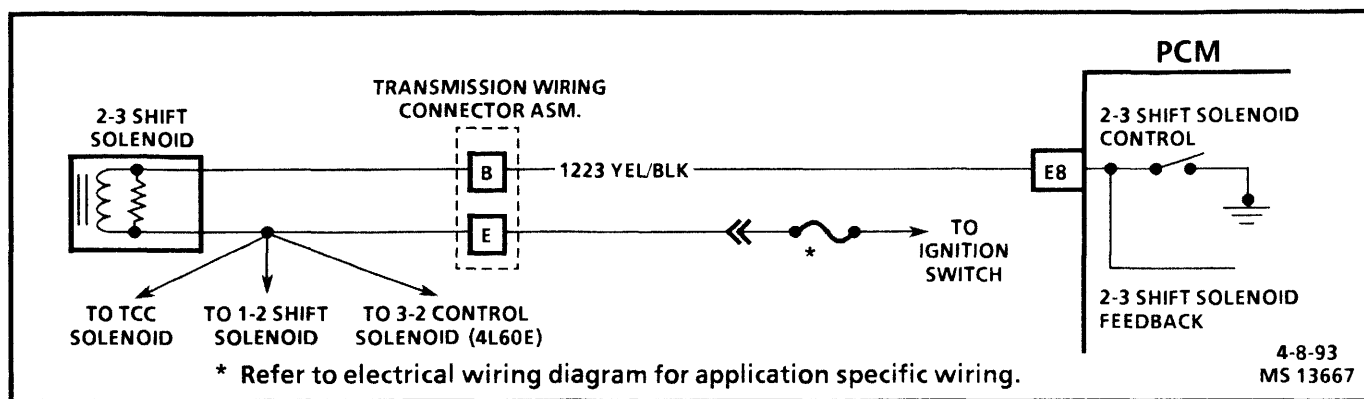
Check transmission fluid. Refer to "Fluid Checking Procedure."

## DTC 79 TRANSMISSION FLUID OVERTEMP



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
PS 17931



## DTC 81

### 2-3 SHIFT SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 2-3 shift solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1223.

#### DTC 81 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high (B + ).
- **OR**
- The PCM commands the solenoid "OFF" and voltage remains low (zero volts).
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Second or third gear only.

**DTC 81 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

If the voltage stays up for at least 2 seconds, DTC 81 will set. If the voltage drops for more than 2 seconds, DTC 81 will set.

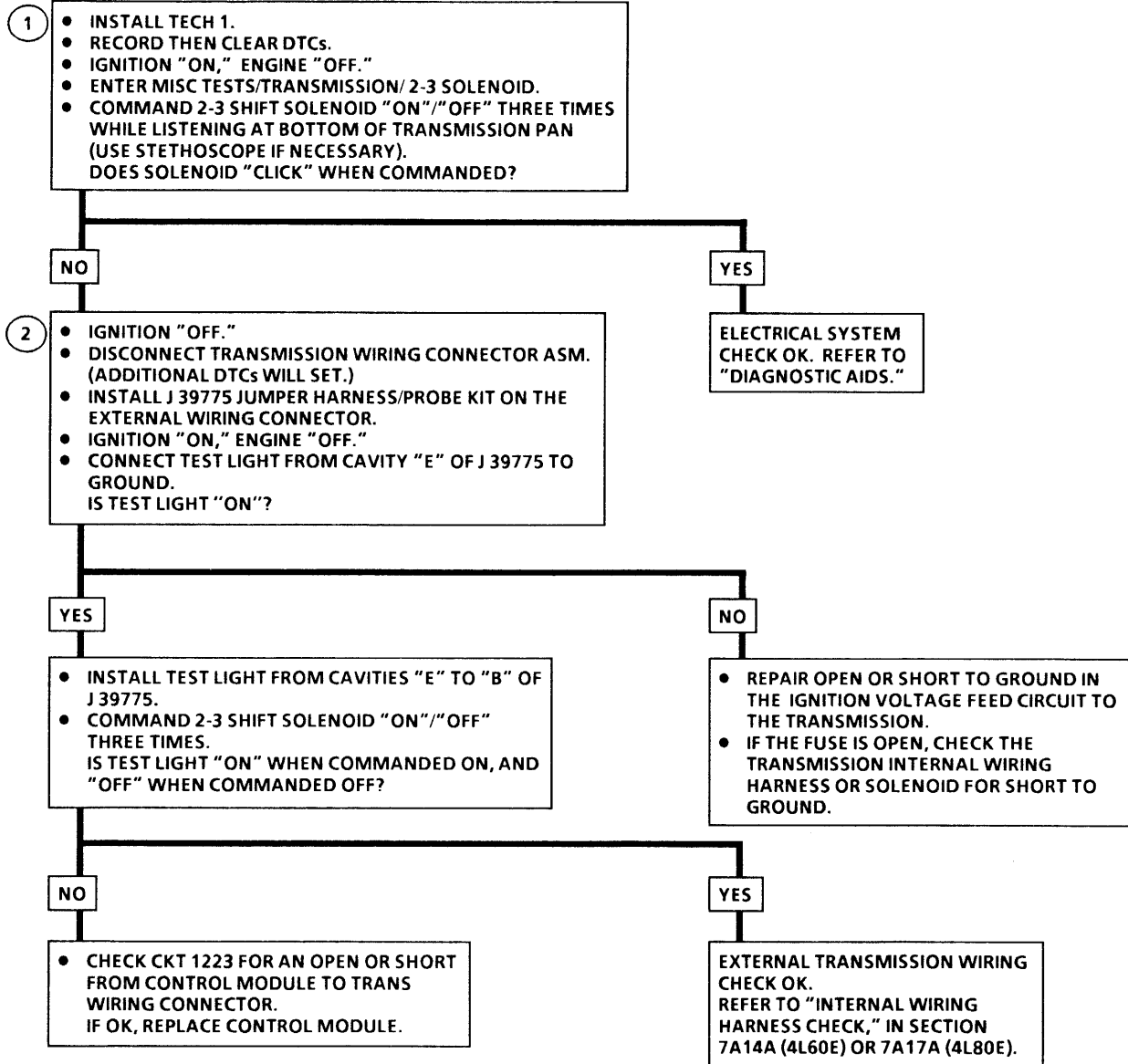
1. This test checks the function of the 2-3 shift solenoid and the internal transmission wiring.
2. This test checks for power to 2-3 shift solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections at the transmission. Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

#### Valid Combination Chart

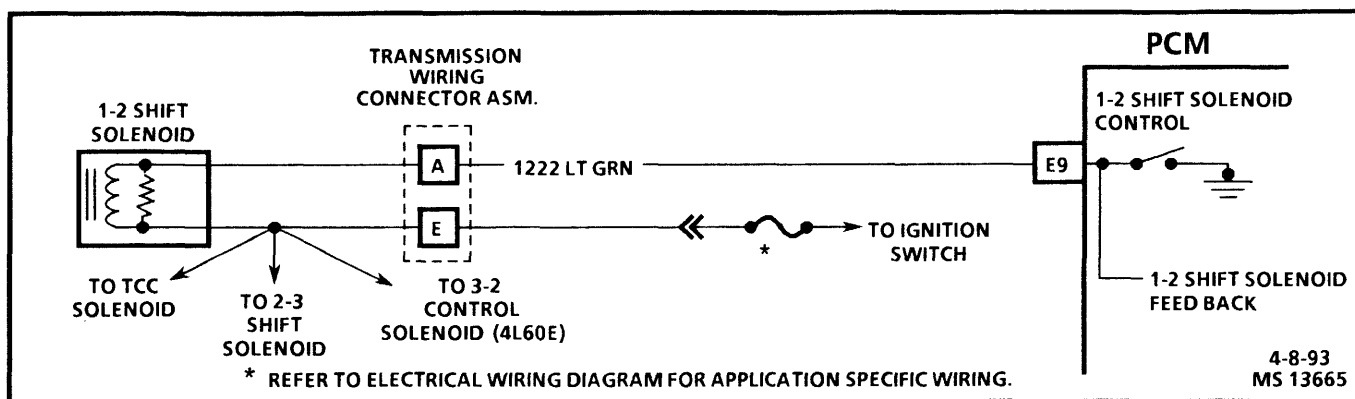
| CHART 4L60E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | ON                 |
| 2           | OFF                | ON                 |
| 3           | OFF                | OFF                |
| 4           | ON                 | OFF                |

**DTC 81****2-3 SHIFT SOLENOID CIRCUIT FAULT**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17093





## DTC 82

### 1-2 SHIFT SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 1-2 shift solenoid on CKT 641. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1222.

#### DTC 82 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high (B+).
- OR
- The PCM commands the solenoid "OFF" and voltage remains low (zero volts).
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- Second or third gear only
- OR
- First and fourth gears only.

**DTC 82 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- This test checks the function of the 1-2 shift solenoid and the internal transmission wiring harness.
- This test checks for power to 1-2 shift solenoid from the ignition through the fuse.

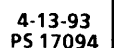
**Diagnostic Aids:** Check all connections for the transmission.

Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

#### Valid Combination Chart

| CHART 4L60E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | ON                 |
| 2           | OFF                | ON                 |
| 3           | OFF                | OFF                |
| 4           | ON                 | OFF                |



### ON-VEHICLE SERVICE

#### INTERNAL TRANSMISSION COMPONENTS

The following list of components will be serviced in SECTION 7A14A of the appropriate service manual.

- 1 - 2 shift solenoid.
- 2 - 3 shift solenoid.
- 3 - 2 control solenoid.
- Pressure control solenoid.
- TCC solenoid with internal wiring harness.
- Any service that requires removal of the pan.

#### EXTERNAL TRANSMISSION COMPONENTS

##### Engine Coolant Temperature (ECT) Sensor

All ECT sensor diagnosis and service will be in SECTION 3.

##### Throttle Position (TP) Sensor

All TP sensor diagnosis and service will be in SECTION 3.

#### Vehicle Speed Sensor (VSS)

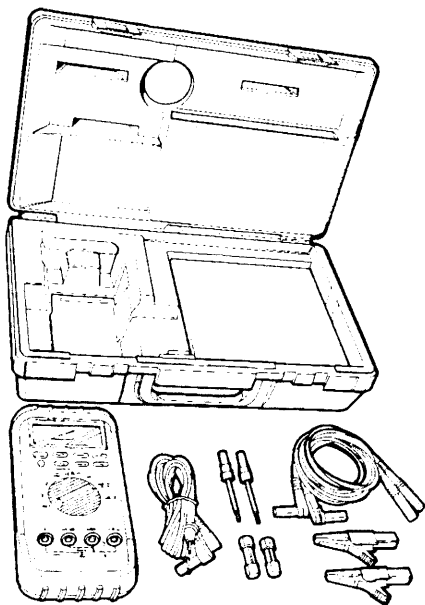
Refer to SECTION 7 of the appropriate service manual for Vehicle Speed Sensor (VSS) service. The VSS is located on the transmission or transfer case.

#### Vehicle Speed Signal (VSS) Buffer Module

Refer to SECTION 8 of the appropriate service manual for vehicle speed signal buffer module replacement. The VSS buffer module is located on the PCM.

#### PCM WIRING DIAGRAMS AND CONNECTOR TERMINAL END VIEWS

All wiring diagrams and terminal identification will be in SECTION 3.



HIGH IMPEDANCE MULTIMETER  
(DIGITAL VOLTMETER-DVM)  
J 39200

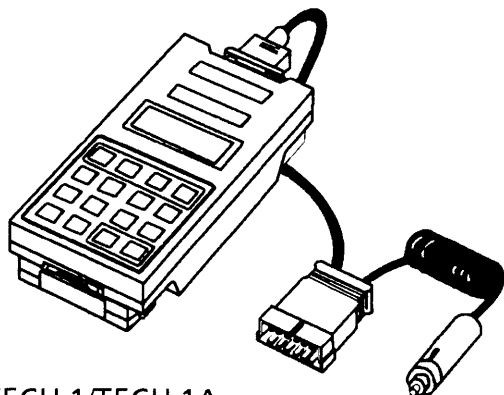
**VOLTMETER** - Voltage Position measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used when circuits require accurate low voltage readings, and some circuits in the PCM/TCM have a very high resistance.

**AMMETER** - When used as ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for further information.

- Selector must be set properly for both function and range. DC is used for most automotive measurements.

**OHMMETER** - Measures resistance of circuit directly in ohms. Refer to meter instructions for further information.

- OL display in all ranges indicates an open circuit.
- Zero display in all ranges indicates a short circuit.
- Intermittent connection in circuit may be indicated by digital reading that will not stabilize.
- Range Switch.
  - 200 $\Omega$  - Displays ohms directly.
  - 2K, 20K, 200K $\Omega$  - Displays ohms in thousands.
  - 2M and 20M $\Omega$  - Displays ohms in millions.



TECH 1/TECH 1A  
3000003 MASS STORAGE CARTRIDGE

#### TECH 1 DIAGNOSTIC SCAN TOOL

A hand-held SCAN tool used to analyze and diagnose the PCM/TCM control system.

(With GM 81-93 Powertrain Software)



#### TACHOMETER

Inductive trigger signal pickup type to check RPM.



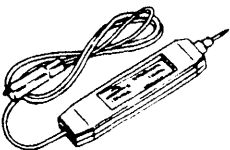
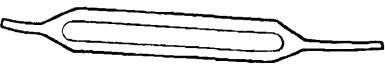
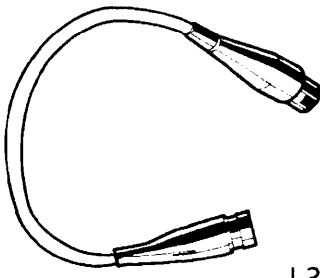
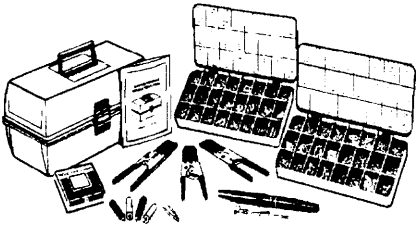
J 35616

#### CONNECTOR TEST ADAPTER KIT

Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.

5-18-92  
MS 13416

Figure 10A-18 - Special Tools (1 of 2)

|                                                                                                              |                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 34636/BT-8405</p>     | <p><b>CIRCUIT TESTER</b><br/>Used to check all relays and solenoids before connecting them to a new PCM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.</p> |
|  <p>J 35689-A</p>           | <p><b>METRI-PACK TERMINAL REMOVER</b><br/>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors.</p>                                                                                                                                                              |
|  <p>J 28742-A/BT-8234-A</p> | <p><b>WEATHER PACK TERMINAL REMOVER</b><br/>Used to remove terminals from Weather Pack connectors.</p>                                                                                                                                                                                    |
|  <p>J 33095/BT-8234-A</p> | <p><b>PCM CONNECTOR TERMINAL REMOVER</b><br/>Used to remove terminal from Micro-Pack connectors.</p>                                                                                                                                                                                      |
|  <p>J 39775</p>           | <p><b>4L60E JUMPER HARNESS</b><br/>Used with J 39200 to measure circuit voltage, amperage, or resistance in the transmission through the transmission connector.</p>                                                                                                                      |
|  <p>J 38125-4</p>         | <p><b>TERMINAL REPAIR KIT</b><br/>Used to replace damaged terminal ends on wiring harnesses.</p>                                                                                                                                                                                          |

2-1-93  
NS 15318

Figure 10A-19 - Special Tools (2 of 2)

## SECTION 10B

## 4L80E DIAGNOSTIC TROUBLE CODES

(WITH TECH 1 SCAN TOOL DIAGNOSTICS)

## CONTENTS

|                                                                                     |        |                                                                                                           |        |
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## GENERAL DESCRIPTION

POWERTRAIN CONTROL MODULE  
(PCM)

Figure 10B-1

The Powertrain Control Module (PCM) is an electronic device which monitors various inputs to control various transmission functions including shift quality and transmission diagnostics. The PCM receives various input information from sensors, switches, and components to process for use within its control program. Based on this input information, the PCM controls various transmission output functions and devices. The PCM is located within the passenger compartment, underneath the right hand side of the dash.

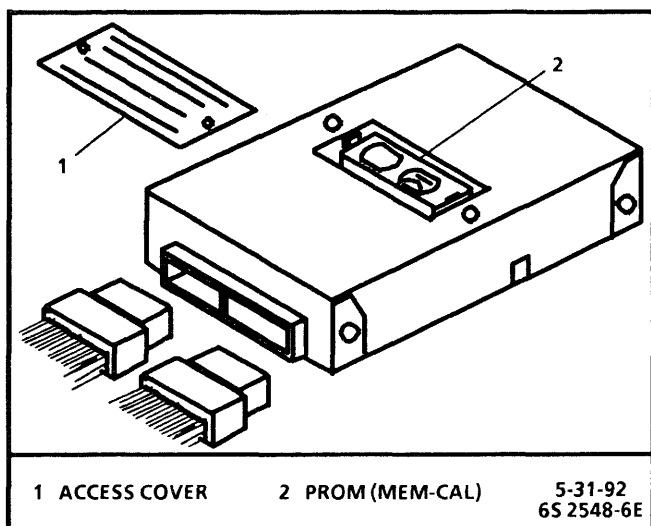


Figure 10B-1 - Powertrain Control Module

## WIRING HARNESS AND CONNECTORS

A wiring harness electrically connects the PCM to various sensors, solenoids, and relays within the system. Many of the connectors used are environmentally protected because of the system low voltages and current levels.

## DATA LINK CONNECTOR (DLC)

Figure 10B-2

This connector is a multiple cavity connector. The DLC provides the technician a means of accessing serial data for aid in diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display DTC(s). The DLC connector is located within the driver's compartment, normally on the left side near the steering column.

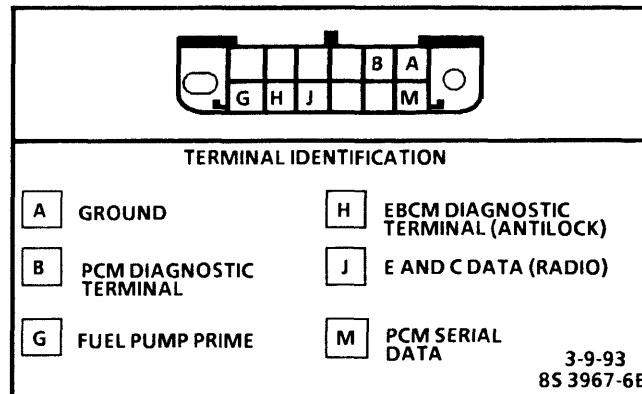


Figure 10B-2 - Data Link Connector (DLC)

## INPUT INFORMATION

## INFORMATION SENSORS AND SWITCHES

The PCM uses the following information sensors to gather data for electronically controlling transmission functions.

- Transmission Fluid Temperature (TFT) sensor.
- Transmission Range (TR) pressure switch assembly.
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Transmission or transfer case Vehicle Speed Sensor (VSS).
- Brake switch.

TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR

Figure 10B-13

The TFT sensor is a thermistor (a device that changes resistance according to changes in temperature) used to indicate transmission fluid temperature. High sensor resistance produces high signal input voltage which corresponds to low fluid temperature. Low sensor resistance produces low signal input voltage which corresponds to high fluid temperature. The PCM uses the TFT sensor signal input to determine the following:

- TCC apply and release schedules.
- Hot mode determination.
- Shift quality.

The TFT sensor is part of the internal wiring harness within the transmission.

## TRANSMISSION ELECTRICAL CONNECTOR

THE TRANSMISSION WIRING CONNECTOR IS A VERY IMPORTANT PART OF THE TRANSMISSION OPERATING SYSTEM. ANY INTERFERENCE WITH THE ELECTRICAL CONNECTION CAN CAUSE THE TRANSMISSION TO SET DIAGNOSTIC TROUBLE CODES (DTC)s AND/OR AFFECT PROPER OPERATION.

THE FOLLOWING ITEMS CAN AFFECT THE ELECTRICAL CONNECTION:

- BENT PINS IN THE CONNECTOR FROM ROUGH HANDLING DURING CONNECTION AND DISCONNECTION.
  - WIRES BACKING AWAY FROM THE PINS OR COMING UNCRIMPED (IN EITHER INTERNAL OR EXTERNAL WIRING HARNESS).
  - DIRT CONTAMINATION ENTERING THE CONNECTOR WHEN DISCONNECTED.
  - PINS IN THE INTERNAL WIRING CONNECTOR BACKING OUT OF THE CONNECTOR OR PUSHED OUT DURING RECONNECTION.
  - EXCESSIVE TRANSMISSION FLUID LEAKING INTO THE CONNECTOR, WICKING UP INTO THE EXTERNAL WIRING HARNESS, AND DEGRADING OF THE WIRE INSULATION. \*
  - WATER/MOISTURE INTRUSION IN THE CONNECTOR.
  - LOW PIN RETENTION IN THE EXTERNAL CONNECTOR FROM EXCESSIVE CONNECTION AND DISCONNECTION OF THE WIRING CONNECTOR ASSEMBLY.
  - PIN CORROSION FROM CONTAMINATION.
- \* THE PRESENCE OF TRANSMISSION FLUID IN THE TRANSMISSION CONNECTOR IS NOT HARMFUL IN ITSELF. THE FLUID ONLY AFFECTS THE EXTERNAL HARNESS WIRING INSULATION IF THE FLUID WICKS UP TO THE HARNESS.

POINTS TO REMEMBER WHEN WORKING WITH THE TRANSMISSION WIRING CONNECTOR ASSEMBLY:

- TO REMOVE THE CONNECTOR, SQUEEZE THE TWO TABS TOWARDS EACH OTHER AND PULL STRAIGHT UP (REFER TO THE ILLUSTRATION).
- CAREFULLY LIMIT TWISTING OR WIGGLING THE CONNECTOR DURING REMOVAL. BENT PINS CAN OCCUR.
- **DO NOT** PRY THE CONNECTOR OFF WITH A SCREWDRIVER OR OTHER TOOL.
- TO REINSTALL THE EXTERNAL WIRING CONNECTOR, FIRST ORIENT THE PINS BY LINING UP THE ARROWS ON EACH HALF OF THE CONNECTOR. PUSH THE CONNECTOR STRAIGHT DOWN INTO THE TRANSMISSION WITHOUT TWISTING OR ANGLING THE MATING PARTS.
- THE CONNECTOR SHOULD CLICK INTO PLACE WITH A POSITIVE FEEL AND/OR NOISE.
- WHENEVER THE TRANSMISSION EXTERNAL WIRING CONNECTOR IS DISCONNECTED FROM THE INTERNAL HARNESS AND THE ENGINE IS OPERATING DTC(s) WILL SET. CLEAR THESE DTC(s) AFTER RECONNECTING THE EXTERNAL CONNECTOR.

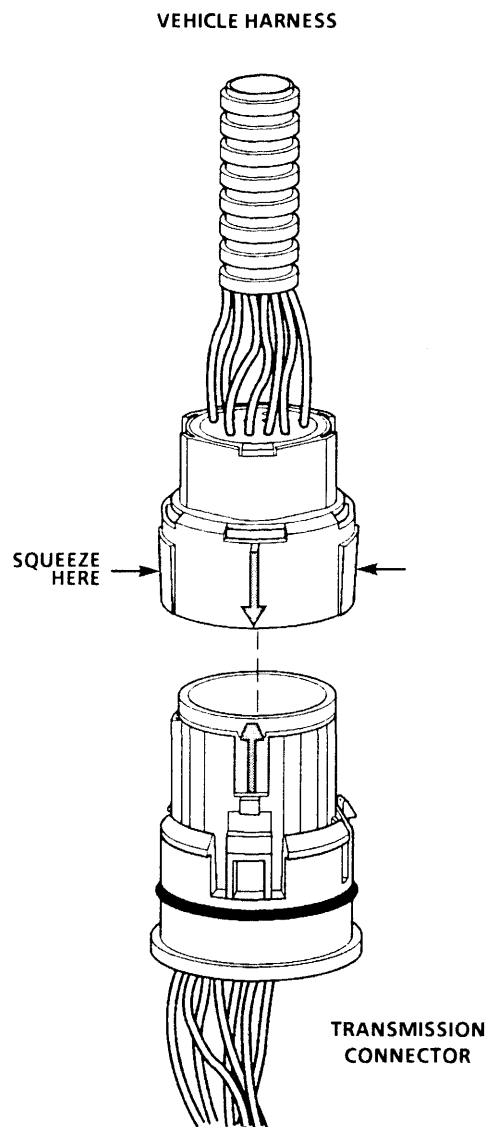


Figure 10B-3 - Transmission Electrical Connector



10B-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY  
Figure 10B-4

This device is a set of five Normally Open (NO) pressure switches that detect fluid pressure within the valve body passages. The five pressure switches are connected to three signal circuits referred to as range signals A, B, C.

"ON" = B +                      "OFF" = 0 volts

The combination of pressure switch states determines the voltage signal (B+ or 0) on each range signal to the PCM. These three range signals are then interpreted by the PCM to indicate the transmission range selected. The transmission range pressure switch assembly is attached to the control valve body within the transmission.

Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | ON  | OFF | ON  |
| Rev          | OFF | OFF | ON  |
| Neutral      | ON  | OFF | ON  |
| 4th          | ON  | OFF | OFF |
| 3rd          | ON  | ON  | OFF |
| 2nd          | ON  | ON  | ON  |
| 1st          | OFF | ON  | ON  |
| Illegal      | OFF | ON  | OFF |
| Illegal      | OFF | OFF | OFF |

Expected Readings

ENGINE COOLANT TEMPERATURE (ECT) SENSOR  
Figure 10B-6

The Engine Coolant Temperature (ECT) sensor is a thermistor (a device that changes resistance according to change in temperature) used to indicate engine coolant temperature.

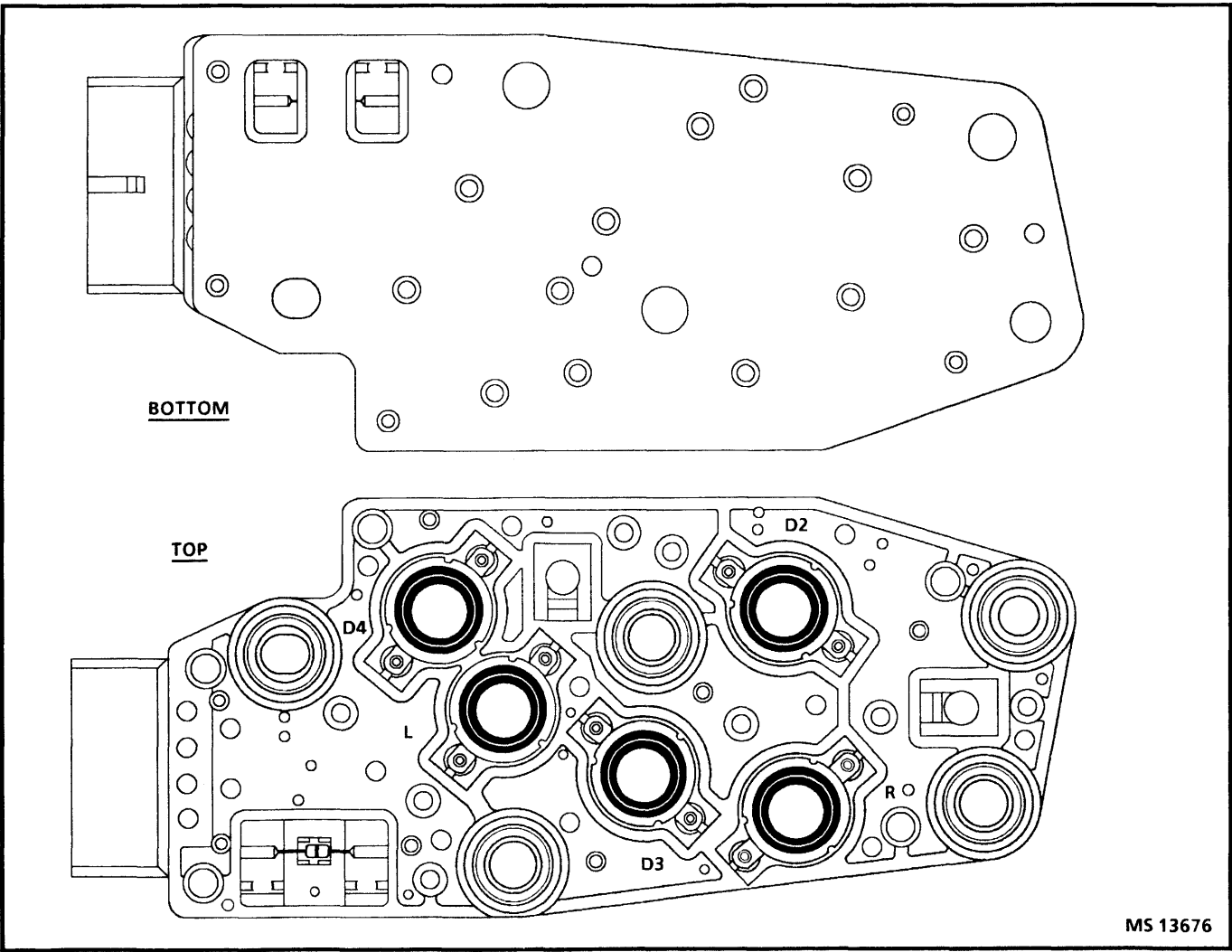


Figure 10B-4 - Transmission Range (TR) Pressure Switch Assembly

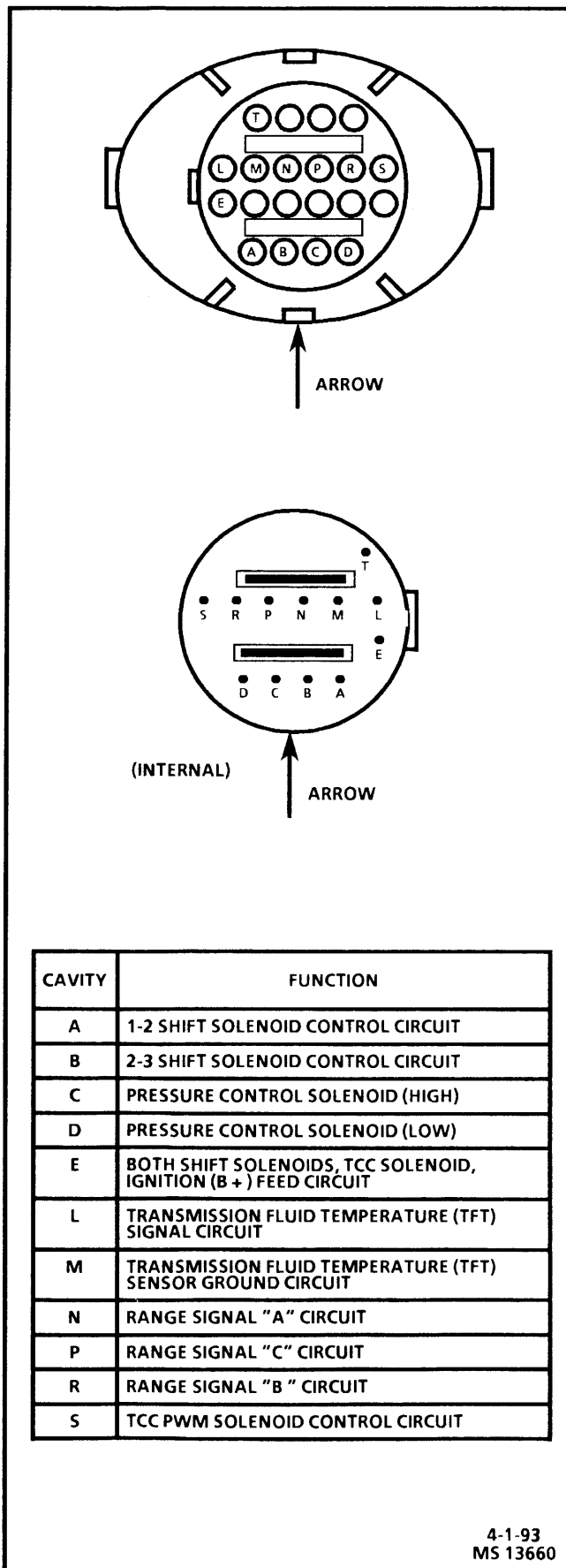


Figure 10B-5 - Harness Connector

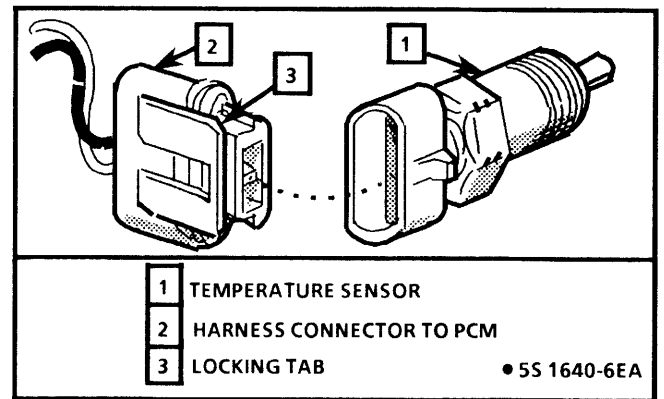


Figure 10B-6 - Engine Coolant Temperature (ECT) Sensor

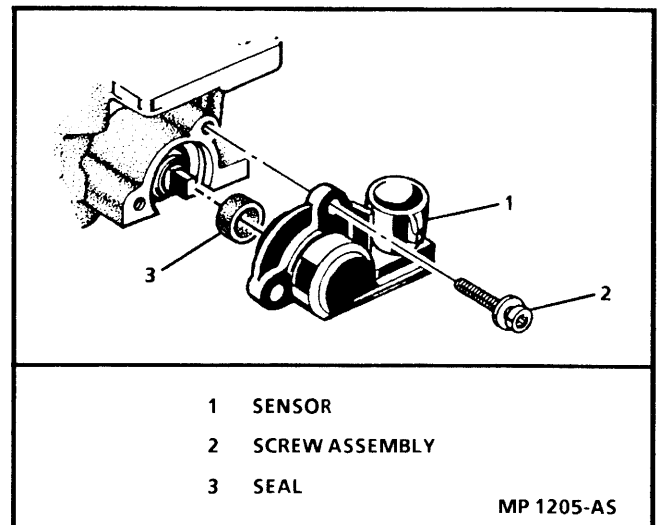


Figure 10B-7 - Throttle Position (TP) Sensor

High sensor resistance produces high signal input voltage which corresponds to low engine temperature. Low sensor resistance produces low signal input voltage which corresponds to high engine coolant temperature. The PCM uses the ECT sensor signal to determine the TCC apply and release schedules. The ECT sensor is attached to the engine assembly.

## THROTTLE POSITION (TP) SENSOR

### Figure 10B-7

The Throttle Position (TP) sensor is a potentiometer (a device for measuring an unknown voltage or potential difference by comparison to a standard voltage). The TP sensor sends a voltage to the control module, varying from approximately .5 volts to approximately 5 volts. This voltage signal to the control module represents throttle shaft angle. At closed throttle, the signal voltage to the control module is approximately 0.5 volt as the throttle shaft angle increases the signal voltage increases to greater than 4.5 volts at wide open throttle. The TP sensor is attached to the throttle body assembly.

## TRANSFER CASE SWITCH ASSEMBLY

This switch assembly is used to indicate the position of the transfer case select lever. When four wheel drive (4WD) low is selected a ground path is provided, changing 4WD low input signal from B+ to 0 voltage. The 4WD low signal input is used to correct the transmission output speed signal from the VSS buffer module to the PCM, to compensate for the transfer case gear reduction. This switch is attached to the transfer case.

## INPUT SPEED SENSOR

**Figure 10B-8**

This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth cut into the outside diameter of the forward clutch housing. As the serrations interrupt the magnetic field an AC voltage is generated in the circuit. This device is used to provide an input speed signal to the control module. The control module uses the input speed sensor signal input to:

- Calculate TCC slip speed.
- Calculate gear ratio.

## VEHICLE SPEED SENSOR (VSS)

**Figure 10B-8**

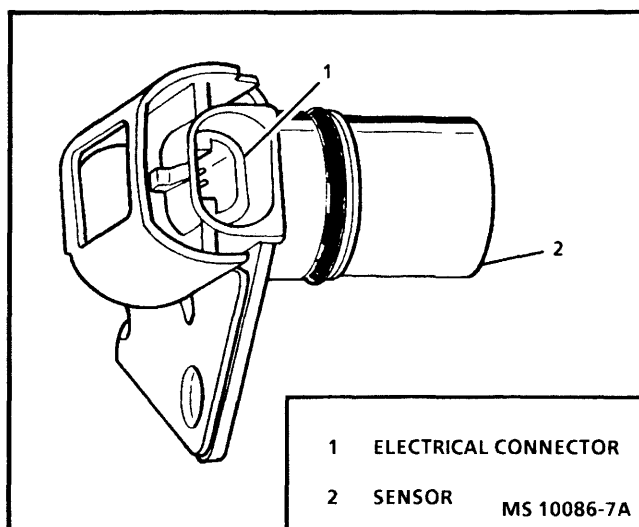
This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth pressed on an output shaft. As the rotor interrupts the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an output shaft speed signal to the control module. The control module uses the vehicle speed sensor signal input to:

- Calculate vehicle speed, trans output speed, TCC slip speed.
- Control shift quality.

The VSS is attached to the output shaft housing.

## VEHICLE SPEED SIGNAL (VSS) BUFFER MODULE

The Vehicle Speed Signal (VSS) buffer module is an electronic device. The VSS buffer module processes inputs from the vehicle speed sensor and outputs various signals. The VSS buffer module outputs a 40 Pulse Per Revolution (PPR) signal. This 40 PPR signal is used by the control module to determine transmission output speed. The VSS buffer module is matched to the vehicle based on transmission, final drive ratio and tire size.



**Figure 10B-8 - Input/Vehicle Speed Sensor**

| CHART |                    |                    |
|-------|--------------------|--------------------|
| Gear  | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1     | ON                 | OFF                |
| 2     | OFF                | OFF                |
| 3     | OFF                | ON                 |
| 4     | ON                 | ON                 |

The VSS buffer module is located on the right hand side of the instrument panel attached to the PCM bracket.

## BRAKE SWITCH

This electrical switch is used to indicate brake pedal status. This switch is normally closed when the brake pedal is not applied. When the brake pedal is applied the switch will open, changing the signal to the PCM. The PCM uses this signal to de-energize the TCC solenoid when brake pedal is applied. The brake switch is located on the brake pedal mounting bracket.

## OUTPUT INFORMATION

### 1-2 SHIFT SOLENOID

**Figure 10B-9**

This electrical device is used to control fluid flow acting on the 1-2 and 3-4 shift valves. The solenoid is a normally open exhaust valve that is used with the 2-3 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

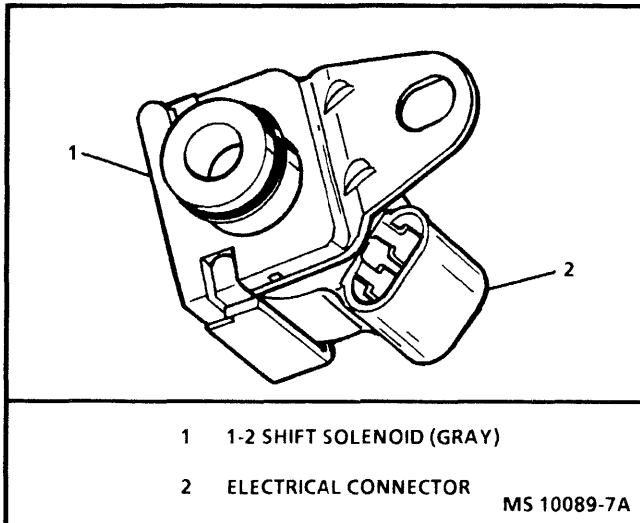


Figure 10B-9 - 1-2 Shift Solenoid

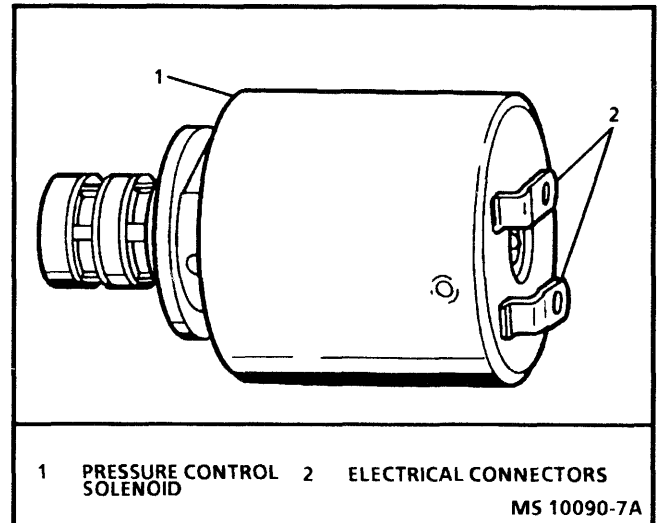


Figure 10B-11 - Pressure Control Solenoid (PCS)

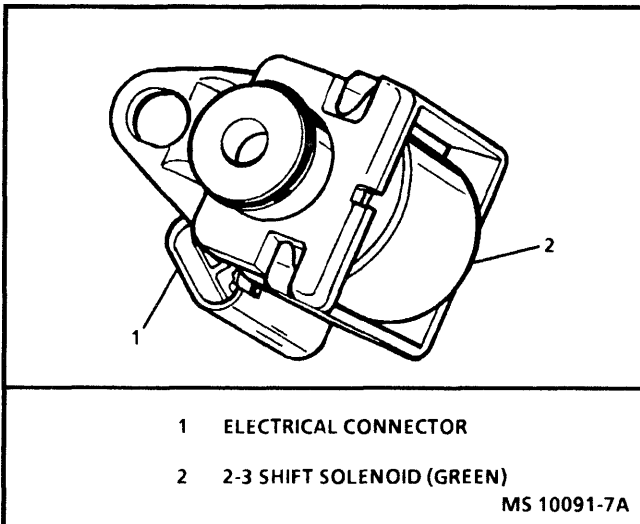


Figure 10B-10 - 2-3 Shift Solenoid

### 2-3 SHIFT SOLENOID Figure 10B-10

This electrical device is used to control fluid flow acting on the 2-3 shift valves. The solenoid is a normally open exhaust valve that is used with the 1-2 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

### PRESSURE CONTROL SOLENOID (PCS) Figure 10B-11

This electrical device is used to control fluid line pressure by controlling actuator feed limit fluid flow acting on an internal spool valve and spring pressure. The solenoid is a normally closed solenoid valve that controls fluid pressure when operating on a duty cycle. The solenoid is attached to the control valve body within the transmission.

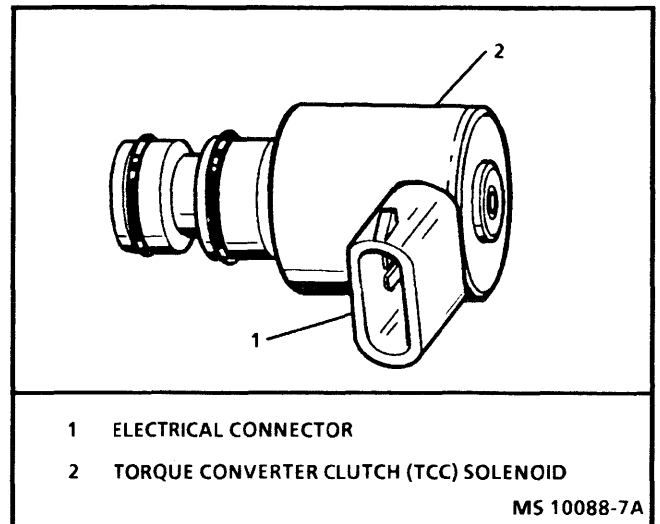


Figure 10B-12 - Torque Converter Clutch (TCC) PWM Solenoid

### TORQUE CONVERTER CLUTCH (TCC) PWM SOLENOID Figure 10B-12

This electrical device is used to control fluid acting on the TCC converter clutch valve, which then controls TCC apply and release. This solenoid is attached to the control valve body within the transmission.

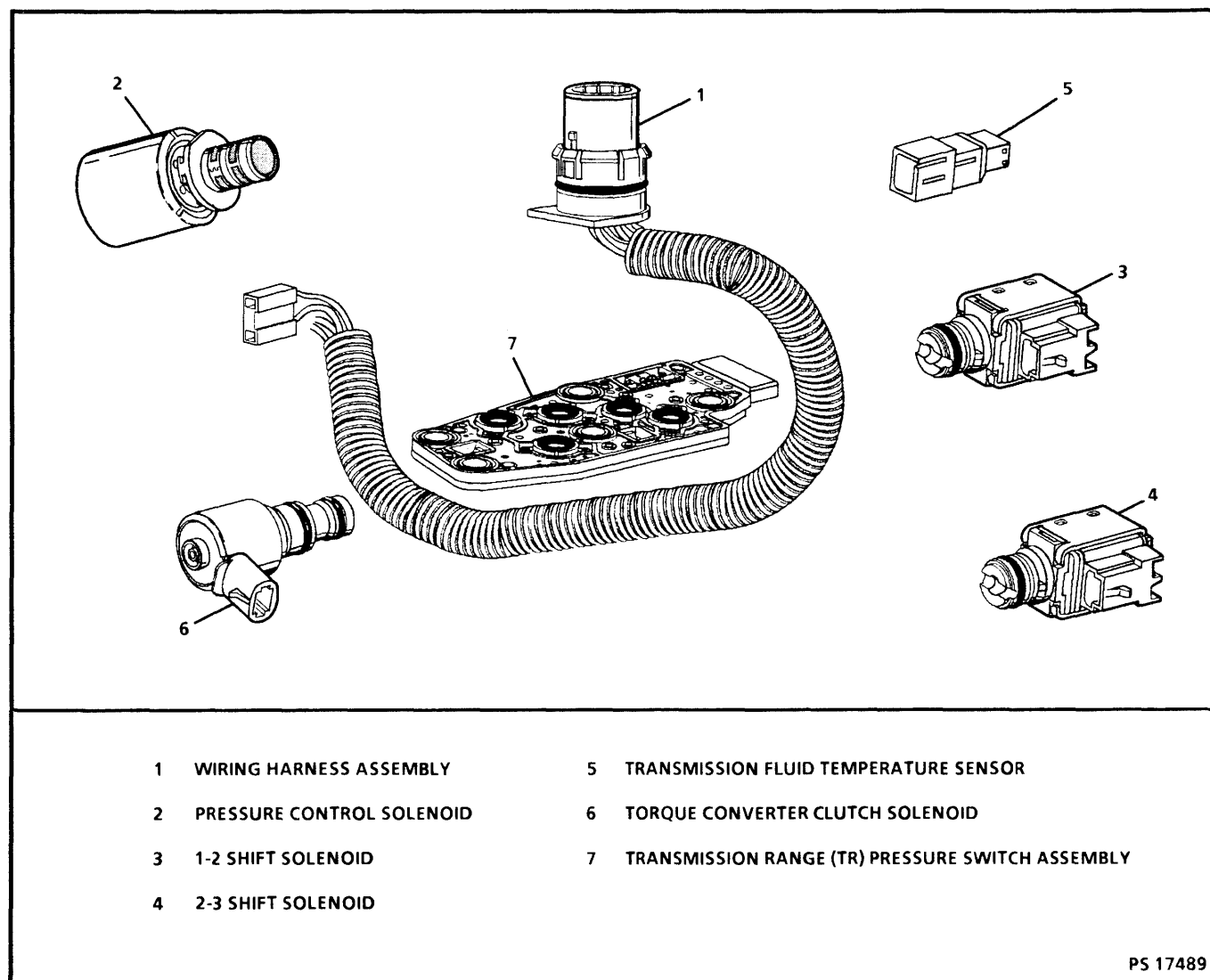


Figure 10B-13 - Electrical Components

PS 17489

## DIAGNOSIS

The PCM is equipped with a self diagnostic feature that detects system failures and aids the technician in locating a faulty circuit. The PCM has memory for comparing the various input information to programmed information. These conditions are described on the facing page of each Diagnostic Trouble Code (DTC) chart. If a value is not within the PCM parameters, a DTC will set and default values will be used.

The PCM will continually perform a self diagnosis check. The PCM can be requested to display any stored DTC by using a scan tool or manually grounding the diagnostic test terminal. When the diagnostic test terminal of the Data Link Connector (DLC) is grounded, the PCM will check the engine speed circuit input, if the voltage is zero, the PCM will flash DTC 12 and any other DTC(s) stored. If DTC 12 will not flash, refer to CHART A-1 or CHART A-2 in SECTION 3 for further diagnostic information.

### Important

- Always refer to the "On-Board Diagnosis (OBD) System Check" in SECTION 3 before proceeding to diagnose the system.

The scan tool will display all stored DTC(s) in current or history status. A DTC 12 is not a fault condition with the ignition "ON," engine "OFF." When the manual grounding procedure is used, the MIL will flash all DTC(s) stored in the PCM memory (current and history). The DTC charts assume the DTC is in current status. If the DTC is in history status, the fault may be an intermittent. An "intermittent" DTC is one which will not reset during the current ignition cycle. The facing page of a DTC chart will contain "DIAGNOSTIC AIDS" to help locate intermittent conditions.

If a visual (physical) check does not locate the cause of the fault, J 39200 DVM can be used to test the suspected circuit. The J 39200 DVM can be used to check for opens or shorts:

- **SHORT TO VOLTAGE** - Connect J 39200 to a known good ground on the DC voltage scale.
- **SHORT TO GROUND** - Connect J 39200 to a known good B+ on the DC voltage scale.
- **OPEN CIRCUIT** - Connect J 39200 to each end of the circuit on the ohms scale with voltage removed from the circuit.

## PCM INTERMITTENT DIAGNOSTIC TROUBLE CODES OR PERFORMANCE

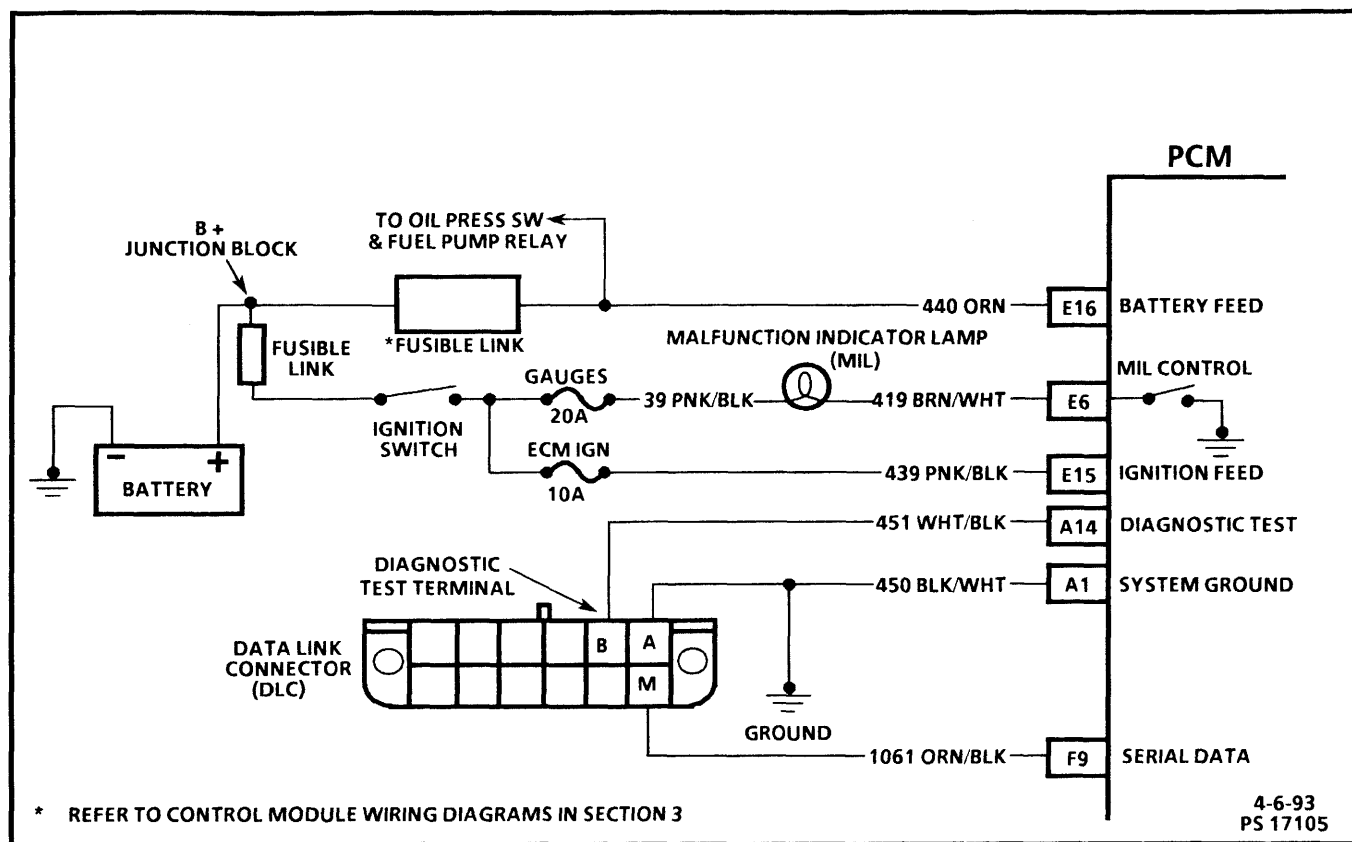
The DTC charts in this section determine if there is a fault within the circuit. The fault must be present to locate the problem. If an intermittent condition occurs, a DTC will be stored in history status, but the circuit check will indicate a normal condition. Most intermittent conditions are usually a faulty connection or component. When diagnosing intermittents, thoroughly check the suspected circuits for:

- Poor terminal tension.
- Poor seating of connector halves.
- Poor terminal to wire connection.
- Improperly formed or damaged terminals.
- Improperly installed electrical options.
- Faulty PCM power or ground connection.
- Intermittent short or open.
- Electrical system surges caused by a defective relay, solenoid, or switch. Normally these conditions will occur when the faulty component is operated.

## CLEARING HISTORY DTC(s)

All history DTC(s) can be cleared after all repairs have been completed in the following ways:

1. With a scan tool.
2. By removing voltage from the PCM.
3. Fifty ignition cycles with fault removed.



## ON-BOARD DIAGNOSTIC SYSTEM CHECK (WITH TECH 1 SCAN TOOL)

### Circuit Description:

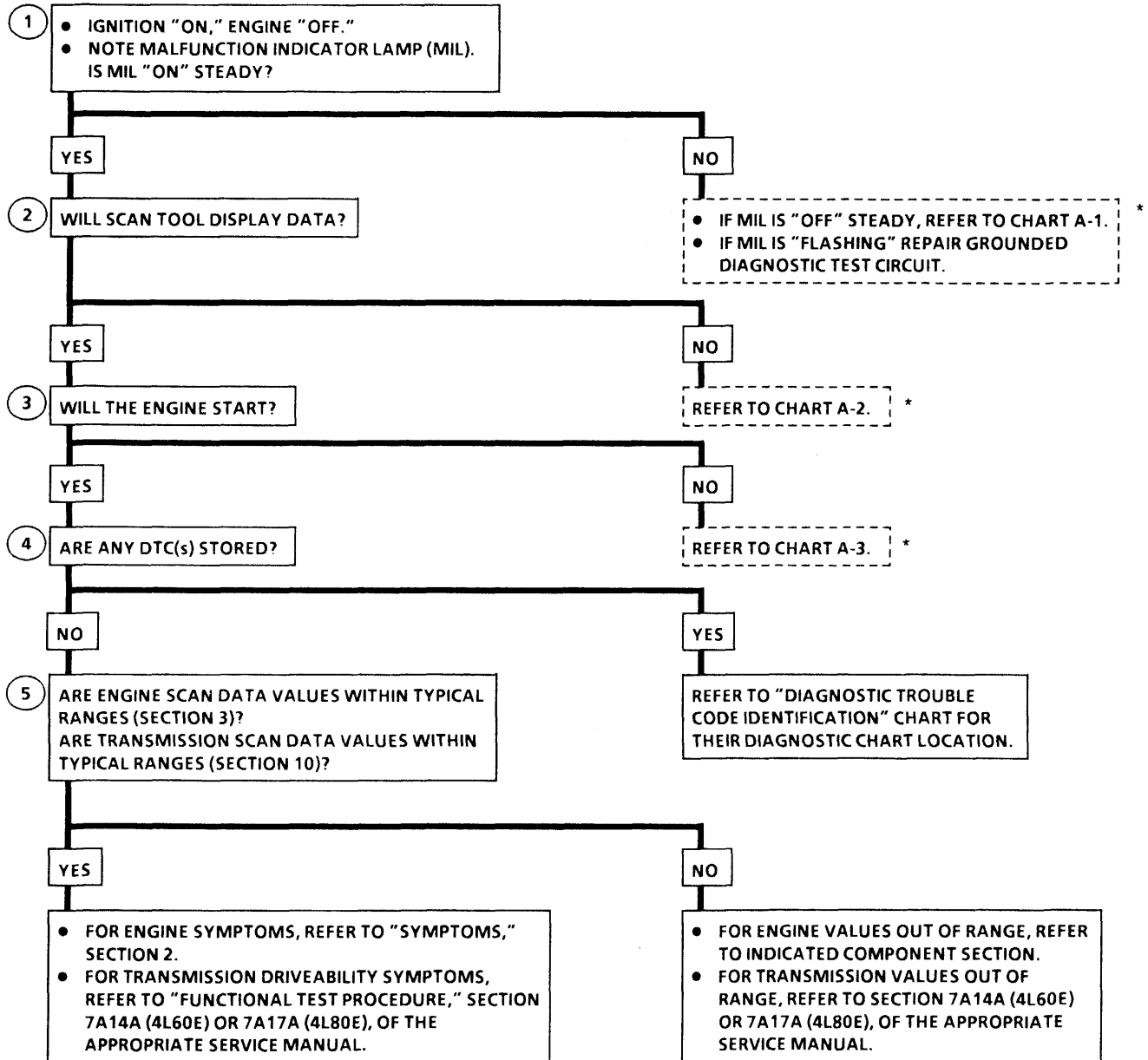
The on-board diagnostic system check is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, because it directs the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it correctly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step is a check for the proper operation of the MIL (Service Engine Soon). The MIL should be "ON" steady.
2. Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
3. Although the PCM is powered up, a "Cranks But Will Not Run" symptom could exist because of a PCM or system problem.
4. This step will isolate if the customer complaint is a MIL or a driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM (MEM-CAL) or PCM.
5. Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. Keep in mind that a base engine problem (i.e., advanced cam timing) may substantially alter sensor values.

# ON-BOARD DIAGNOSTIC SYSTEM CHECK

(WITH TECH 1 SCAN TOOL)



\* IN SECTION 3



## 10B-12 DRIVEABILITY AND EMISSIONS (GASOLINE)

If after completing the On-Board Diagnostic (OBD) system check and finding the Tech 1 diagnostics functioning properly and no DTC(s) displayed, the "Transmission Tech 1 Values" may be used for comparison with values obtained on the vehicle being diagnosed. The "Transmission Tech 1 Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosing. For further description on the values and use of the Tech 1 to diagnosis PCM inputs, refer to "General Description." If all values are within the range illustrated, refer to SECTION 7A14A (4L60E) or 7A17A (4L80E) "Functional Test Procedure."

### TRANSMISSION TECH 1 DATA

Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Closed Loop / Accessories Off

| <u>SCAN Position</u>   | <u>Units Displayed</u>                               | <u>Typical Data Value</u>    | <u>Refer To Section</u> |
|------------------------|------------------------------------------------------|------------------------------|-------------------------|
| Engine Speed           | RPM                                                  | ± 50 RPM From desired        | 3                       |
| Trans Output Spd       | RPM                                                  | 0 RPM                        | 10A/10B                 |
| Eng Cool Temp          | C°/F°                                                | 85°C - 105°C (185°F - 221°F) | 3                       |
| Trans Fluid Temp       | C°/F°                                                | 82°C - 94°C (180°F - 200°F)  | 10A/10B                 |
| Throt Position         | Volts                                                | 0.3 - 0.9V                   | 3                       |
| Throttle Angle         | Percentage                                           | 0%                           | 3                       |
| # A/B/C RNG            | Off/On                                               | Off/On/Off                   | 10A                     |
| * A/B/C RNG            | Off/On                                               | On/Off/On                    | 10B                     |
| Trans Range Sw         | Invalid, Rev,<br>Drive 4, 3,<br>2, Low,<br>Park/Neut | Park/Neut                    | 10A/10B                 |
| Commanded Gear         | 1-4                                                  | 1                            | 10A/10B                 |
| Adaptable Shift        | No, Yes                                              | No                           | 10A/10B                 |
| 1-2 Sol 2-3 Sol        | Off/On                                               | On/On                        | 10A/10B                 |
| CTR FDBK 1/2 2/3       | Off/On                                               | On/On                        | 10A/10B                 |
| * Trans Input Speed    | RPM                                                  | ± 50 RPM of Engine Speed     | 10B                     |
| # 3-2 Control Sol      | Percentage                                           | 0%                           | 10A/10B                 |
| # 3-2 Control FDBK     | Off/On                                               | Off                          | 10A                     |
| Hot Mode               | No, Yes                                              | No                           | 10A/10B                 |
| * TCC PWM Solenoid     | Percentage                                           | 0%                           | 10B                     |
| TCC Slip Speed         | RPM                                                  | ± 50 RPM From Engine Speed   | 10A/10B                 |
| # TCC Solenoid         | Off/On                                               | Off                          | 10A                     |
| # CTR FDBK TCC Sol     | Off/On                                               | Off                          | 10A/10B                 |
| Desired PCS            | Amps                                                 | 1.01 Amps                    | 10A/10B                 |
| Actual PCS             | Amps                                                 | 1.01 Amps                    | 10A/10B                 |
| PCS Duty Cycle         | Percentage                                           | 40% - 60%                    | 10A/10B                 |
| MPH Km/h               | 0-255                                                | 0                            | 10A/10B                 |
| 4WD Low Switch         | No, Yes                                              | No                           | 10A/10B                 |
| Cruise Engaged         | No, Yes                                              | No                           | 9B                      |
| TCC Brake Switch       | Open/Closed                                          | Closed                       | 10A/10B                 |
| Kickdown Enabled       | No, Yes                                              | No                           | 10A/10B                 |
| * Trans Gear Ratio     | Ratio                                                | 0.00                         | 10B                     |
| * Turbine Speed        | RPM                                                  | ± 50 RPM Of Engine Speed     | 10B                     |
| 1-2 Shift Time         | Seconds                                              | 0                            | 10A/10B                 |
| 2-3 Shift Time         | Seconds                                              | 0                            | 10A/10B                 |
| # 1-2 Shift Time Error | Seconds                                              | 0                            | 10A                     |
| # Curr Adapt Cell      | % TP                                                 | Not Used                     | 10A                     |
| Trans Calib ID         | 0-65535                                              | Internal ID                  | 10A/10B                 |
| System Voltage         | Volts                                                | 12.0 - 14.5V                 | 10A/10B                 |

# 4L60E Only

\* 4L80E Only

## TRANSMISSION TECH 1 DATA DEFINITIONS

**ENGINE SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

**TRANS OUTPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

**ENGINE (ENG) COOLANT (COOL) TEMPERATURE (TEMP)** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the engine coolant temperature sensor. Engine coolant temperature is high (151°C) when signal voltage is low (0 volt), and engine coolant temperature is low (-40°C) when signal voltage is high (5 volts).

**TRANS FLUID TEMP** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high (151°C) when signal voltage is low (0 volt), and transmission fluid temperature is low (-40°C) when signal voltage is high (5 volts).

**THROTTLE (THROT) POSITION** - Scan tool displays a range of 0.00 volt to 5.10 volts. - This parameter indicates the signal input of the throttle position sensor circuit. Low voltage (approximately .3V to 1.3V) indicates closed throttle, high voltage (approximately greater than 4.5V) indicates wide open throttle.

**THROTTLE ANGLE** - Scan tool displays a range of 0% to 100%. - This parameter indicates the signal input of the throttle position sensor circuit. 0% throttle angle (low voltage) indicates closed throttle, 100% throttle angle (high voltage) indicates wide open throttle.

**A/B/C RANGE (RNG)** - Scan tool displays "ON"/"OFF," "ON"/"OFF," "ON"/"OFF." - These parameters are the three inputs from the transmission range pressure switch assembly. "ON" represents a B+ voltage signal, "OFF" represents a 0 voltage signal.

**TRANS RANGE SWITCH (SW)** - Scan tool displays a range of invalid, Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, and Low. - This parameter is the decoded status of the three A/B/C range inputs from the transmission range pressure switch assembly and represents the position of the transmission manual valve.

**COMMANDED GEAR** - Scan tool displays a range of 1, 2, 3, or 4. - This parameter is the decoded commanded state of the 1-2 and 2-3 shift solenoids.

**1-2 SOLENOID (SOL)/2-3 SOLENOID (SOL)** - Scan tool displays "ON"/"OFF." - These parameters are the commanded status of the 1-2 and 2-3 shift solenoids. "ON" represents a commanded energized state (current flowing through solenoid). "OFF" represents a commanded non-energized state (current not flowing through solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) 1/2 2/3** - Scan tool displays "ON"/"OFF." - These parameters are the actual states of the 1-2 and 2-3 shift solenoid driver control circuits. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage.

**TRANS INPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission input shaft expressed as revolutions per minute.

**TCC SLIP SPEED** - Scan tool displays a range of -4096 RPM to +4095 RPM. - This parameter is the difference between transmission input speed and engine speed. A negative value indicates input speed is less than engine speed (deceleration). A positive value indicates engine speed is greater than input speed (acceleration). A value of zero indicates input speed is equal to engine speed (TCC applied).

**HOT MODE** - Scan tool displays "ON"/"OFF." - "ON" indicates transmission fluid temperature has exceeded 146°C (295°F).

**TCC PWM SOLENOID** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded percentage of "ON" time of the TCC solenoid. 100% represents an "ON" (energized) commanded state. 0% represents (non-energized) commanded state.

**DESIRED PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the commanded current of the pressure control solenoid circuit. 0.00 amps (no current flow) indicates commanded higher line pressure. 1.10 amps (high current flow) indicates commanded lower line pressure.

## 10B-14 DRIVEABILITY AND EMISSIONS (GASOLINE)

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**ACTUAL PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the actual current of the pressure control solenoid circuit at the control module. 0.00 amps (no current flow) indicates actual higher line pressure. 1.10 amps (high current flow) indicates actual lower line pressure.

**PRESSURE CONTROL SOLENOID (PCS) DUTY CYCLE** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded state of the pressure control solenoid expressed as a percent of energized on time. 0% indicates zero on time (non-energized) or no current flow. 100% indicates maximum on time (energized) or high current flow.

**MPH Km/h** - Scan tool displays a range of 0 mph to 255 mph. - This parameter is the input signal from the vehicle speed sensor.

**FOUR WHEEL DRIVE (4WD) LOW SWITCH** - Scan tool displays NO/YES. - This parameter is the signal state of the four wheel drive low circuit. NO indicates a B+ voltage signal (4WD low not requested), YES indicates a 0 voltage signal (4WD low requested).

**CRUISE ENGAGED** - Scan tool displays NO/YES. - This parameter is the signal state of the cruise control "ON"/"OFF" switch. NO indicates a 0 voltage signal (cruise control not requested). YES indicates a B+ voltage (cruise control requested).

**TCC BRAKE SWITCH** - Scan tool displays OPEN/CLOSED. - This parameter indicates the state of the TCC brake switch circuit input. Applied indicates a 0 voltage input (brake switch open, brake pedal applied). Released indicates a B+ voltage input (brake switch closed, brake pedal released).

**KICKDOWN ENABLED** - Scan tool displays NO/YES. - This parameter indicates whether enabling conditions exist for an acceleration mode downshift. NO indicates enabling conditions (throttle position, vehicle speed, input speed, etc.) do not exist for an acceleration mode downshift. YES indicates enabling conditions exist for an acceleration mode downshift.

**1-2 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 1-2 shift.

**2-3 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 2-3 shift.

**TRANS GEAR RATIO** - Scan tool displays a range of 0.00 to 5.00. - This parameter is the difference between input speed and output speed.

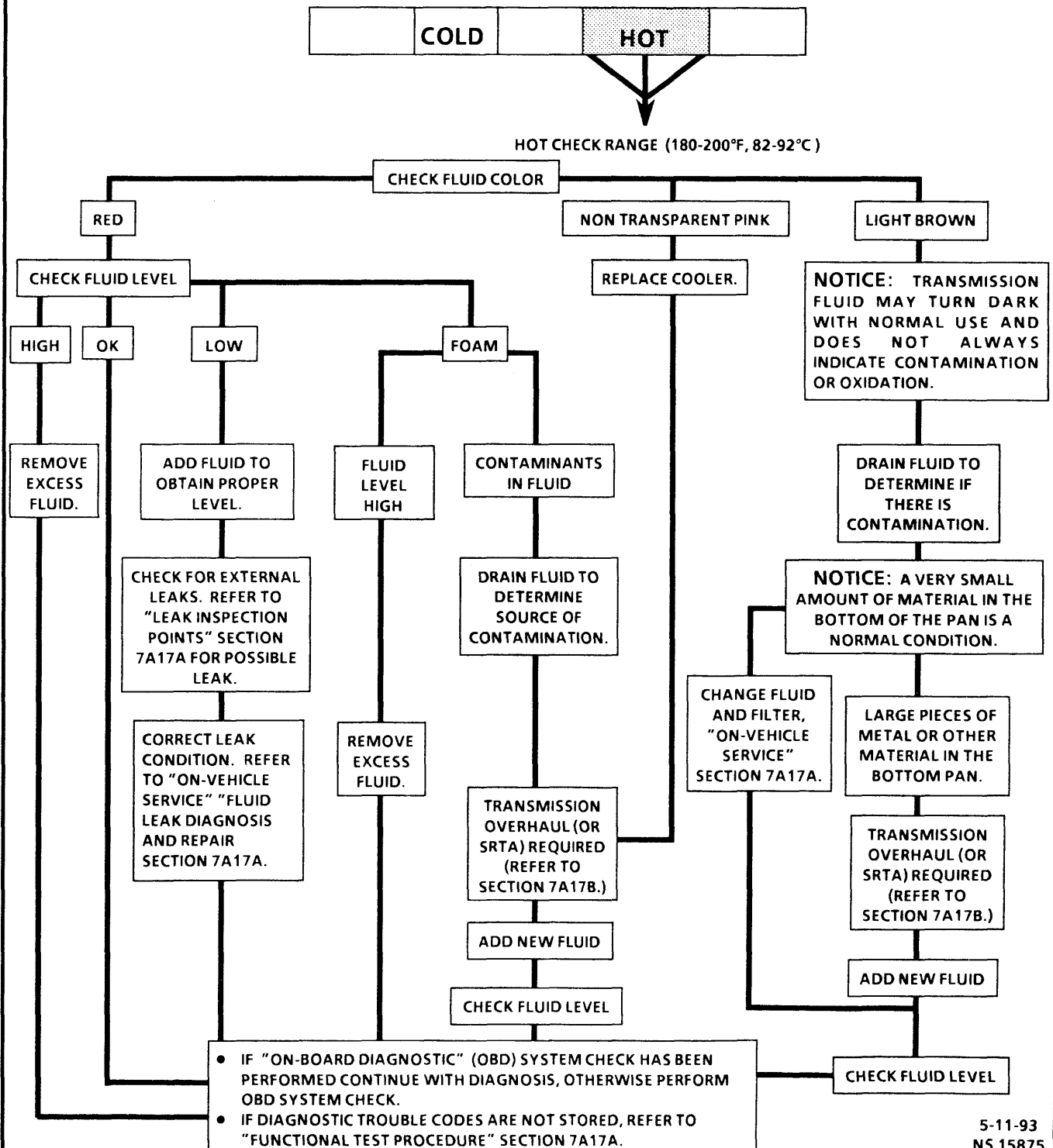
**TURBINE SPEED** - Scan tool displays a range of 0 RPM to 8191 RPM. - This parameter indicates rotational speed of the turbine shaft.

**TRANS CALIBRATION (CALIB) ID** - Scan tool displays a four digit identification of the software calibration.

**SYSTEM VOLTAGE** - Scan tool displays 0.00 volt to 25.5 volts. - This parameter is the battery ignition voltage input to the control module.

## 4L80E TRANSMISSION FLUID CHECKING PROCEDURE

1. Warm the transmission to normal operating temperature by driving the vehicle about 15 miles (24 km). Operating temperature is 180-200°F (82-94°C).
  2. Park vehicle on a level surface, place shift lever in "P" park and apply the parking brake.
  3. Check fluid level on the dipstick (read the lower level).
  4. If fluid level is low, add only enough DEXRON®-IIIE to bring the fluid level into the hot area.
- \* It is important to check fluid level when the transmission has reached operating temperature. The hot range is calibrated correspond to the correct fluid level range for fluid between 180 and 200°F (82-94°C).



## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.



### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION | DTC NUMBER AND NAME                                                        | SECTION |
|-------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------|---------|
| DTC 13 - Oxygen O2S Sensor Circuit (Open Circuit)                                         | 3A      | DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit High (Low Vacuum) | 3A      |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3A      | DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit Low (High Vacuum) | 3A      |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3A      | DTC 35 - IAC Error                                                         | 3A      |
| DTC 16 - VSS Buffer Fault                                                                 | 3A      | *DTC 37 - Brake Switch Stuck "ON"                                          | 10A/10B |
| DTC 21 - Throttle Position (TP) Sensor Circuit High (Signal Voltage High)                 | 3A      | *DTC 38 - Brake Switch Stuck "OFF"                                         | 10A/10B |
| DTC 22 - Throttle Position (TP) Sensor Circuit Low (Signal Voltage Low)                   | 3A      | *DTC 39 - Torque Converter Clutch (TCC) Stuck OFF                          | 10/B    |
| DTC 23 - Intake Air Temperature (IAT) Sensor Circuit High (Low Temperature Indicated)     | 3A      | DTC 42 - Ignition Control (IC) Error                                       | 3A      |
| *DTC 24 - Vehicle Speed Sensor (VSS) Circuit Low (Trans Output Speed Signal)              | 10A/10B | DTC 43 - Knock Sensor (KS) Circuit                                         | 3A      |
| DTC 25 - Intake Air Temperature (IAT) Sensor Circuit Low (High Temperature Indicated)     | 3A      | DTC 44 - Lean Exhaust                                                      | 3A      |
| *DTC 28 - Transmission Range (TR) Pressure Switch Assembly                                | 10A/10B | DTC 45 - Rich Exhaust                                                      | 3A      |
| DTC 32 - Exhaust Gas Recirculation (EGR) Error                                            | 3A      | DTC 51 - PROM (MEM-CAL) Error                                              | 3A      |
|                                                                                           |         | *DTC 52 - System Voltage High Long                                         | 10A/10B |
|                                                                                           |         | *DTC 53 - System Voltage High                                              | 10A/10B |
|                                                                                           |         | DTC 54 - Fuel Pump Relay Circuit (Low Voltage)                             | 3A      |
|                                                                                           |         | DTC 55 - Faulty PCM                                                        | 3A      |

Figure 10B-14 - Diagnostic Trouble Code Identification (1 of 2)

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go out and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E) or 10B (4L80E). Remember, always start with the lowest numerical DTC first, when diagnosing some engine DTCs other transmission symptoms can occur.

| DTC NUMBER AND NAME,                                                                           | SECTION | DTC NUMBER AND NAME                                                                  | SECTION |
|------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------|---------|
| *DTC 58 - Transmission Fluid Temperature (TFT) Sensor Circuit Low (High Temperature Indicated) | 10A/10B | *DTC 81 - 2-3 Shift Solenoid Circuit Fault                                           | 10A/10B |
| *DTC 59 - Transmission Fluid Temperature (TFT) Sensor Circuit High (Low Temperature Indicated) | 10A/10B | *DTC 82 - 1-2 Shift Solenoid Circuit Fault                                           | 10A/10B |
| *DTC 66 - 3-2 Control Solenoid Circuit Fault                                                   | 10A     | *DTC 83 - Torque Converter Clutch (TCC) Pulse Width Modulated (PWM) Solenoid Circuit | 10B     |
| *DTC 67 Torque Converter Clutch (TCC) Solenoid Circuit Fault                                   | 10A     | *DTC 85 - Undefined Ratio Error                                                      | 10B     |
| *DTC 68 - Trans Component Slipping                                                             | 10B     | *DTC 86 - Low Ratio Error                                                            | 10B     |
| *DTC 69 - Torque Converter Clutch (TCC) Stuck "ON"                                             | 10A/10B | *DTC 87 - High Ratio Error                                                           | 10B     |
| *DTC 72 - Vehicle Speed Sensor (VSS) Circuit Loss (Trans Output Speed Signal)                  | 10A/10B |                                                                                      |         |
| *DTC 73 - Pressure Control Solenoid (PCS) Fault (Current Error)                                | 10A/10B |                                                                                      |         |
| *DTC 74 - Transmission Input Speed (TIS) Sensor Circuit                                        | 10B     |                                                                                      |         |
| *DTC 75 - System Voltage Low                                                                   | 10A/10B |                                                                                      |         |
| *DTC 79 - Transmission Fluid Over temp                                                         | 10A/10B |                                                                                      |         |

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PS 17022

Figure 10B-15 - Diagnostic Trouble Code Identification (2 of 2)

# 10B-18 DRIVEABILITY AND EMISSIONS (GASOLINE)

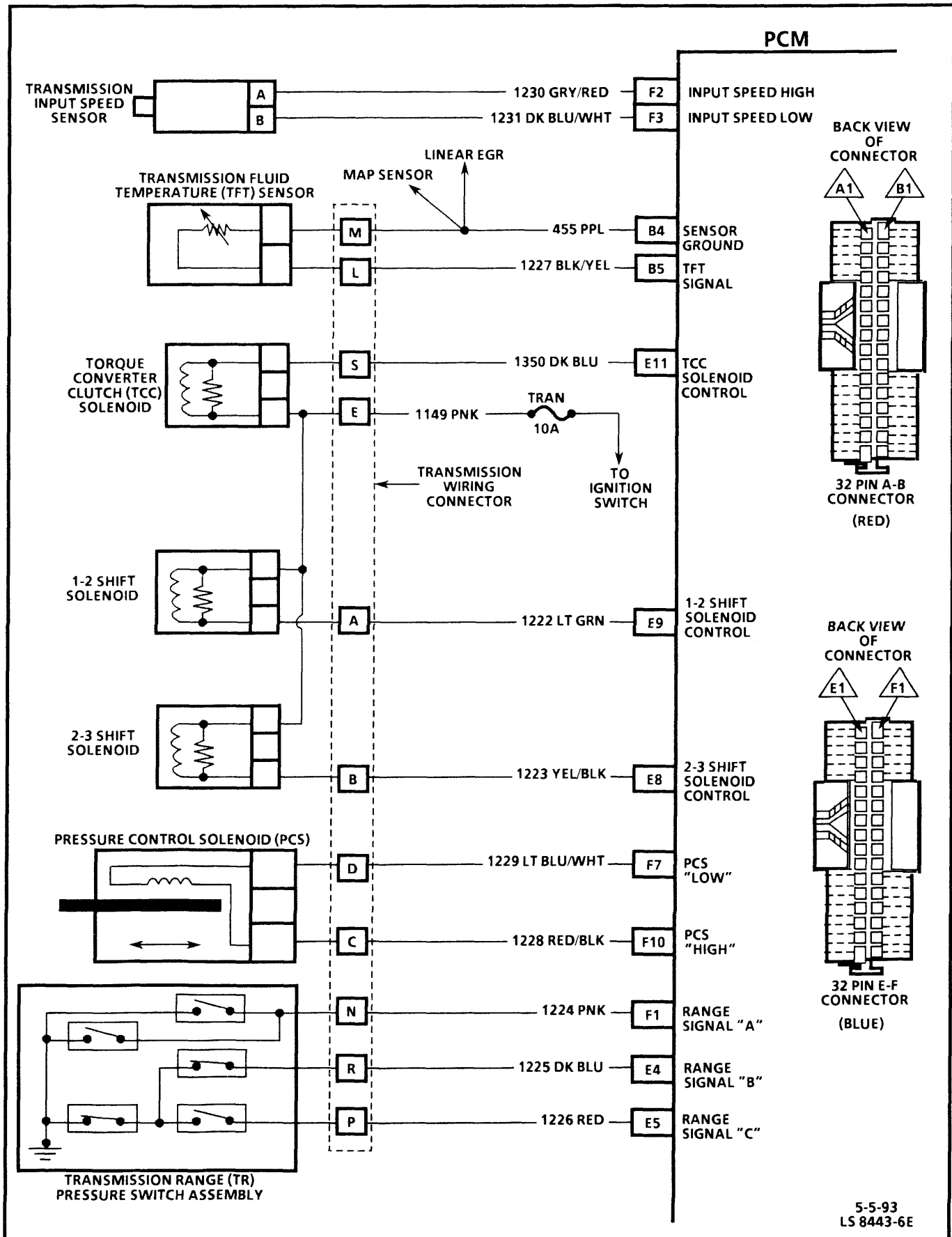
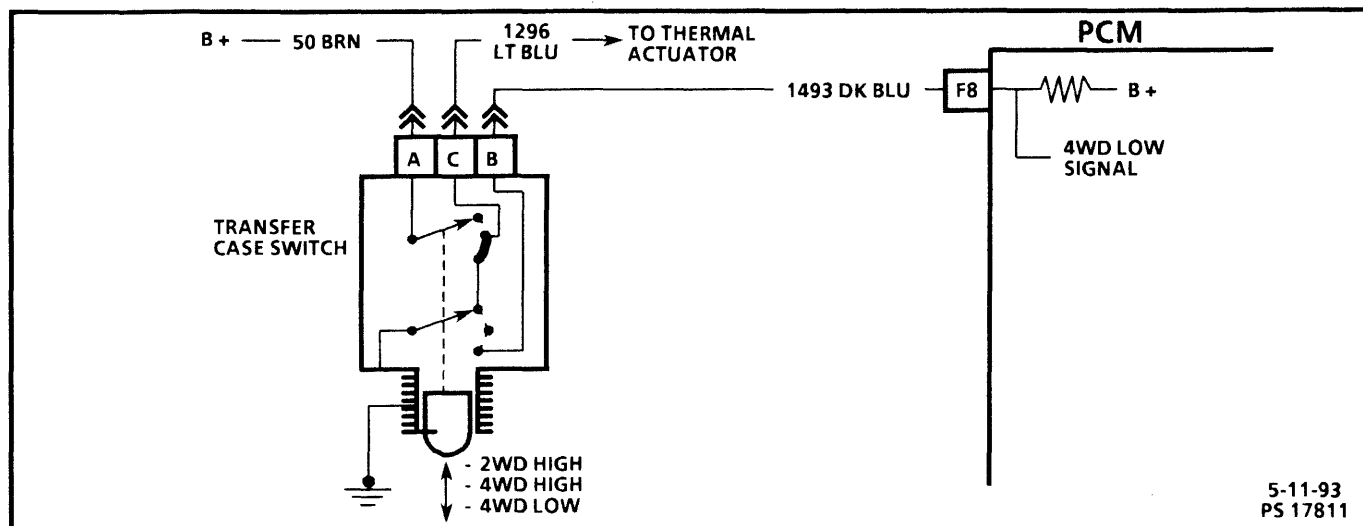


Figure 10B-16 - PCM Wiring Diagram 4.3L, 5.7L, 7.4L (C/K) 4L80E Transmission

**BLANK**





## 4WD LOW SWITCH SIGNAL CHECK

### Circuit Description:

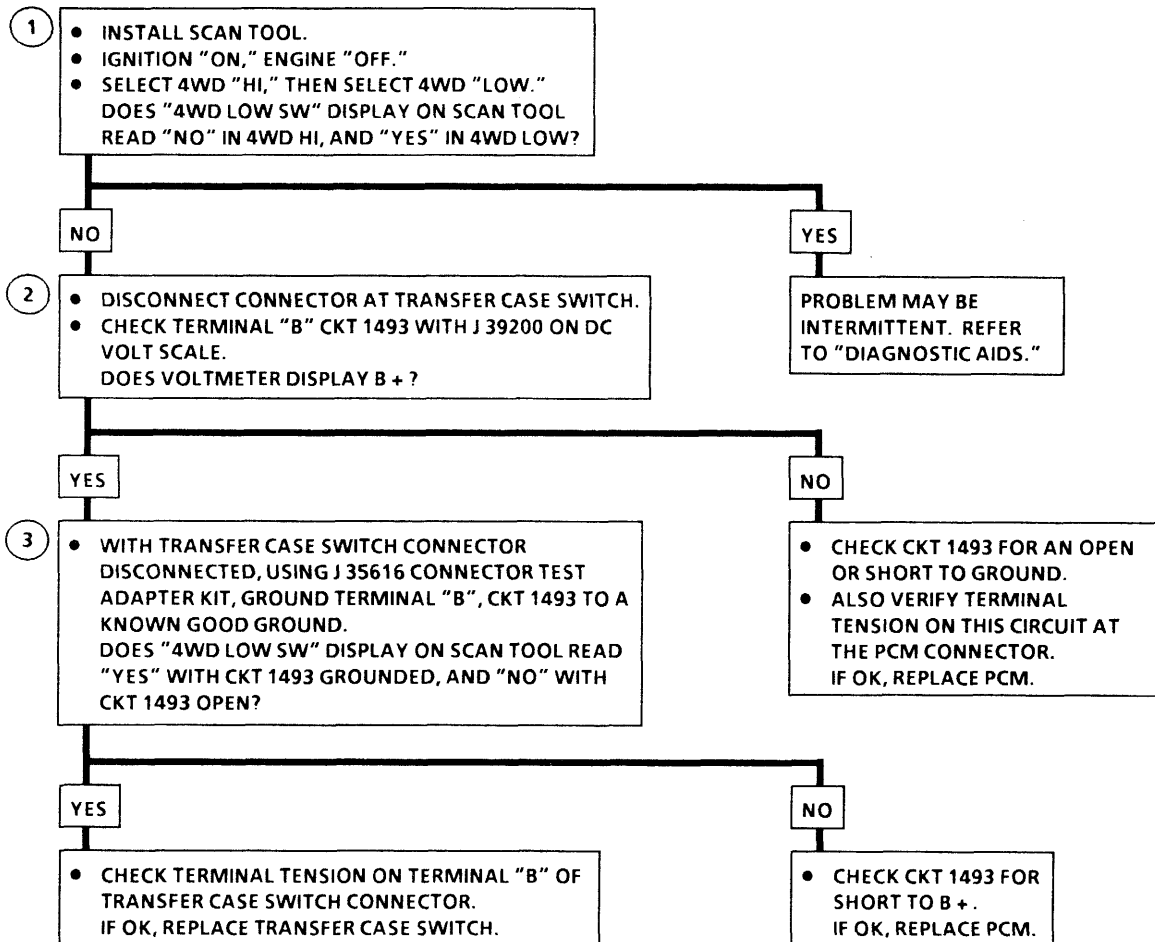
The 4WD low circuit consists of a transfer case switch, front axle actuator, and wiring. The PCM supplies a B+ voltage signal to the transfer case switch on CKT 1493. With 2WD or 4WD HI selected, no ground path is provided for CKT 1493, and the voltage signal at the PCM will be B+. When 4WD low is selected, the transfer case switch provides a ground for CKT 1493, and the PCM 4WD low signal CKT 1493 will change from B+ to zero volts. The transfer case switch also completes CKT 50 (B+) to CKT 1296 to provide B+ to the front axle actuator.

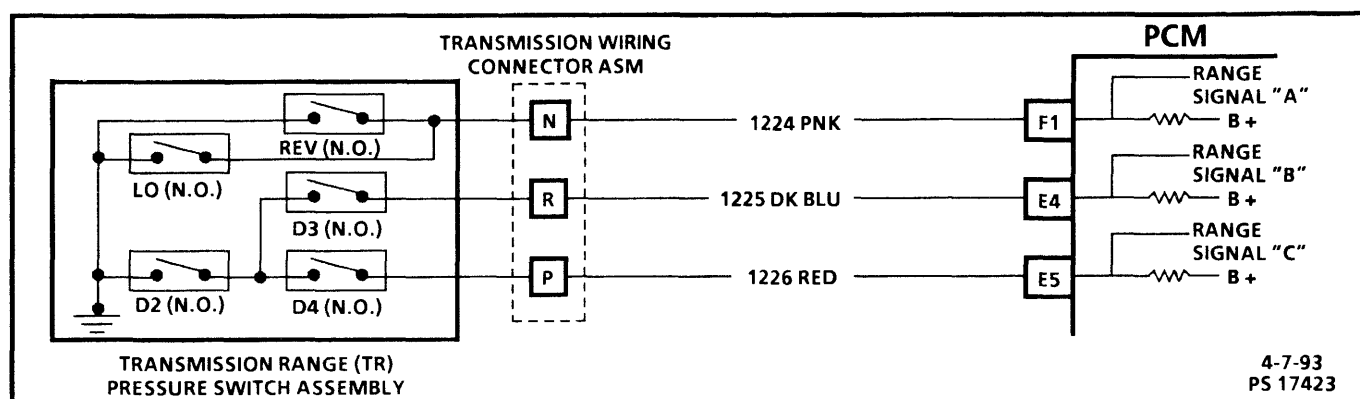
**Action Taken (PCM will default to):** No DTC(s) will be set, however, failures of the 4WD low circuit can cause many types of complaints such as: early/late shifts, erratic shifts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for proper circuit operation.
2. This test checks for a proper reference signal from the PCM.
3. This test checks the ability of the transfer case switch to ground the reference signal from the PCM.

**Diagnostic Aids:** For further information, refer to SECTION 7D of the appropriate service manual.

**4WD LOW SWITCH SIGNAL CHECK**



## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

### Circuit Description:

The Transmission Range (TR) switch assembly consists of five normally open pressure switches. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** Refer to accompanying chart for various A/B/C range combinations. Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A17A of the appropriate service manual for further information.

"ON" = B+/"OFF" = 0 volts

**Valid Combination Chart**

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | ON  | OFF | ON  |
| Rev          | OFF | OFF | ON  |
| Neutral      | ON  | OFF | ON  |
| 4th          | ON  | OFF | OFF |
| 3rd          | ON  | ON  | OFF |
| 2nd          | ON  | ON  | ON  |
| 1st          | OFF | ON  | ON  |
| Illegal      | OFF | ON  | OFF |
| Illegal      | OFF | OFF | OFF |

Expected Readings 4L80E

## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

- 1
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

YES

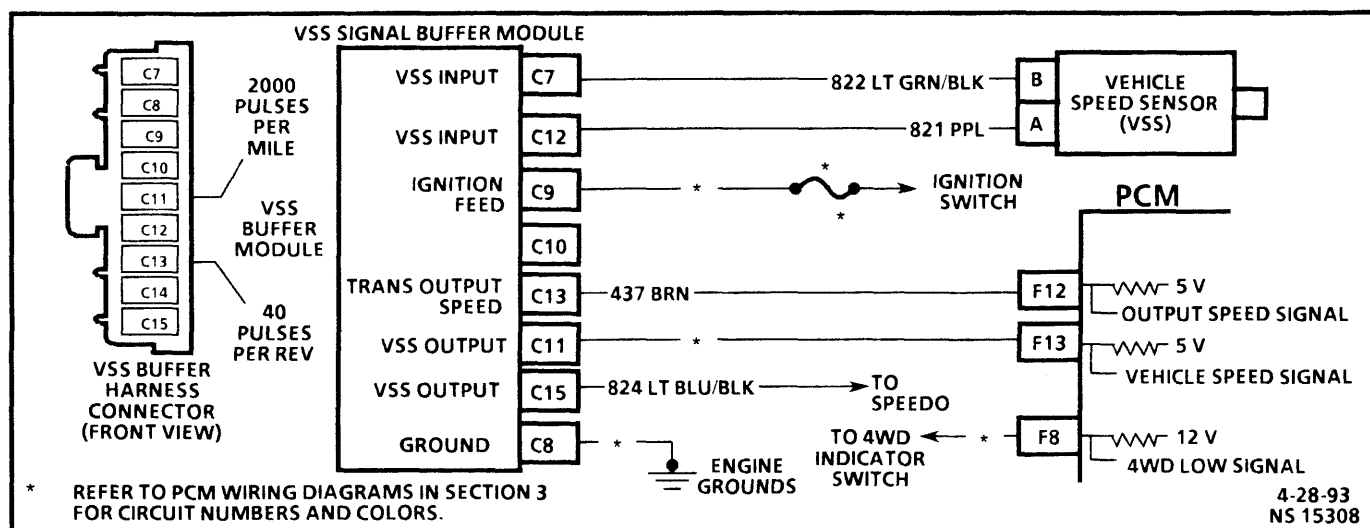
NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

NO

- 3
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

- 2
- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.



## DTC 24

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 pulse per revolution signal to the PCM.

#### DTC 24 Will Set When:

- No DTC(s) 21, 22, 28, 33, or 34.4
- Not in P/N.
- CKT 437 voltage is constant.
- Engine speed is greater than 3000 RPM.
- Output speed is less than 200 RPM.
- MAP is greater than 40 kPa.
- TP is between 10% and 100%.
- All conditions met for 3 seconds.

**Action Taken (PCM will default to):** Second gear only maximum line pressure.

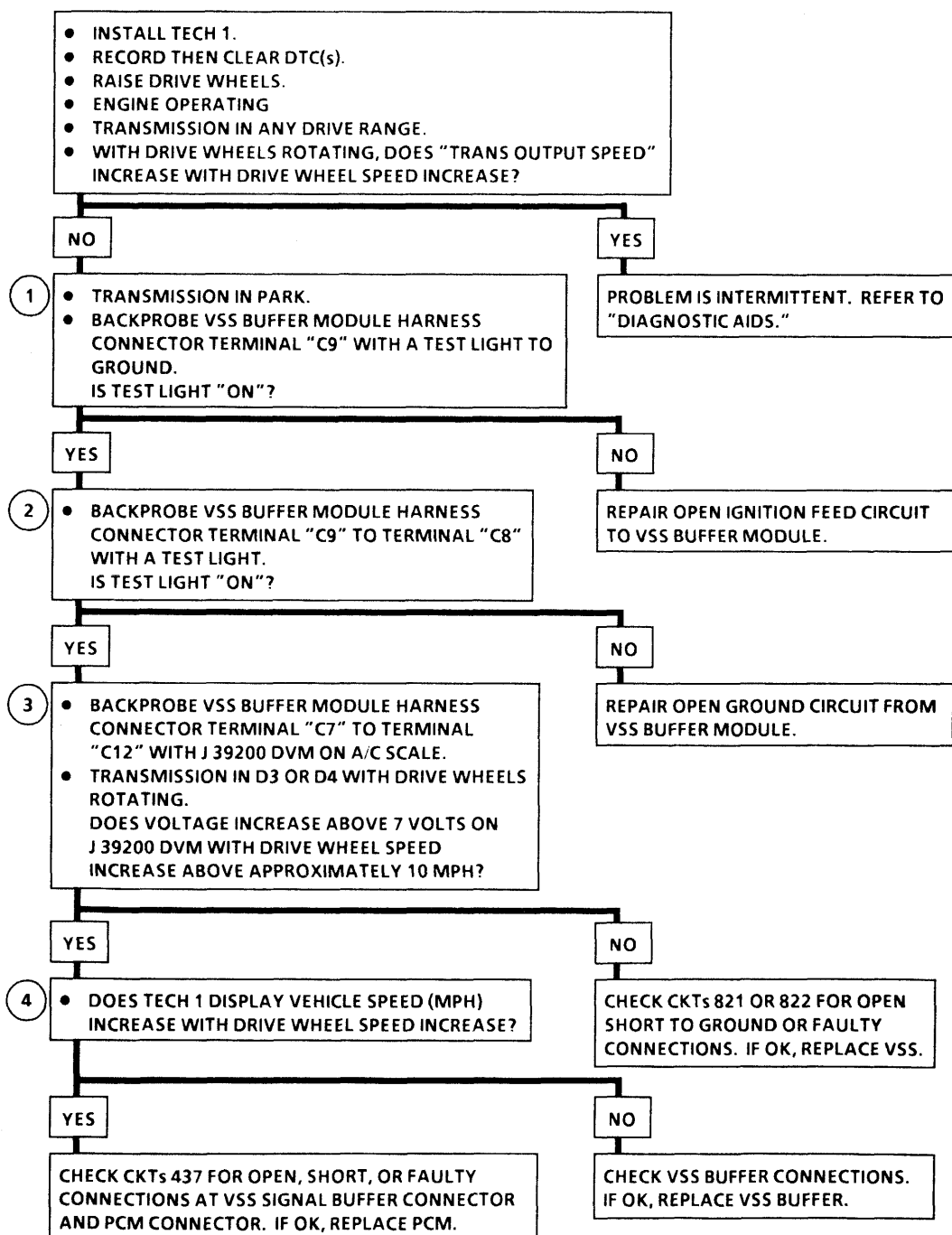
**DTC 24 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

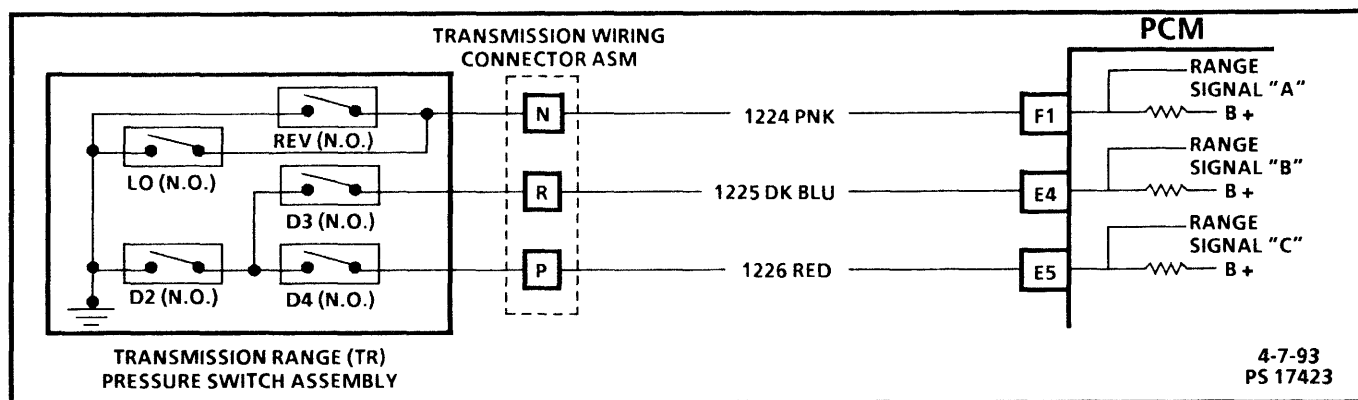
#### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost during vehicle operation.

**DTC 24****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

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MS 13697



## DTC 28

### TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT

#### Circuit Description:

The Transmission Range (TR) switch assembly consists of five normally open pressure switches mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what transmission range has been selected by the vehicle operator. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and D2 will be indicated.

#### DTC 28 Will Set When:

- Range signals "A" and "C" are both zero volts.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Drive 4 shift control.
- Disable manual mode.
- No fourth gear in hot mode.

**DTC 28 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled from "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

"ON" = 0 volts/"OFF" = B+

#### Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings 4L60E

**Diagnostic Aids:** DTC 28 will set if the PCM detects one of two "Illegal" combinations.

Refer to accompanying chart for various A/B/C range combinations.

Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A (4L60-E)/7A17A (4L80-E) of the appropriate service manual for further information.

"ON" = B+/"OFF" = 0 volts

#### Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | ON  | OFF | ON  |
| Rev          | OFF | OFF | ON  |
| Neutral      | ON  | OFF | ON  |
| 4th          | ON  | OFF | OFF |
| 3rd          | ON  | ON  | OFF |
| 2nd          | ON  | ON  | ON  |
| 1st          | OFF | ON  | ON  |
| Illegal      | OFF | ON  | OFF |
| Illegal      | OFF | OFF | OFF |

Expected Readings 4L80E

**DTC 28****TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT**

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

①

- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
- PARKING BRAKE APPLIED AND WHEELS BLOCKED.
- APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
- DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
- INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
- IGNITION "ON," ENGINE "OFF."
- WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B + AT ALL THREE CIRCUITS?

NO

③

- ON CIRCUIT(S) THAT DID NOT INDICATE B +, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

YES

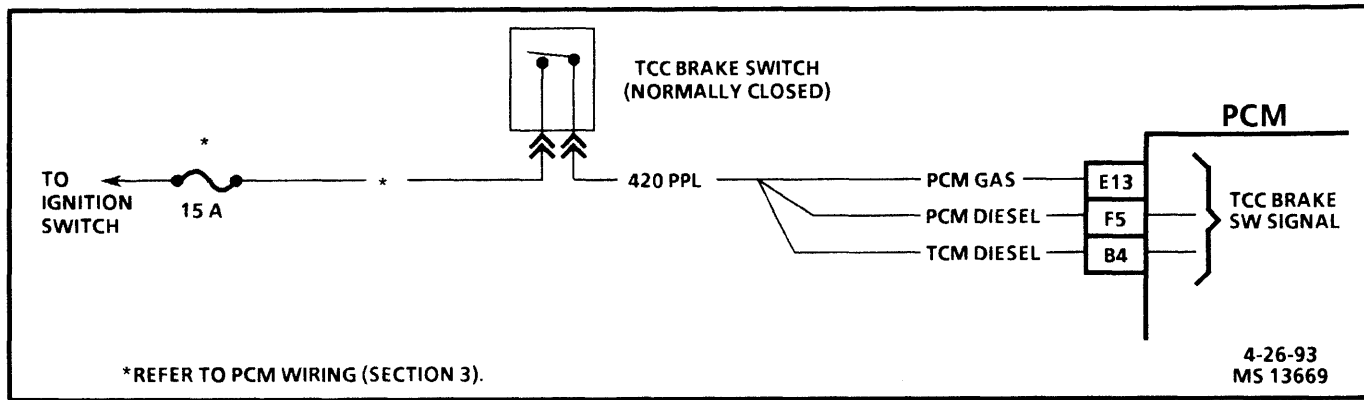
②

- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-27-93  
PS 17065





## DTC 37/38

### TCC BRAKE SWITCH STUCK "ON"/ TCC BRAKE SWITCH STUCK "OFF"

#### Circuit Description:

The normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The signal voltage drops to 0 volts when the TCC brake switch is opened (brake pedal applied).

#### DTC 37 Will Set When:

- CKT 420 is open.
  - Vehicle speed is less than 5 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - Then vehicle speed is greater than 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

#### DTC 38 Will Set When:

- CKT 420 has constant voltage.
  - Vehicle speed is greater than 20 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

#### Action Taken (PCM will default to):

- No TCC.
- No fourth gear in hot mode.

**DTC 37/38 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

**DTC 37/38****TCC BRAKE SWITCH STUCK "ON"/  
TCC BRAKE SWITCH STUCK "OFF"**

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

①

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

②

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

YES

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

YES

③

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

YES

ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

YES

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

NO

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

NO

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

NO

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

NO

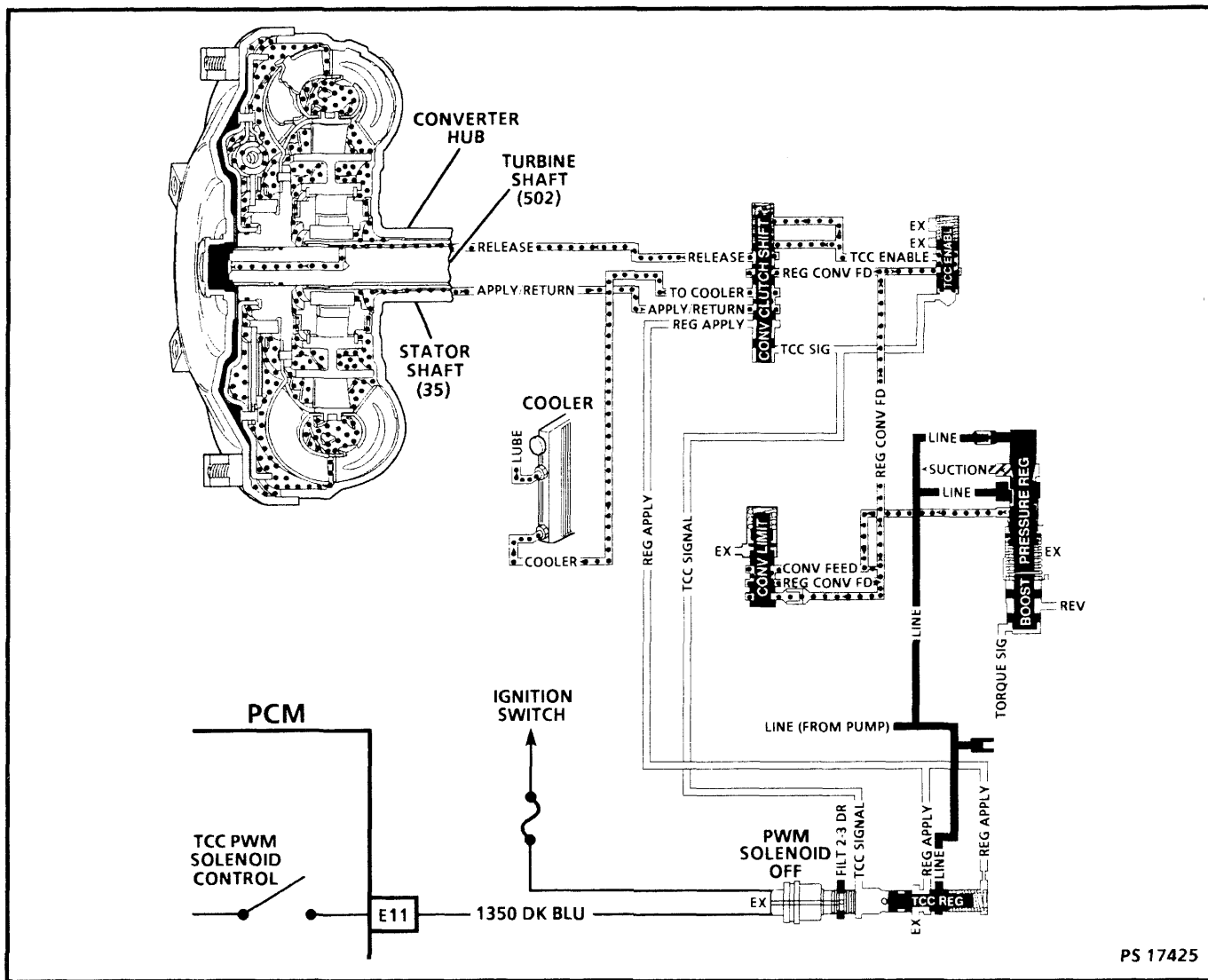
REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

NO

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-3-93  
PS 17053



## DTC 39

### Circuit Description:

The PCM commands the TCC PWM solenoid "ON" by modulating TCC signal fluid acting on the converter clutch shift valve. Then TCC apply fluid applies the torque converter clutch.

### DTC 39 Will Set When:

- No DTC(s) 28, 71, or 74.
- TCC slip speed greater than 65 RPM.
- Trans range in D3 or D4.
- 2nd or 3rd gear.
- All conditions are met for two seconds.

**Action Taken (PCM will default to):** Inhibits 4<sup>th</sup> gear if in hot mode.

**DTC 39 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON "

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks the mechanical and hydraulic operation of the TCC, while commanded "ON" by the PCM.

**Diagnostic Aids:** Snapshot mode will record 5 data parameters per second.

**DTC 39**  
**TCC STUCK "OFF"**

1

- IF DTC 83 IS SET, REFER TO THAT CHART BEFORE PROCEEDING.
- INSTALL SCAN TOOL.
- DRIVE VEHICLE IN D3 AND IN 3<sup>rd</sup> GEAR.
- USE SNAPSHOT MODE TO RECORD DATA PARAMETERS.
- WHILE REVIEWING DATA, IS TCC SLIP SPEED GREATER THAN 65 RPM WHILE TCC PWM SOLENOID IS COMMANDED "ON" (GREATER THAN 95%), FOR 2 SECONDS?

YES

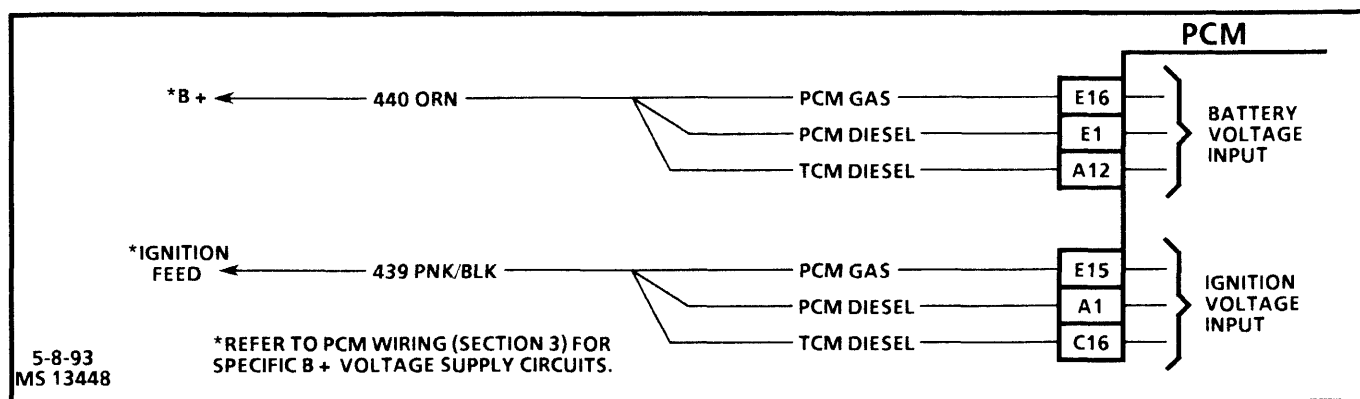
THE TORQUE CONVERTER CLUTCH IS MECHANICALLY STUCK "OFF," REFER TO SYMPTOM DIAGNOSIS CHARTS, "NO TCC" SECTION 7A 17A.

NO

THE CONDITION MAY BE INTERMITTENT, REFER TO "TORQUE CONVERTER CLUTCH (TCC) DIAGNOSIS" IN SECTION 7A 17A OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17415



## DTC 52/53

### SYSTEM VOLTAGE HIGH LONG/SYSTEM VOLTAGE HIGH

#### Circuit Description:

Ignition voltage is supplied to the control module to indicate the ignition status of the ignition switch. Battery voltage is supplied to the control module to, in part, maintain memory of learned functions and parameters.

#### DTC 52 Will Set When:

- The ignition is "ON."
- The ignition system voltage is greater than 16 volts.
- All conditions met for 109 minutes.

#### DTC 53 Will Set When:

- The ignition is "ON."
- The ignition system voltage is greater than 19.5 volts.
- All conditions met for 2 minutes.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- 2<sup>nd</sup> gear (4L80E), 3<sup>rd</sup> gear (4L60E).
- Inhibit TCC.

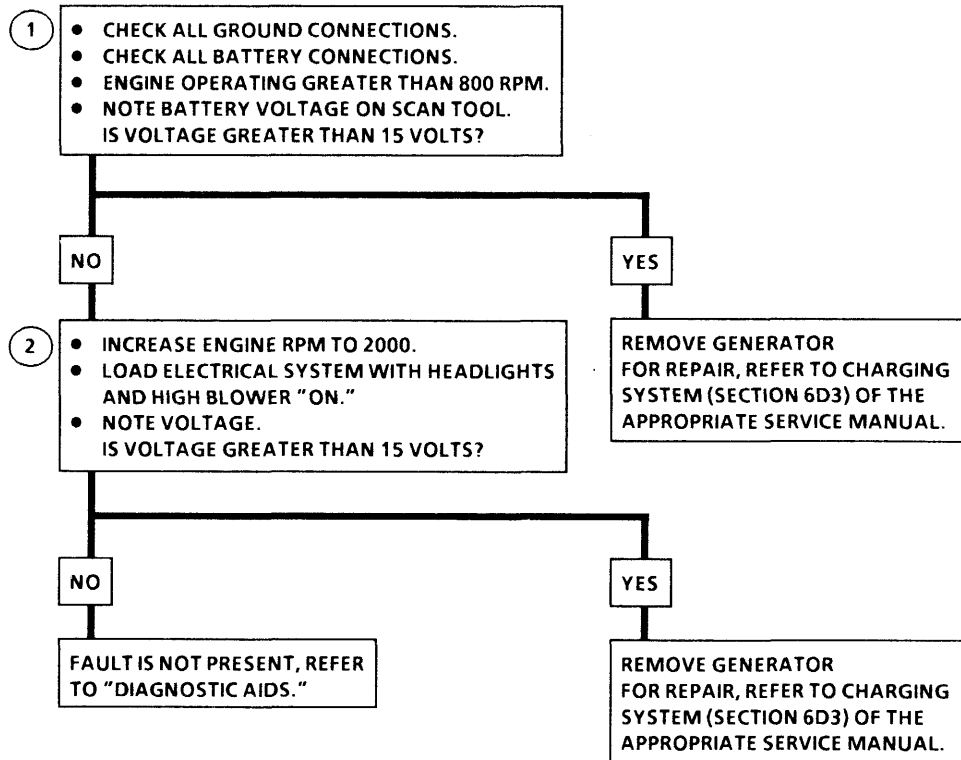
**DTC 52/53 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

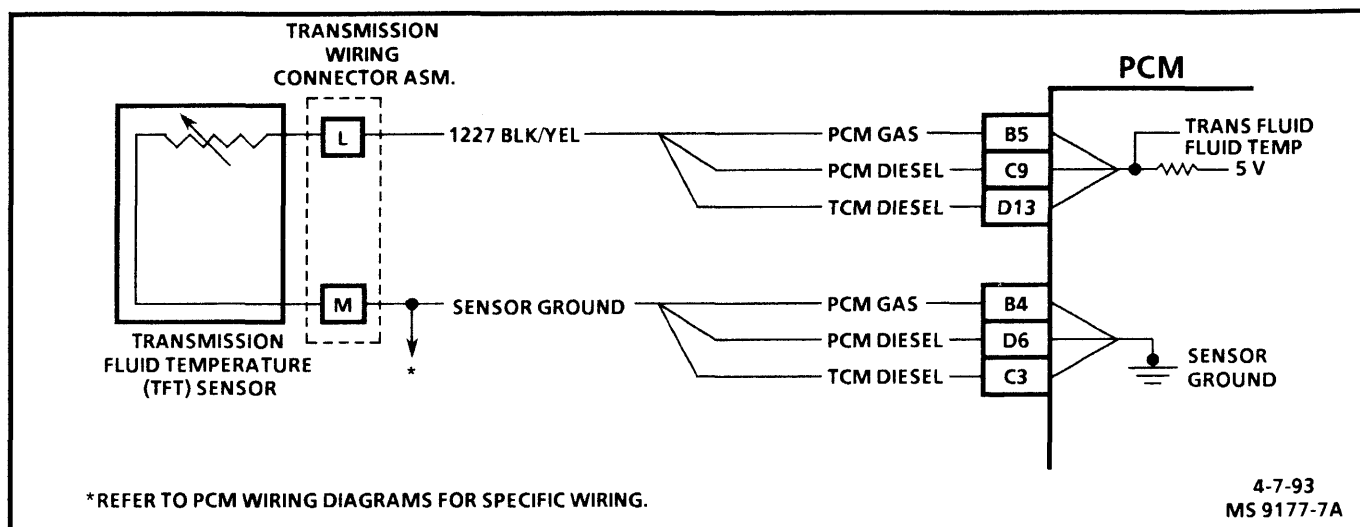
#### Diagnostic Aids:

- Charging the battery and jump-starting an engine may set DTC 52/DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 52/53**  
**SYSTEM VOLTAGE HIGH LONG/  
SYSTEM VOLTAGE HIGH**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067



## DTC 58

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts. With a DTC 79 also set, check the transmission cooling system.

#### DTC 58 Will Set When:

- Signal voltage indicates TFT greater than 151°C (306°F).
- All conditions met for 1 second.

**Action Taken (PCM will default to):** The PCM will use a warm default trans fluid temperature value.

**DTC 58 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

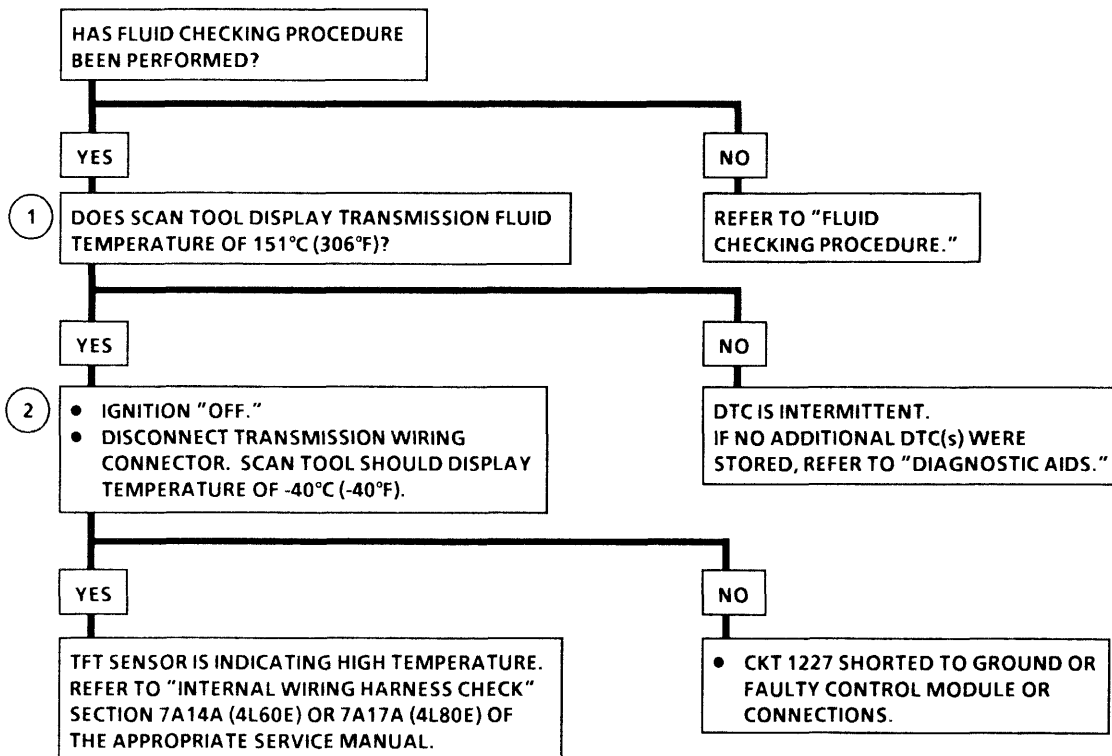
1. This test checks for a short to ground or a skewed sensor.
2. This test checks for an internal fault within the transmission by creating an open.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C (212°F) then stabilize.

Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

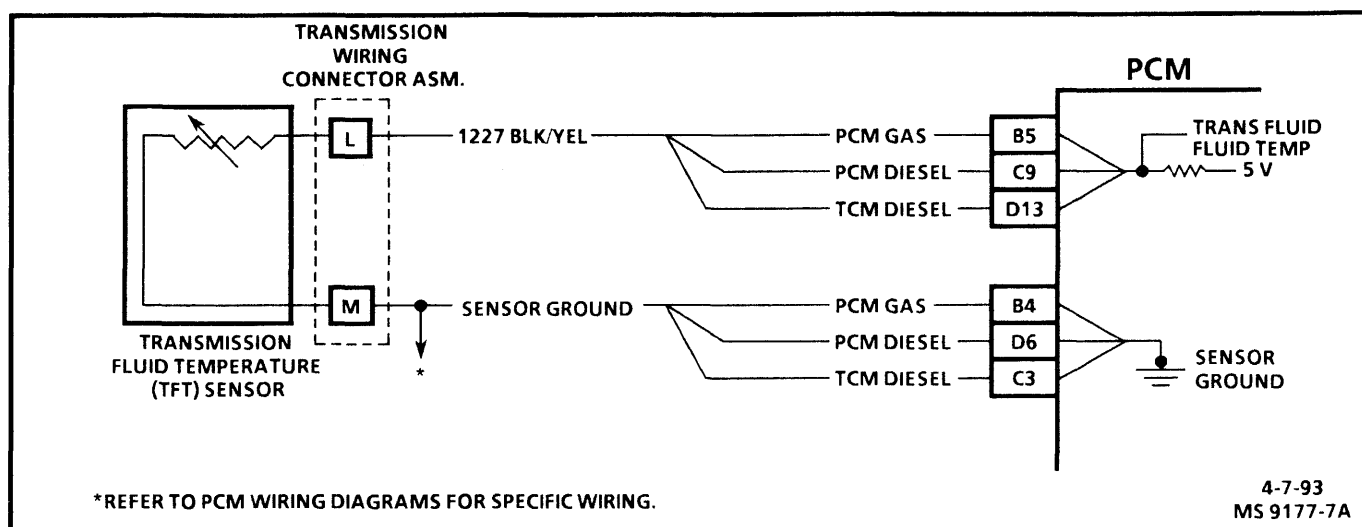
The temperature to resistance value scale in SECTION 7A17A may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" (mis-scaled) sensor could result in delayed garage shifts or TCC complaints.

**DTC 58****TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-29-93  
MS 13671





## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies 5 volts to the sensor on CKT 1227. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases at about 1.5 to 2.0 volts.

#### DTC 59 Will Set When:

- Signal voltage indicates TFT less than -40°C (-40°F).
- All conditions met for 1 second.

**Action Taken (PCM will default to):** The PCM will use a warm default trans fluid temperature value.

**DTC 59 Will Clear When:** The fault condition(s) no longer exist.

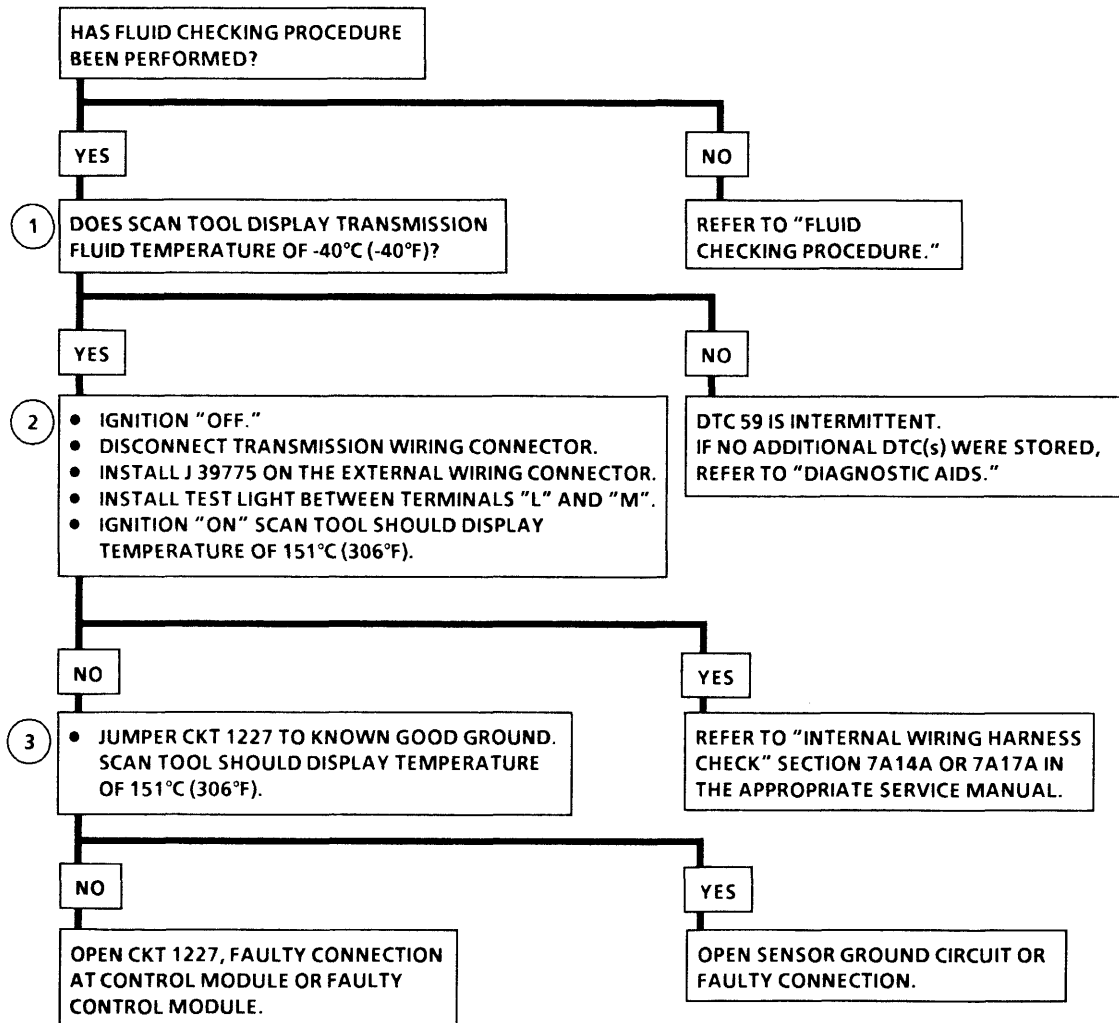
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks for entire circuit and indicates whether the malfunction is present.
2. This test simulates a DTC 58. If the PCM recognizes the low signal voltage (high temperature), and the scan displays 151°C (305°F) or greater, the PCM and wiring are OK.
3. This test checks if CKT 1227 is open. There should be 5 volts present at the sensor connector if measured with J 39200.

**Diagnostic Aids:** Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100°C (212°F) then stabilize.

A faulty connection or an open in CKT 455 or CKT 1227 can result in a DTC 59.

The "Temperature to Resistance Value" scale in SECTION 7A17A may be used to check the TFT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor can result in firm shifts, or TCC complaints.

**DTC 59****TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)**

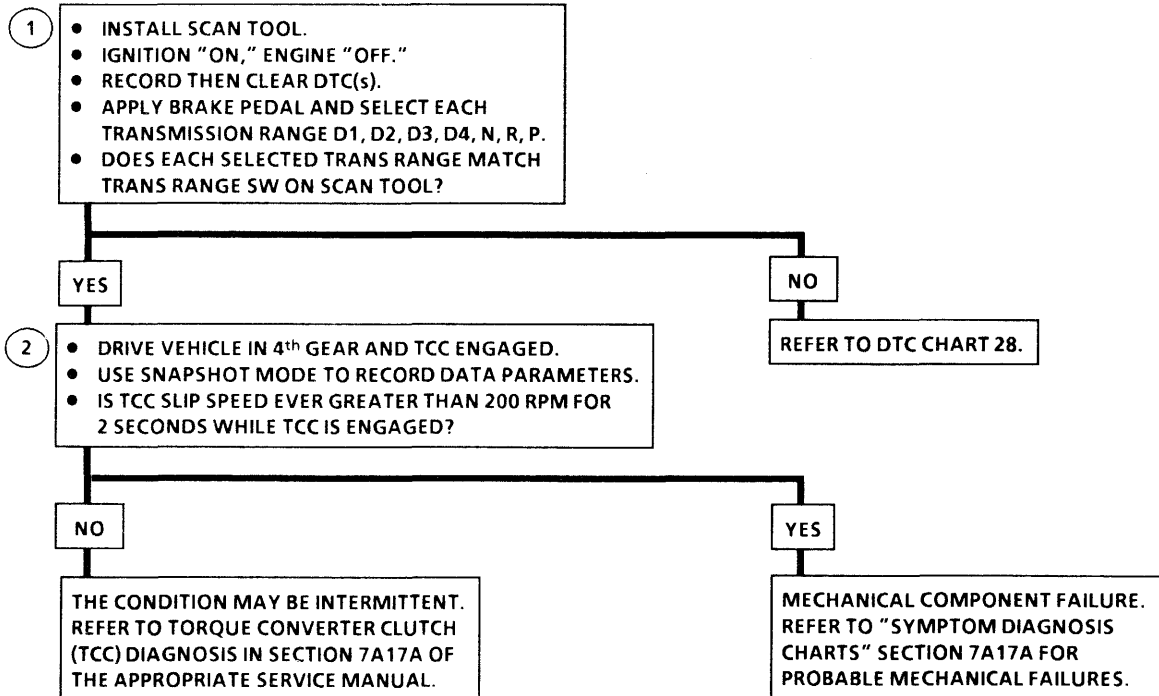
WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

## TRANS COMPONENT SLIPPING

- DTC 68 will set when going to default (second gear).
- Refer to “PCM/TCM Intermittent DTC(s) or Performance.”  
Refer to SECTION 7A17A for information on “Internal Transmission Faults.”
- An intermittent incorrect engine speed signal will set a DTC 68 if the incorrect signal lasts for greater than 2 seconds.
- A mechanical failure in the 1-2 shift solenoid (stuck “OFF”) or 2-3 shift solenoid (stuck “ON”), could set DTC 68.

## DTC 68

### TRANS COMPONENT SLIPPING



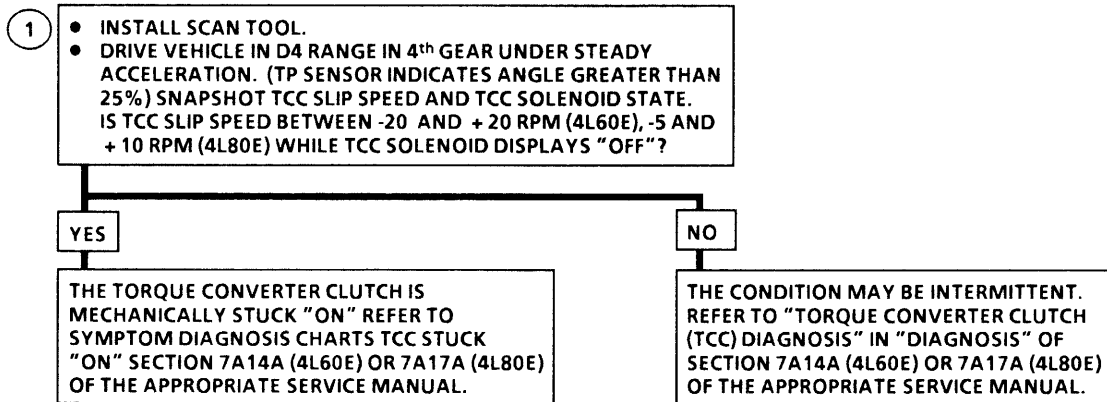
WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-28-93  
PS 17429

**Diagnostic Aids:** If the TCC is mechanically stuck “ON,” vehicle speed is zero, brakes are applied, and D2 is selected, the TCC fluid will mechanically apply the TCC causing an engine stall.

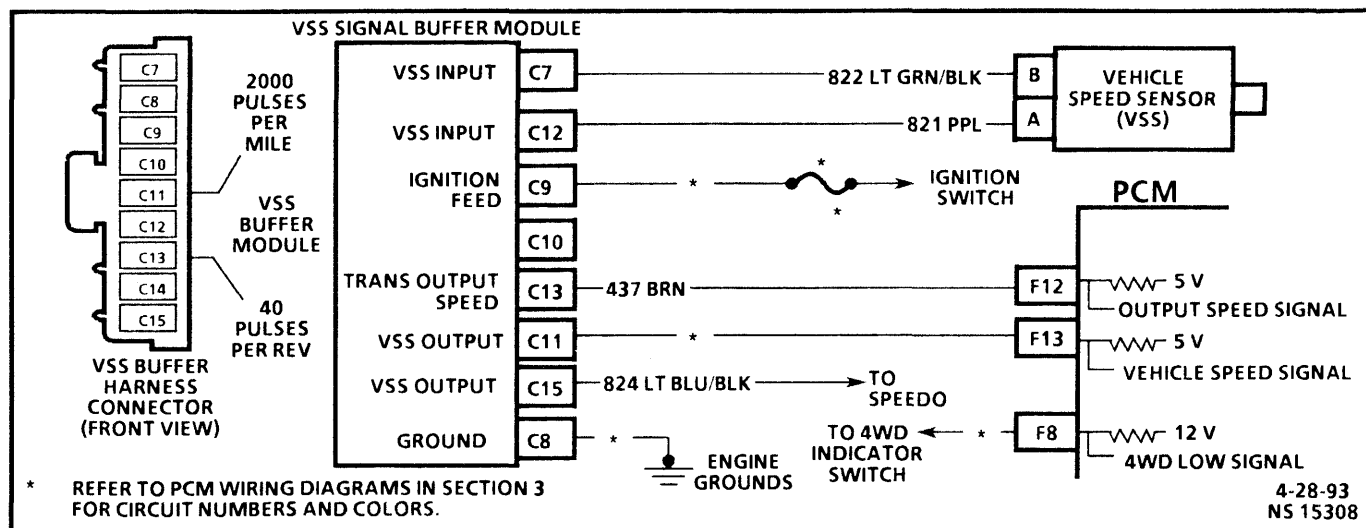
## DTC 69

### TORQUE CONVERTER CLUTCH (TCC) STUCK "ON"



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17052



## DTC 72

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

#### DTC 72 Will Set When:

- No DTC 28 set.
- Not in P/N.
  - Transmission output speed change is greater than 1000 RPM.
  - Engine speed is greater than 200 RPM (4L60E), 300 RPM (4L80E).
  - Conditions met for 2 seconds.
- No DTC 28 set.
- In P/N.
  - Transmission output speed change is greater than 2050 RPM.
  - Engine speed is greater than 200 RPM (4L60E), 300 RPM (4L80E).
  - Conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- A (soft) delayed landing to second gear.
- Maximum line pressure.

**DTC 72 Will Clear When:** Fault conditions no longer exist and the ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

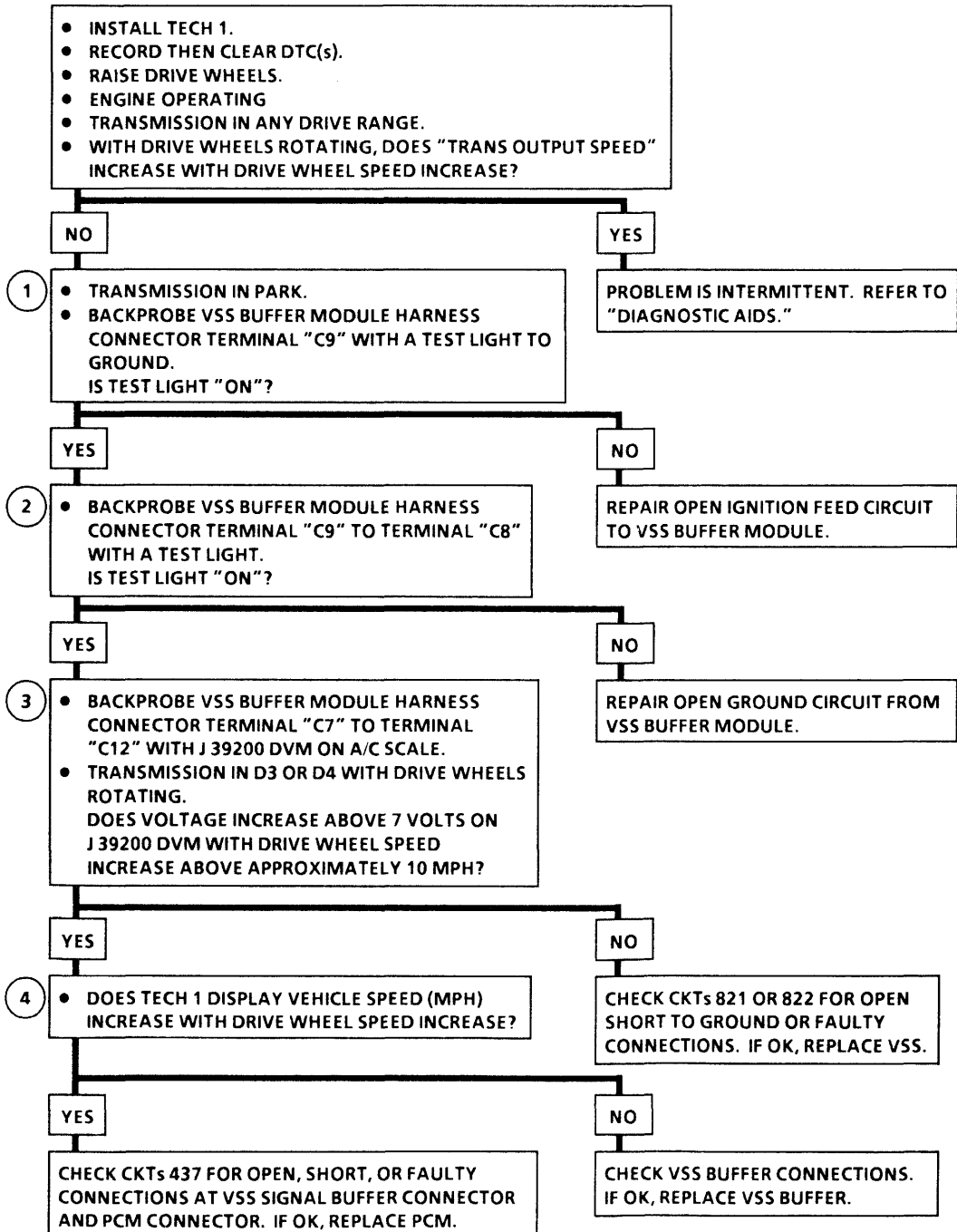
1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

#### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

# DTC 72

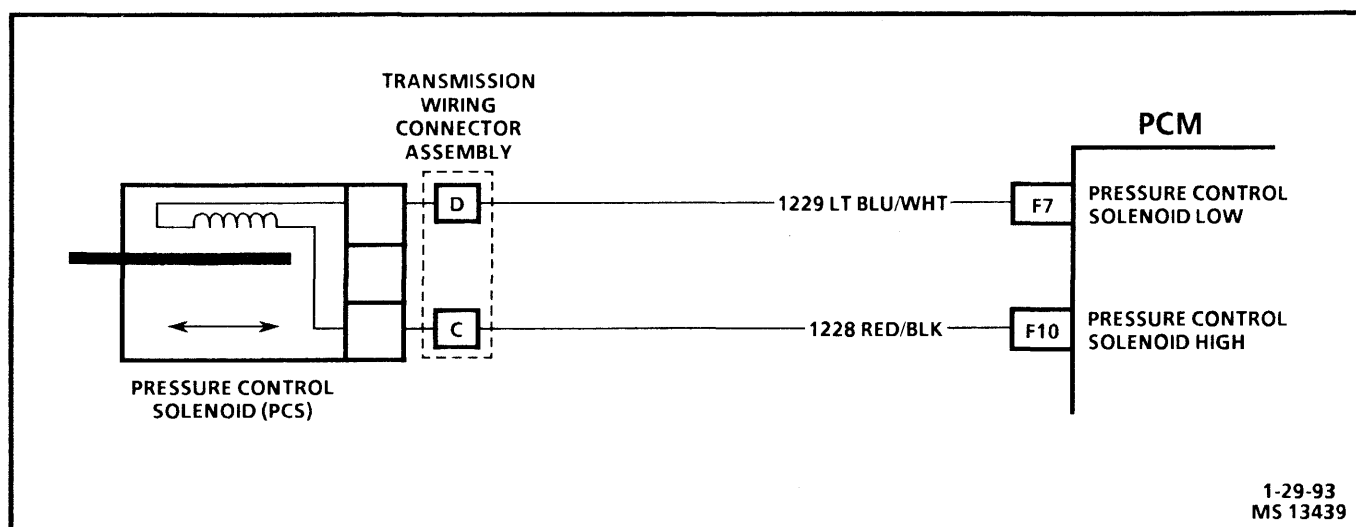
## VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS (TRANS OUTPUT SPEED SIGNAL)



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697





## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)

#### Circuit Description:

The pressure control solenoid is a PCM controlled device used to regulate transmission line pressure. The PCM compares TP voltage, engine RPM and other inputs to determine the appropriate line pressure for a given load. The PCM will regulate the pressure by applying a varying amperage to the pressure control solenoid. The applied amperage can vary from 0.1 to 1.1 amp. The PCM then monitors the amperage at the return line.

#### DTC 73 Will Set When:

- No DTC 75 stored.
- The return amperage varies greater than 0.16 amp from the commanded amperage.
- All conditions met for one second.

#### Action Taken (PCM will default to):

- Harsh shifts.
- Maximum line pressure.

**DTC 73 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

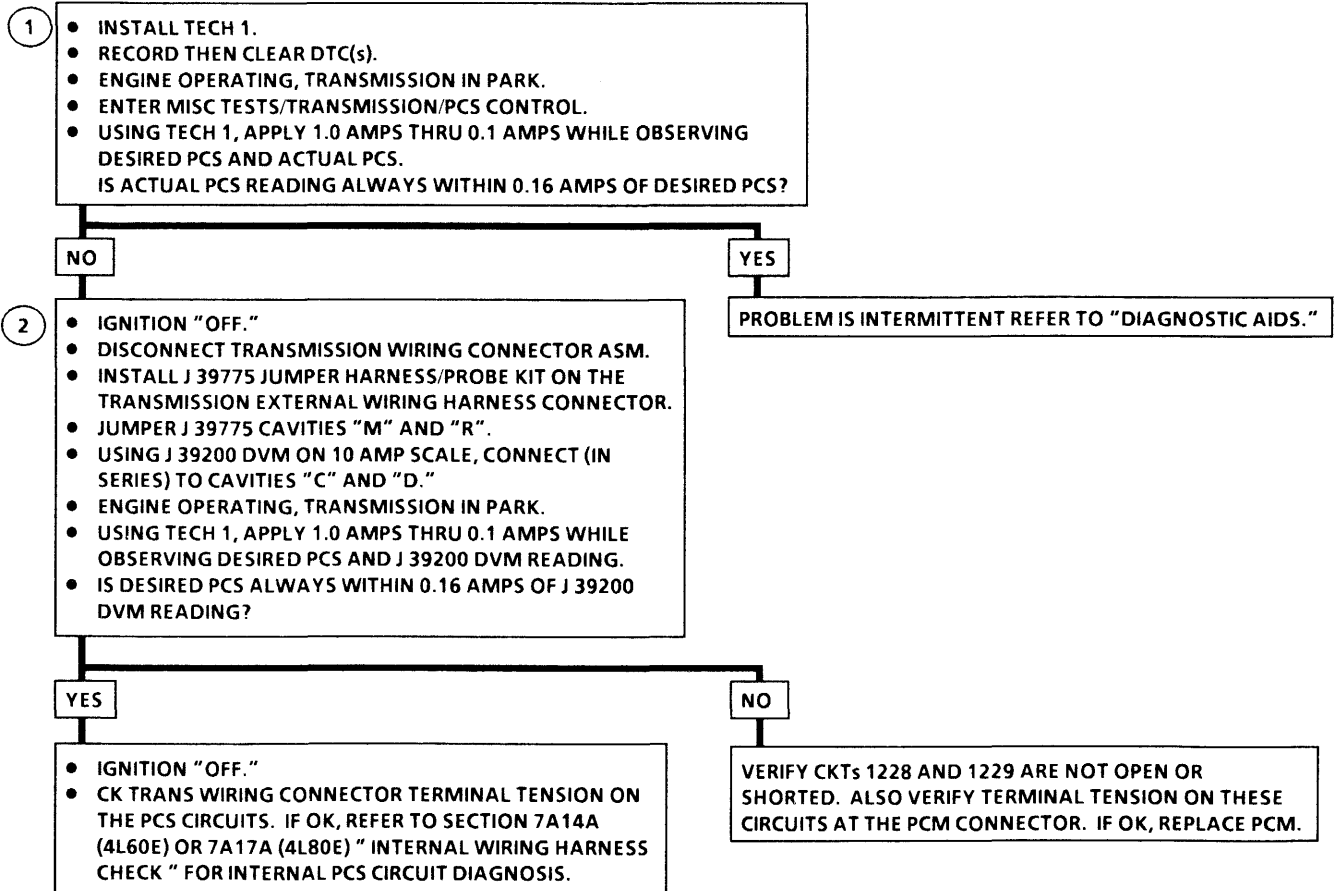
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the pressure control solenoid.
2. This test checks internal transmission harness and the pressure control solenoid for high resistance.

**Diagnostic Aids:** Check for poor connections at PCM and at transmission connector.

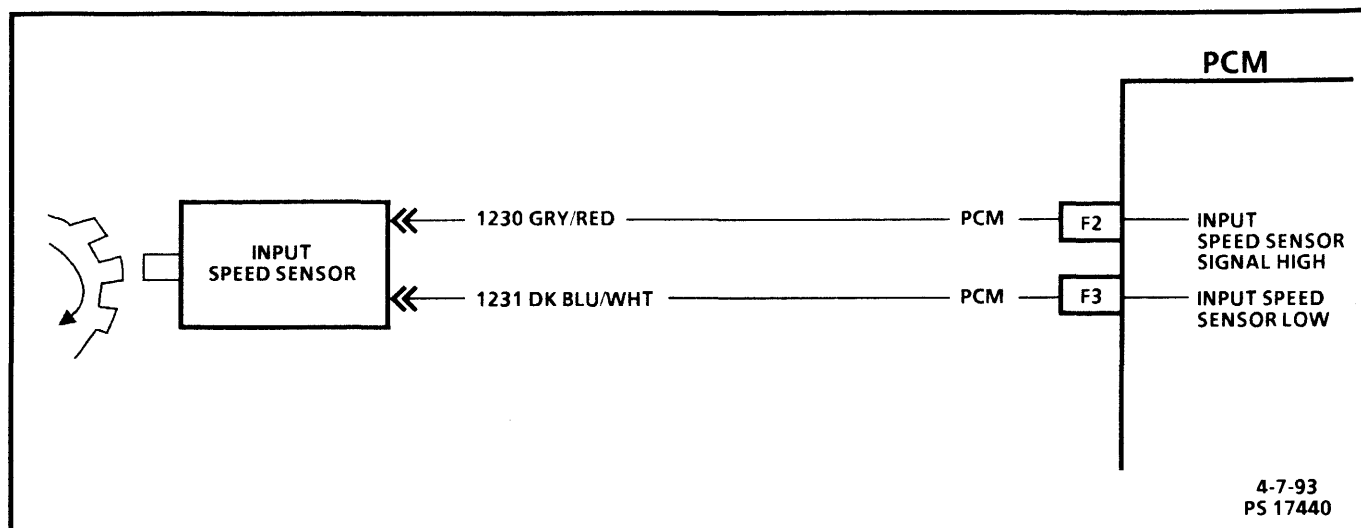
## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
PS 16751



## DTC 74

### TRANSMISSION INPUT SPEED (TIS) SENSOR CIRCUIT

#### Circuit Description:

The TIS sensor consists of a permanent magnet surrounded by a coil of wire. As the forward clutch housing rotates, an AC voltage is induced in the circuit. The signal voltage and frequency vary directly with the forward clutch rotational speed.

#### DTC 74 Will Set When:

- No DTC(s) 24, 28, or 71.
- Trans range not in park or neutral.
- Engine speed greater than 300 RPM.
- Trans output speed greater than 200 RPM.
- Trans input speed less than 50 RPM.
- All conditions met for 2 seconds.

**Action Taken (PCM will default to):** Inhibit TCC operation.

**DTC 74 Will Clear When:** The fault condition(s) no longer exist.

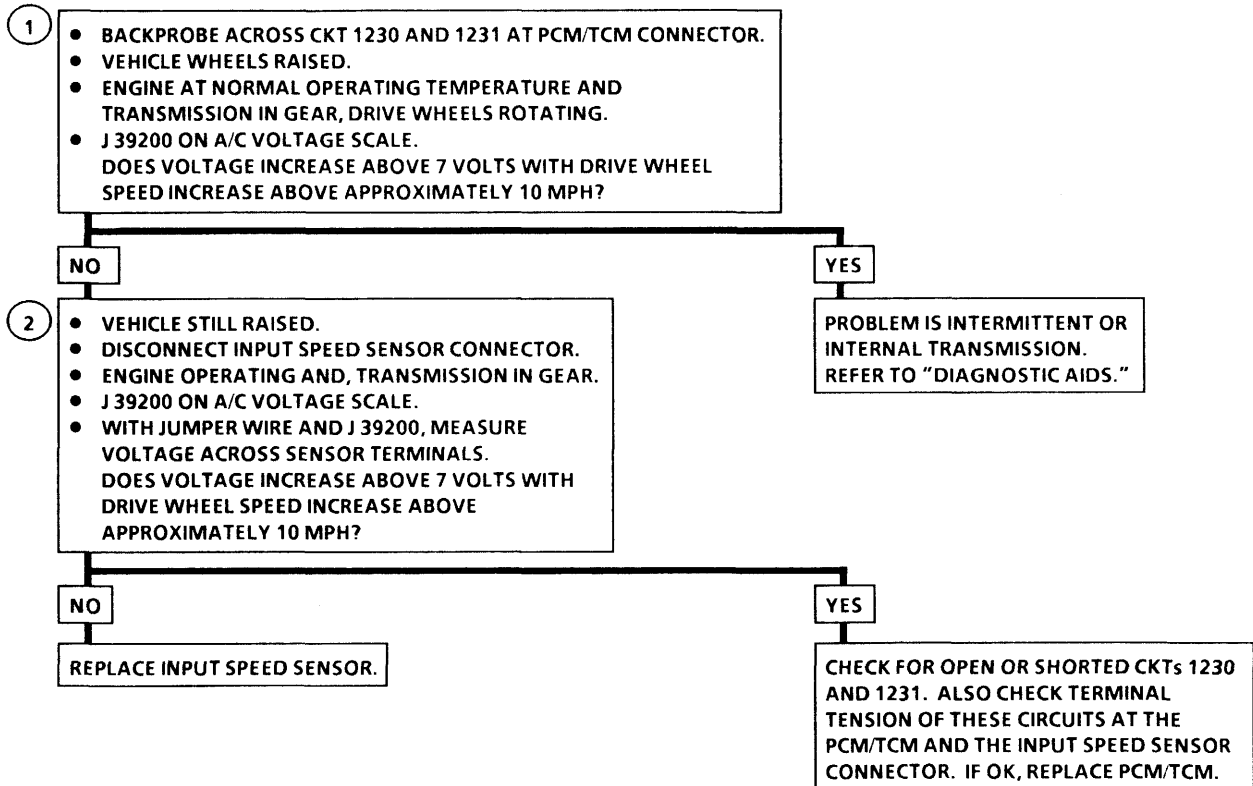
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks the entire circuit for continuity.
2. This checks the output of the input speed sensor.

**Diagnostic Aids:** Refers to PCM/TCM intermittent DTC(s) or performance.

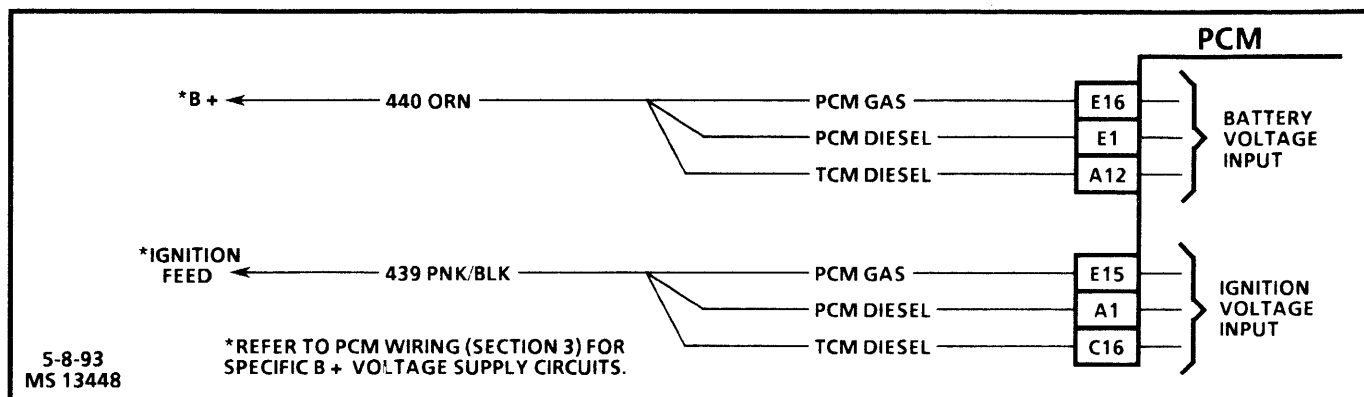
## DTC 74

### TRANSMISSION INPUT SPEED (TIS) SENSOR CIRCUIT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
MS 8857-6E



## DTC 75

### SYSTEM VOLTAGE LOW

#### Circuit Description:

Ignition voltage is supplied to the control module to indicate the ignition status of the ignition switch. Battery voltage is supplied to the control module to, in part, maintain memory of learned functions and parameters.

#### DTC 75 Will Set When:

- The ignition is "ON."
- Ignition feed voltage to the control module is less than the graduated scale of:
  - $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) = 7.3 volts.
  - $90^{\circ}\text{C}$  ( $194^{\circ}\text{F}$ ) = 10.3 volts.
  - $150^{\circ}\text{C}$  ( $304^{\circ}\text{F}$ ) = 11.7 volts.
- Engine speed greater than 1000 RPM.
- All conditions met for 4 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- 2<sup>nd</sup> gear (4L80E), 3<sup>rd</sup> gear (4L60E).
- Inhibit TCC.
- Inhibit 4<sup>th</sup> gear.

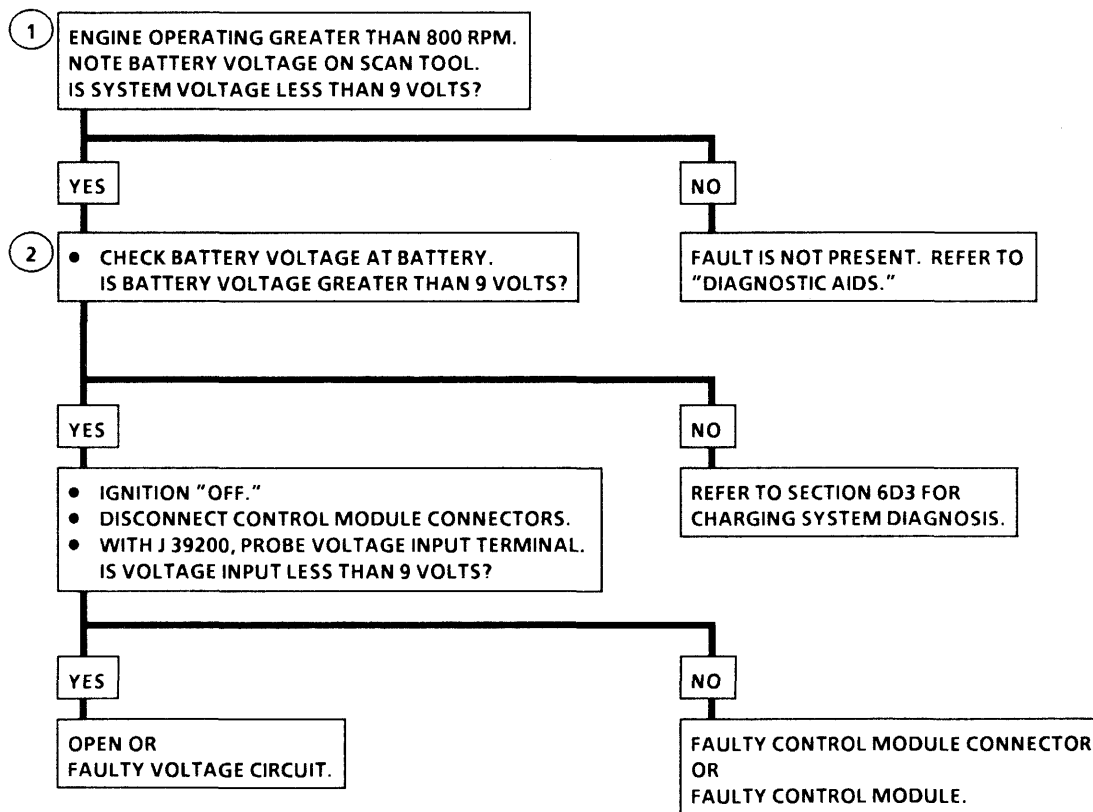
**DTC 75 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

#### Diagnostic Aids:

- Charging the battery and jump-starting an engine may set DTC 52/DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 75**  
**SYSTEM VOLTAGE LOW**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17066

## DTC 79

## TRANSMISSION FLUID OVERTEMP

### Circuit Description:

The Transmission Fluid Temperature (TFT) sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.

### DTC 79 Will Set When:

- No DTC 58.
- Trans fluid temp greater than 146°C (295°F).
- All conditions met for 30 minutes.

**DTC 79 Will Clear When:** The fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for skewed or shorted circuit.
2. This test simulates a DTC 59.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C then stabilize.

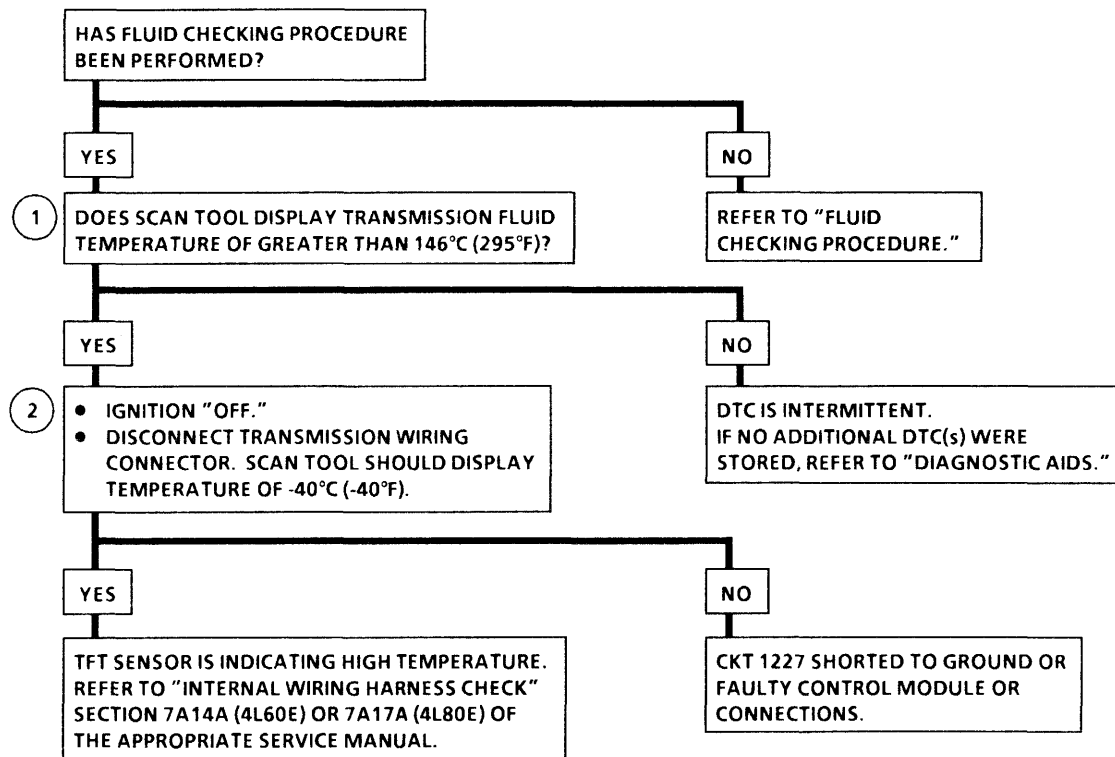
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A17A may be used to test the transmission sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" sensor could result in delayed garage shifts or TCC complaints.

Check transmission fluid. Refer to "Fluid Checking Procedure."

## DTC 79

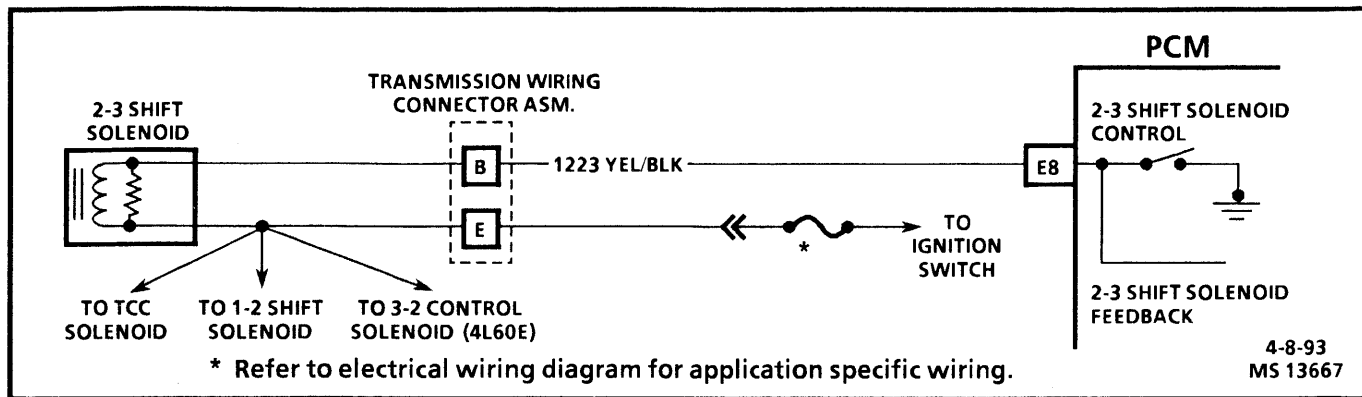
### TRANSMISSION FLUID OVERTEMP



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
PS 17931





## DTC 81

### 2-3 SHIFT SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 2-3 shift solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1223.

#### DTC 81 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high (B+).
- OR
- The PCM commands the solenoid "OFF" and voltage remains low (zero volts).
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Second or third gear only.

**DTC 81 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

If the voltage stays up for at least 2 seconds, DTC 81 will set. If the voltage drops for more than 2 seconds, DTC 81 will set.

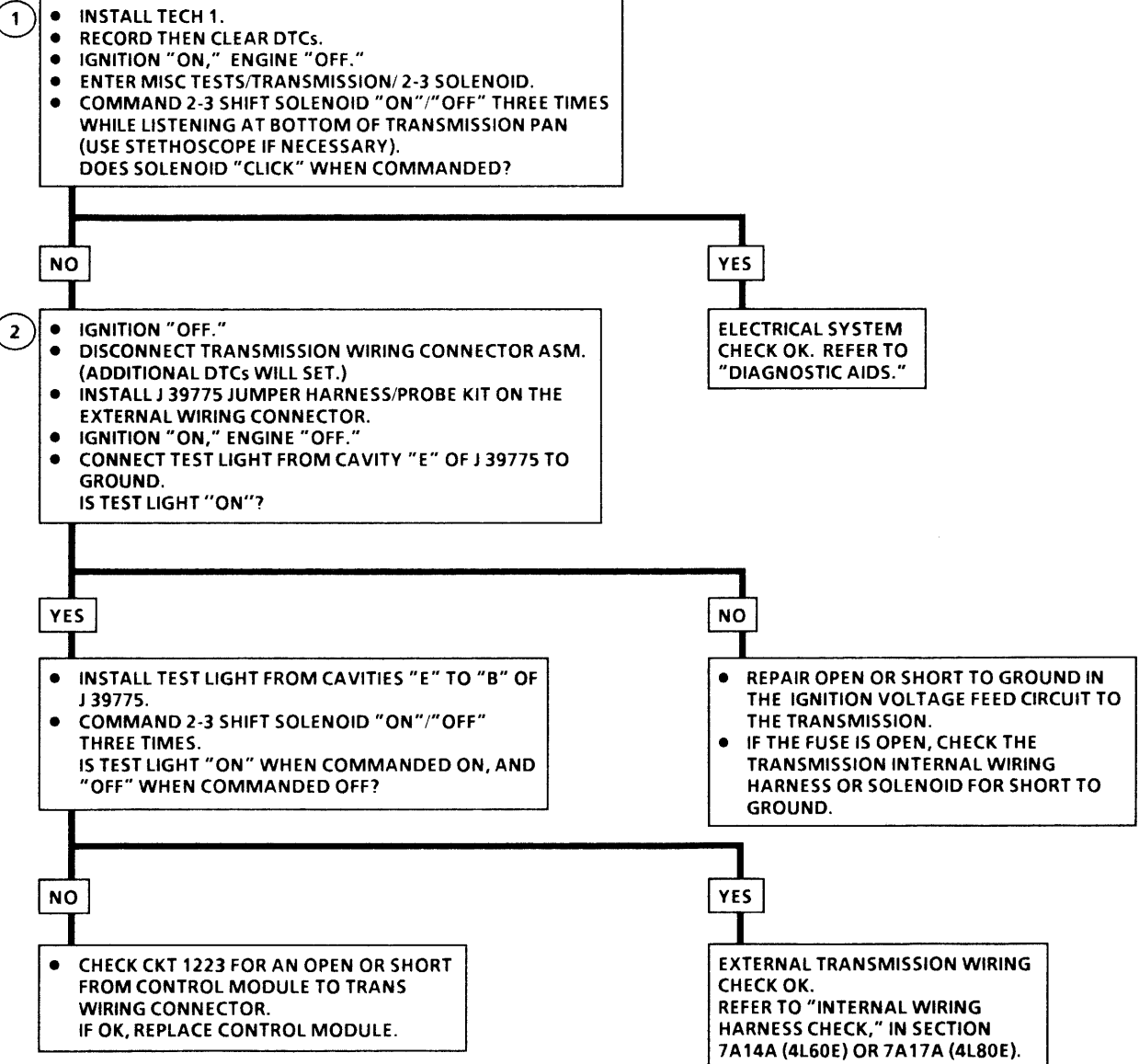
1. This test checks the function of the 2-3 shift solenoid and the internal transmission wiring.
2. This test checks for power to 2-3 shift solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections at the transmission. Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

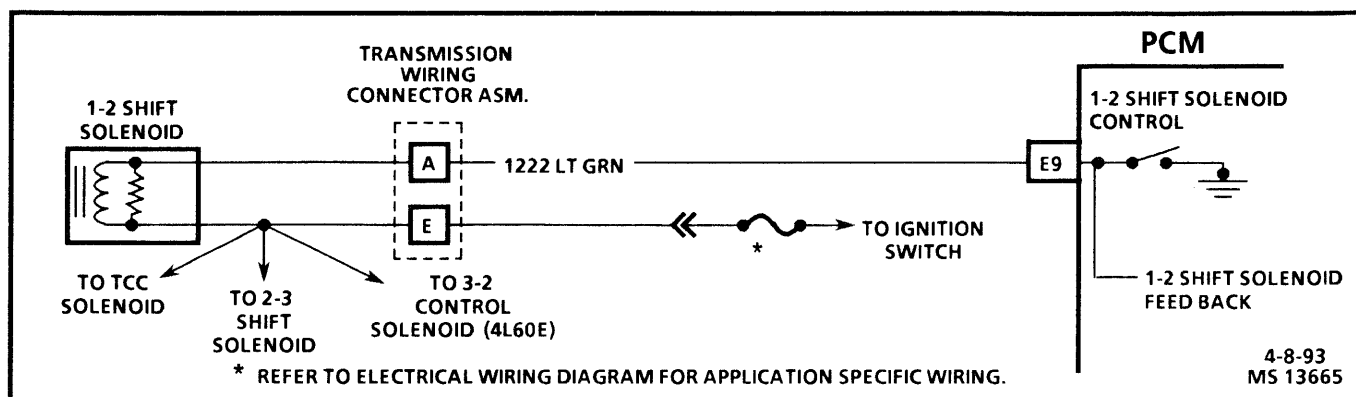
#### Valid Combination Chart

| CHART 4L80E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | OFF                |
| 2           | OFF                | OFF                |
| 3           | OFF                | ON                 |
| 4           | ON                 | ON                 |

**DTC 81****2-3 SHIFT SOLENOID CIRCUIT FAULT**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17093



## DTC 82

### 1-2 SHIFT SOLENOID FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 1-2 shift solenoid on CKT 641. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1222.

#### DTC 82 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high (B+).
- OR
- The PCM commands the solenoid "OFF" and voltage remains low (zero volts).
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- Second or third gear only
- OR
- First and fourth gears only.

**DTC 82 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the function of the 1-2 shift solenoid and the internal transmission wiring harness.
2. This test checks for power to 1-2 shift solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections for the transmission.

Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

#### Valid Combination Chart

| CHART 4L80E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | OFF                |
| 2           | OFF                | OFF                |
| 3           | OFF                | ON                 |
| 4           | ON                 | ON                 |

## DTC 82

### 1-2 SHIFT SOLENOID FAULT

①

- INSTALL TECH 1.
- RECORD THEN CLEAR DTCs.
- IGNITION "ON," ENGINE "OFF."
- ENTER MISC TESTS/TRANSMISSION/ 1-2 SOLENOID.
- COMMAND 1-2 SHIFT SOLENOID "ON"/"OFF" THREE TIMES WHILE LISTENING AT BOTTOM OF TRANSMISSION PAN (USE STETHESCOPE IF NECESSARY).
- DOES SOLENOID "CLICK" WHEN COMMANDED?

NO

YES

②

- IGNITION "OFF."
- DISCONNECT TRANSMISSION WIRING CONNECTOR ASM. (ADDITIONAL DTCs WILL SET.)
- INSTALL J 39775 JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
- IGNITION "ON," ENGINE "OFF."
- CONNECT TEST LIGHT FROM CAVITY "E" OF J 39775 TO GROUND. IS TEST LIGHT "ON"?

ELECTRICAL SYSTEM  
CHECK OK. REFER TO  
"DIAGNOSTIC AIDS."

YES

NO

- INSTALL TEST LIGHT FROM CAVITIES "E" TO "A" OF J 39775.
- COMMAND 1-2 SHIFT SOLENOID "ON"/"OFF" THREE TIMES.
- IS TEST LIGHT "ON" WHEN COMMANDED "ON," AND "OFF" WHEN COMMANDED "OFF"?

REPAIR OPEN OR SHORT TO GROUND IN THE  
IGNITION VOLTAGE FEED CIRCUIT TO THE  
TRANSMISSION. IF THE FUSE IS OPEN, CHECK  
THE TRANSMISSION INTERNAL WIRING HARNESS  
OR SOLENOID FOR SHORT TO GROUND.

NO

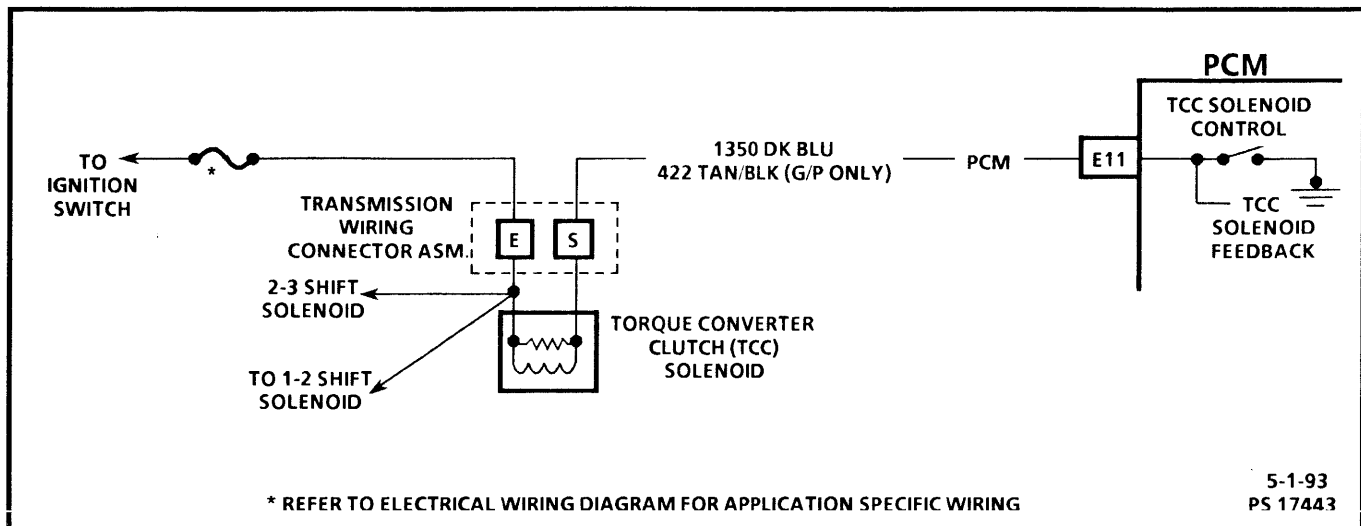
YES

- CHECK CKT 1222 FOR AN OPEN OR SHORT FROM THE TRANSMISSION EXTERNAL WIRING CONNECTOR TO THE CONTROL MODULE CONNECTOR. IF OKAY, REPLACE PCM.

EXTERNAL TRANSMISSION WIRING CHECK OKAY.  
REFER TO "INTERNAL WIRING HARNESS CHECK"  
IN SECTION 7A14A (4L60E) OR 7A17A (4L80E).

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17094



## DTC 83

### TCC PWM SOLENOID CIRCUIT FAULT

#### Circuit Description:

The control module supplies a ground through an internal Quad-Driver Module (QDM) allowing current to flow through the solenoid coil according to the duty cycle (percentage of "ON" and "OFF" time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solenoid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows 2-3 drive fluid to feed the TCC signal circuit. The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift valve. When the TCC shift valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch.

#### DTC 83 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high (B+).
- OR
- The PCM commands the solenoid "OFF" and voltage remains low (zero volts).
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- Inhibit TCC operation.
- Inhibit 4<sup>th</sup> gear operation if in hot mode.

**DTC 83 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

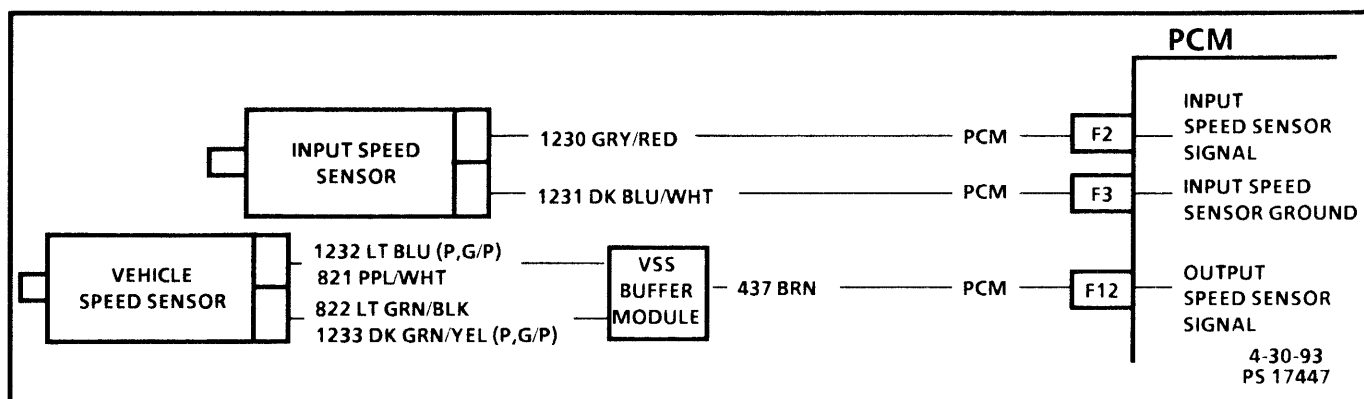
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will check if the PCM/TCM is commanding the TCC solenoid "ON."
2. This test will check for voltage to the solenoid.

**Diagnostic Aids:** Check all connections at the transmission pass-thru connector.

If they are OK, refer to "PCM/TCM Intermittent DTC(s) or Performance."





## DTC 85

### UNDEFINED RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 85 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 87.
- TP is greater than 25%.
- Not in P/N or 4<sup>th</sup> gear.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.

| COMMANDED GEAR  | IF CALCULATED RATIO IS |           |
|-----------------|------------------------|-----------|
|                 | LESS THAN              | MORE THAN |
| 1 <sup>st</sup> | 2.38                   | 2.63      |
| 2 <sup>nd</sup> | 1.43                   | 1.58      |
| 3 <sup>rd</sup> | .95                    | 1.05      |
| REV             | 1.97                   | 2.17      |

- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

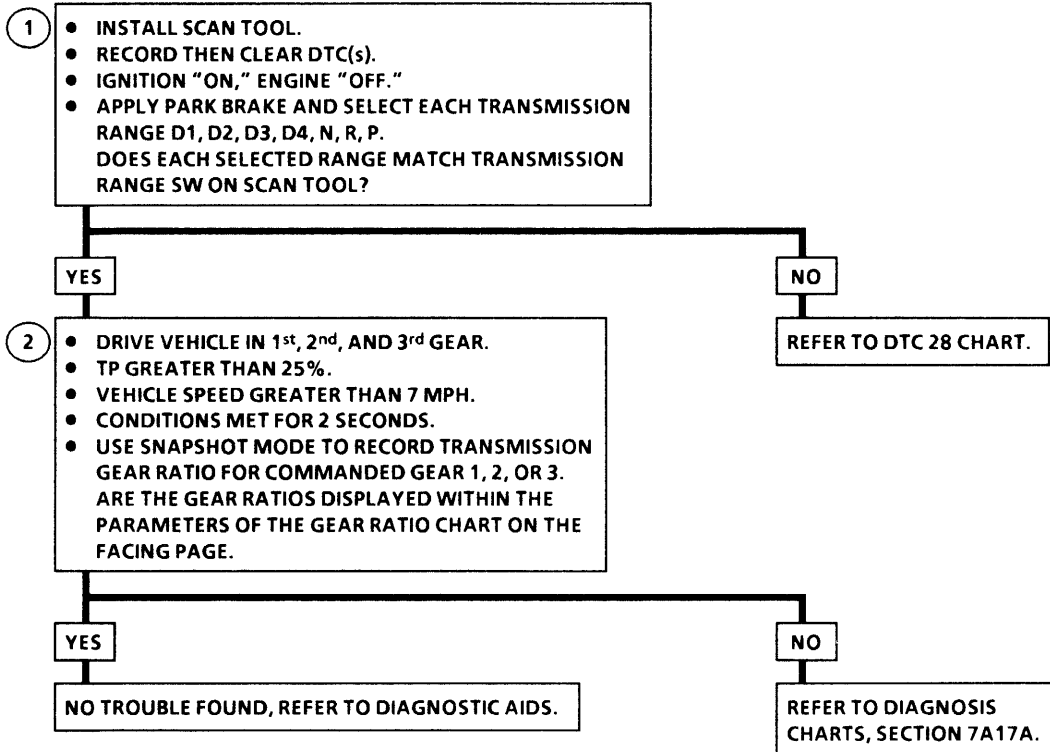
- Line pressure set to maximum
- Inhibits TCC operation.

**DTC 85 Will Clear When:** The condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test checks the calculated ratio to determine if the ratio is within the parameters.

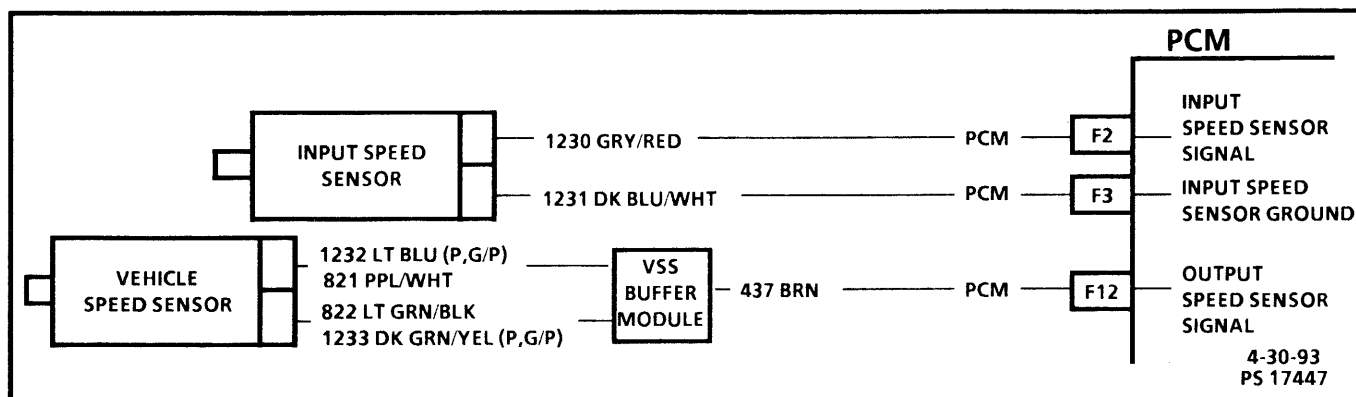
**Diagnostic Aids:** DTC 85 will set when an unknown gear ratio is detected for any gear but 4<sup>th</sup>. Note commanded gear and incorrect ratio. Refer to symptom diagnosis charts in SECTION 7A17A.

**DTC 85**  
**UNDEFINED RATIO ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17453





## DTC 86

### LOW RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 86 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- Not in P,R,N.
- Engine speed greater than 300 RPM.
- TP greater than 25%.
- Vehicle speed greater than 7 mph.
- Trans gear ratio is less than 1.06 in first or second gear.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

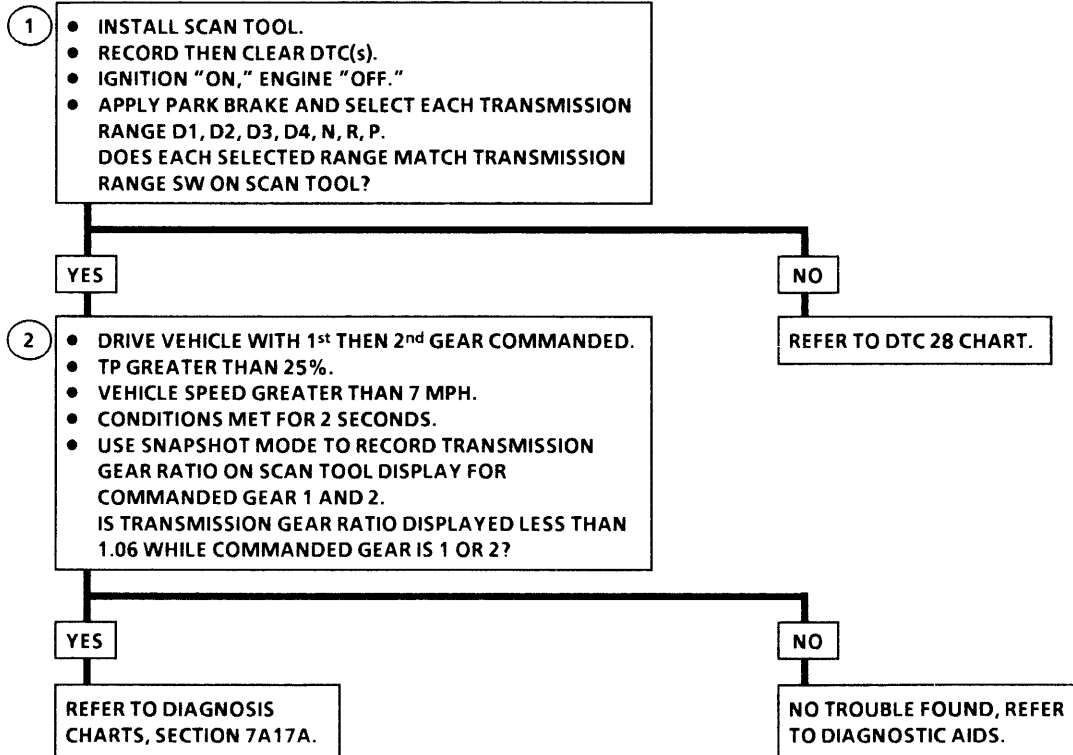
- 2<sup>nd</sup> gear.
- Line pressure set to maximum.
- Inhibit TCC operation.

**DTC 86 Will Clear When:** The fault no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

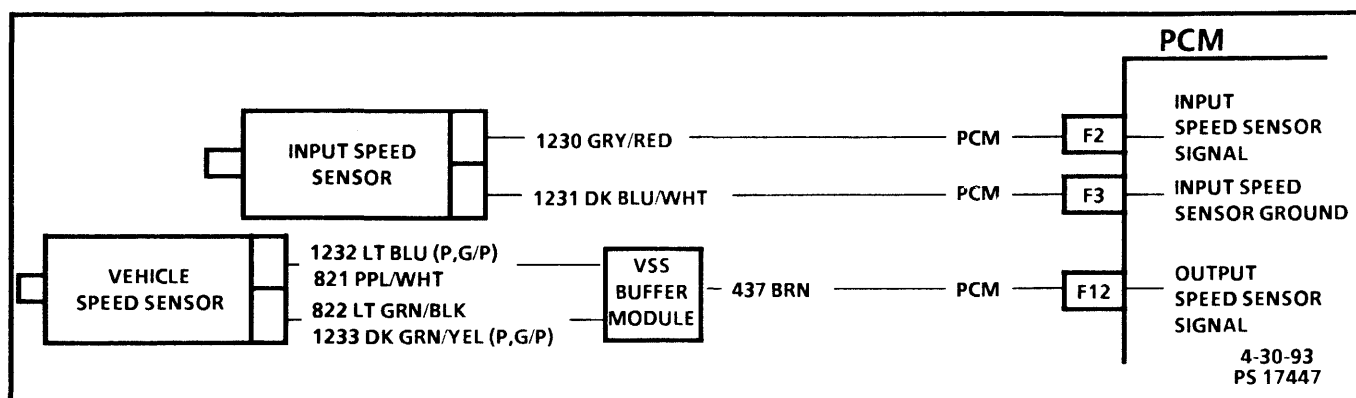
1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

**Diagnostic Aids:** This DTC will set when trans commanded gear is 1 or 2 and trans is mechanically in 3<sup>rd</sup> or 4<sup>th</sup> gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

**DTC 86**  
**LOW RATIO ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17454



## DTC 87

### HIGH RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 87 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- TP is greater than 25%.
- Not in P/R/N.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.
- Transmission temperature is greater than 20°C.
- Trans gear ratio is greater than 1.42 in 3<sup>rd</sup> or 4<sup>th</sup> gear.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

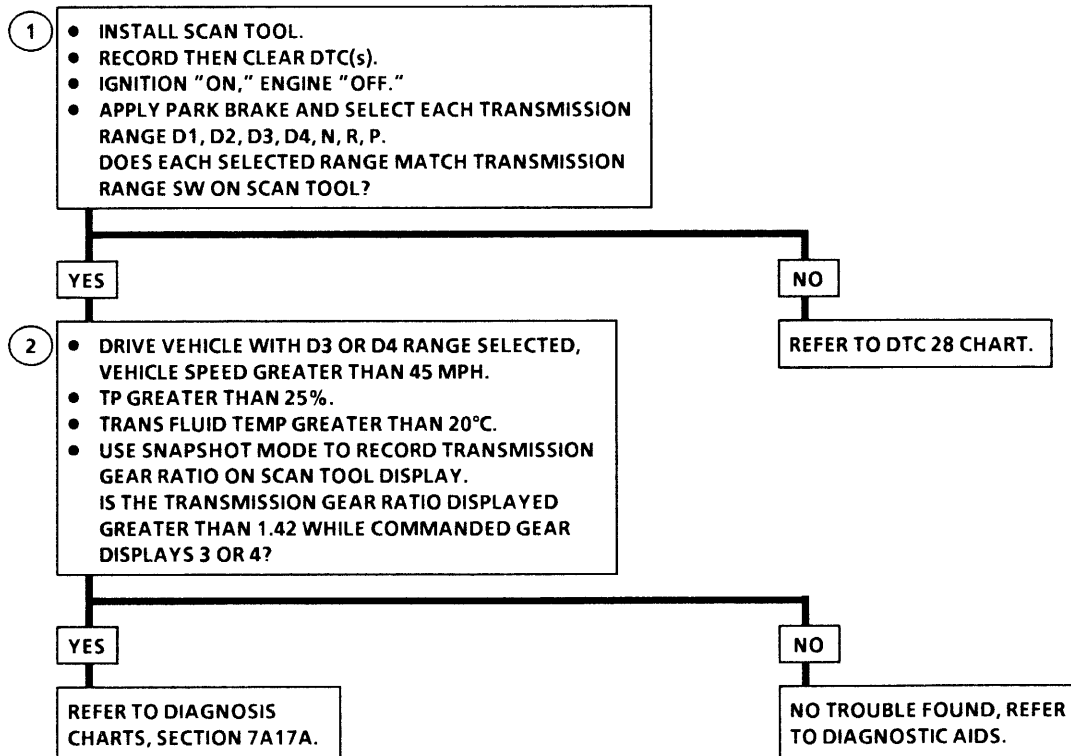
- 2<sup>nd</sup> gear.
- Line pressure set to maximum.
- Inhibit TCC operation.

**DTC 87 Will Clear When:** The fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

**Diagnostic Aids:** This DTC will set when trans commanded gear is 3 or 4 and trans is mechanically in 1<sup>st</sup> or 2<sup>nd</sup> gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

**DTC 87**  
**HIGH RATIO ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17455

## **ON-VEHICLE SERVICE**

### **INTERNAL TRANSMISSION COMPONENTS**

The following list of components will be serviced in SECTION 7A17A of the appropriate service manual.

- 1 - 2 shift solenoid.
- 2 - 3 shift solenoid.
- Pressure control solenoid.
- TCC solenoid with internal wiring harness.
- Any service that requires removal of the pan.

### **EXTERNAL TRANSMISSION COMPONENTS**

#### **Engine Coolant Temperature (ECT) Sensor**

The TCM will not use input PROM the ECT sensor. The PCM ECT sensor diagnosis and service will be in SECTION 3.

#### **Throttle Position (TP) Sensor**

#### **PCM**

All PCM TP sensor diagnosis and service will be in SECTION 3.

### **Vehicle Speed Sensor (VSS)**

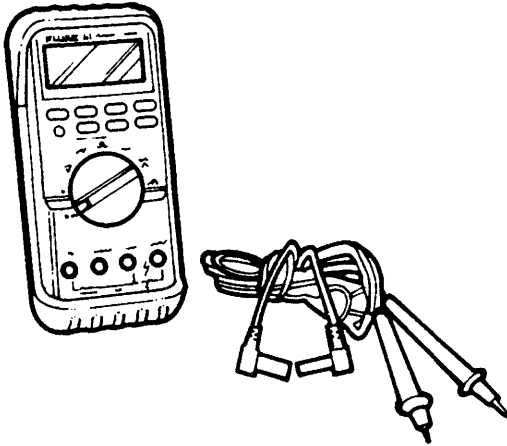
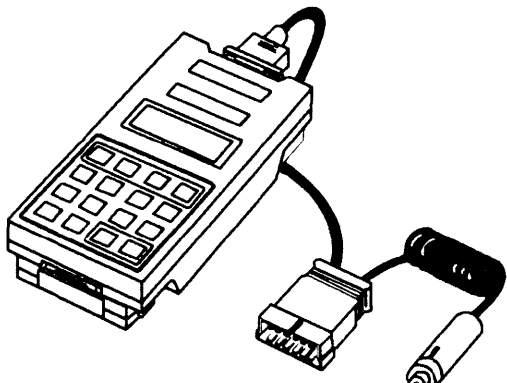
Refer to SECTION 7 of the appropriate service manual for Vehicle Speed Sensor (VSS) service, which is located on the transmission or transfer case.

### **Vehicle Speed Signal (VSS) Buffer Module**

Refer to SECTION 8C for vehicle speed signal buffer. The VSS buffer module is located in the instrument panel near the PCM/TCM.

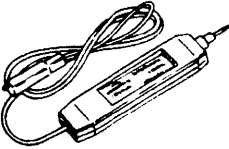
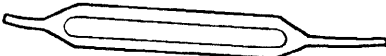
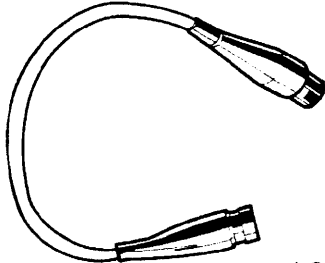
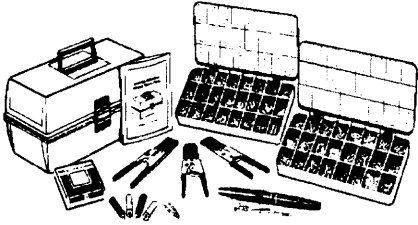
### **PCM WIRING DIAGRAMS AND CONNECTOR TERMINAL END VIEWS**

All PCM wiring diagrams and terminal identification will be in SECTION 3.

|                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>HIGH IMPEDANCE MULTIMETER<br/>(DIGITAL VOLTMETER-DVM)<br/>J 39200</p> | <p><b>VOLTMETER</b> - Voltage Position measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used when circuits require accurate low voltage readings, and some circuits in the PCM/TCM have a very high resistance.</p> <p><b>AMMETER</b> - When used as ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• Selector must be set properly for both function and range. DC is used for most automotive measurements.</li> </ul> <p><b>OHMMETER</b> - Measures resistance of circuit directly in ohms. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• OL display in all ranges indicates an open circuit.</li> <li>• Zero display in all ranges indicates a short circuit.</li> <li>• Intermittent connection in circuit may be indicated by digital reading that will not stabilize.</li> <li>• Range Switch. <ul style="list-style-type: none"> <li>200<math>\Omega</math> - Displays ohms directly.</li> <li>2K,20K,200K<math>\Omega</math> - Displays ohms in thousands.</li> <li>2M and 20M<math>\Omega</math> - Displays ohms in millions.</li> </ul> </li> </ul> |
|  <p>TECH 1/TECH 1A<br/>3000003 MASS STORAGE CARTRIDGE</p>               | <p><b>TECH 1 DIAGNOSTIC SCAN TOOL</b><br/>A hand-held SCAN tool used to analyze and diagnose the PCM/TCM control system.</p> <p>(With GM 81-93 Powertrain Software)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                         | <p><b>TACHOMETER</b><br/>Inductive trigger signal pickup type to check RPM.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  <p>J 35616</p>                                                         | <p><b>CONNECTOR TEST ADAPTER KIT</b><br/>Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

5-18-92  
MS 13416

Figure 10B-17 - Special Tools (1 of 2)

|                                                                                                              |                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 34636/BT-8405</p>     | <p><b>CIRCUIT TESTER</b><br/>Used to check all relays and solenoids before connecting them to a new PCM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.</p> |
|  <p>J 35689-A</p>           | <p><b>METRI-PACK TERMINAL REMOVER</b><br/>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors.</p>                                                                                                                                                              |
|  <p>J 28742-A/BT-8234-A</p> | <p><b>WEATHER PACK TERMINAL REMOVER</b><br/>Used to remove terminals from Weather Pack connectors.</p>                                                                                                                                                                                    |
|  <p>J 33095/BT-8234-A</p> | <p><b>PCM CONNECTOR TERMINAL REMOVER</b><br/>Used to remove terminal from Micro-Pack connectors.</p>                                                                                                                                                                                      |
|  <p>J 39775</p>           | <p><b>JUMPER HARNESS</b><br/>Used with J 39200 to measure circuit voltage, amperage, or resistance in the transmission through the transmission connector.</p>                                                                                                                            |
|  <p>J 38125-4</p>         | <p><b>TERMINAL REPAIR KIT</b><br/>Used to replace damaged terminal ends on wiring harnesses.</p>                                                                                                                                                                                          |

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NS 15318

Figure 10B-18 - Special Tools (2 of 2)

## SECTION 10C

# MANUAL TRANSMISSION CONTROLS

### CONTENTS

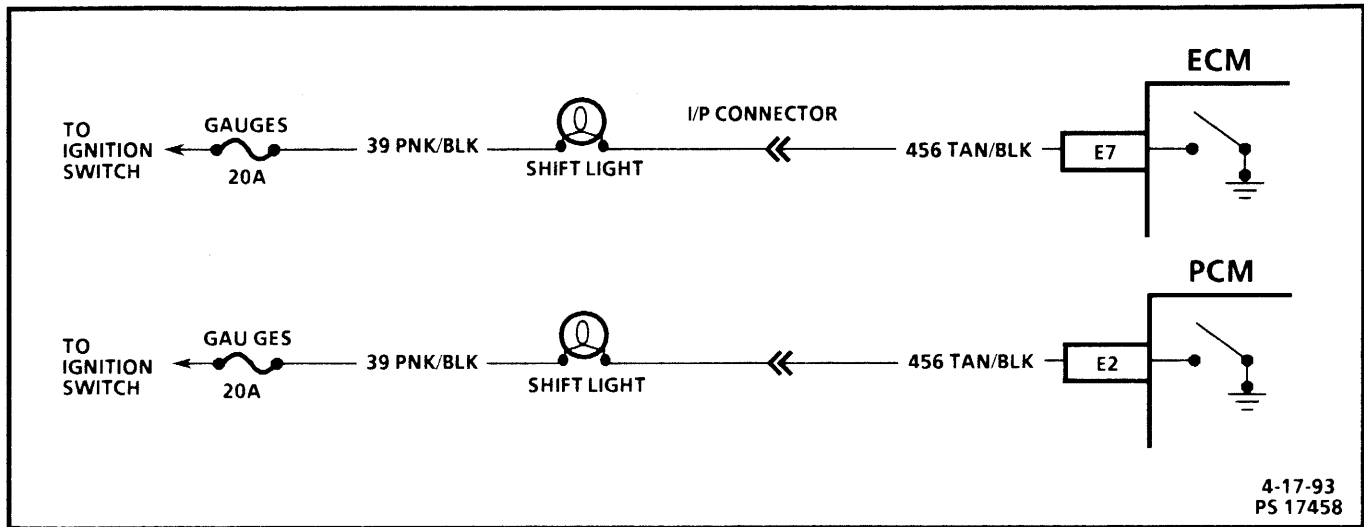
|                           |       |                          |       |
|---------------------------|-------|--------------------------|-------|
| General Description ..... | 10C-1 | Shift Light System ..... | 10C-4 |
| Shift Light System .....  | 10C-1 | On-Vehicle Service ..... | 10C-4 |
| Manual Transmission Shift |       | Shift Light System ..... | 10C-4 |
| Light Check .....         | 10C-2 | Parts Information .....  | 10C-4 |
| Diagnosis .....           | 10C-4 |                          |       |

### GENERAL DESCRIPTION

#### SHIFT LIGHT SYSTEM

All manual transmission vehicles under 8500 GVW have a shift light on the instrument panel. This light indicates the best shift point for maximum fuel economy. The light is controlled by the control module and is turned "ON" by grounding CKT 456.





## MANUAL TRANSMISSION SHIFT LIGHT CHECK

### Circuit Description:

The control module uses information from the following inputs to control the shift light:

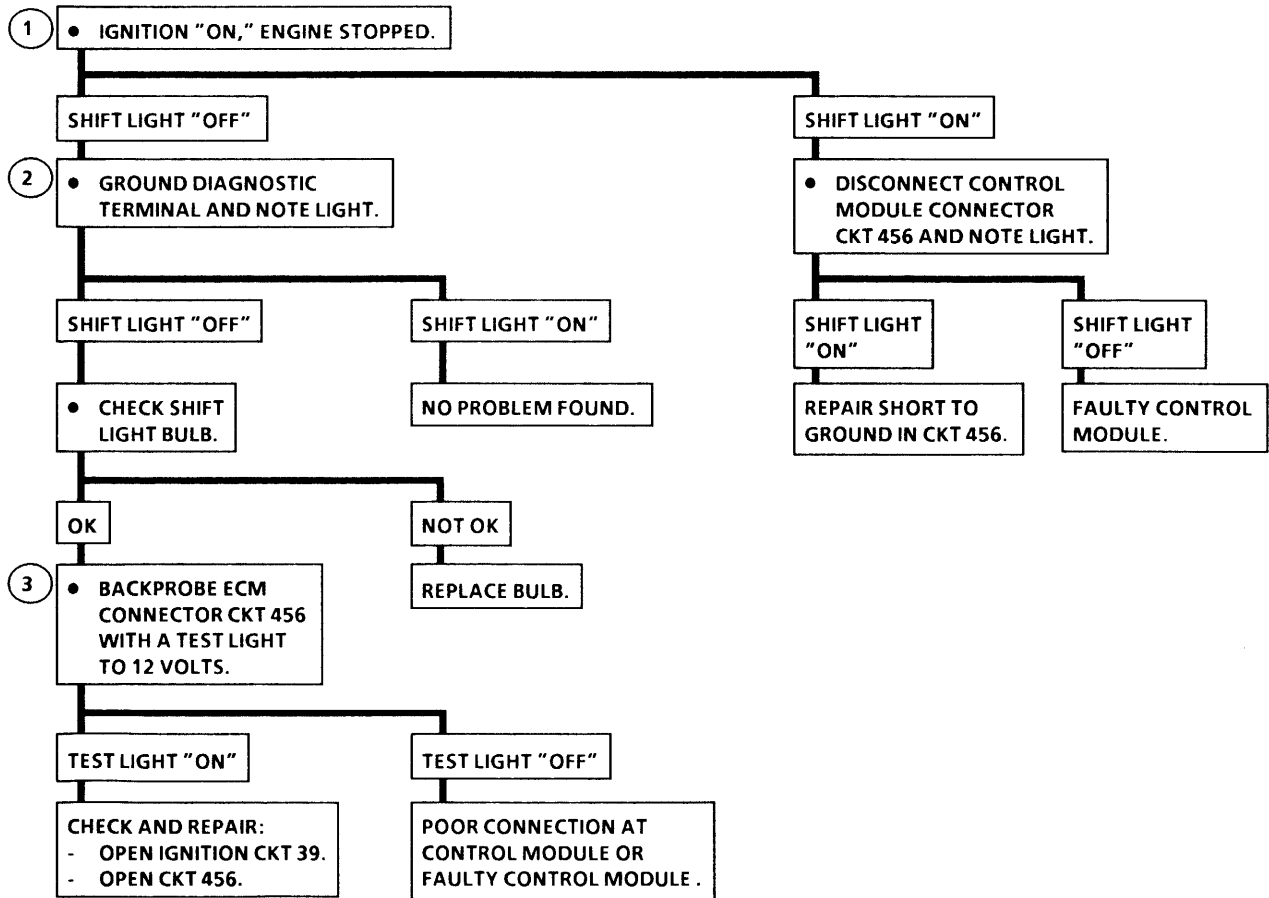
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Vehicle Speed Sensor (VSS).
- RPM.

The control module uses the measured RPM and the vehicle speed to calculate what gear the vehicle is in. It's this calculation that determines when the shift light should be turned "ON"

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This should not turn "ON" the shift light. If the light is "ON," there is a short to ground in CKT 456 wiring, or a fault in the control module.
2. This should turn "ON" the shift light.
3. This checks for an open in the shift light circuit, or a faulty control module.

# MANUAL TRANSMISSION SHIFT LIGHT CHECK



DIAGNOSIS

SHIFT LIGHT SYSTEM

If the manual transmission shift light does not illuminate, or is "ON" all the time, while driving the vehicle, refer to "Manual Transmission Shift Light Check" chart.

ON-VEHICLE SERVICE

SHIFT LIGHT SYSTEM

- Refer to SECTION 3A or 3B, for wiring repair or for replacement of the control module.

PARTS INFORMATION

| PART NAME             | GROUP |
|-----------------------|-------|
| Sensor, VSS (1) ..... | 4.337 |

## SECTION 11

# CRANKCASE VENTILATION SYSTEM

### CONTENTS

|                                      |      |                          |      |
|--------------------------------------|------|--------------------------|------|
| General Description .....            | 11-1 | Functional Check .....   | 11-2 |
| Diagnosis .....                      | 11-2 | On-Vehicle Service ..... | 11-3 |
| Results of Incorrect Operation ..... | 11-2 | Parts Information .....  | 11-3 |

### GENERAL DESCRIPTION

A crankcase ventilation system is used to provide more complete scavenging of crankcase vapors. Fresh air from the air cleaner through a filter is supplied to the crankcase, mixed with blow-by gases and then passed through a crankcase ventilation valve into the intake manifold (Figure 11-1).

The primary control is through the crankcase ventilation valve (Figure 11-2), which meters the flow at a rate depending on manifold vacuum.

To maintain idle quality, the crankcase ventilation valve restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase vent tube into the air cleaner to be consumed by normal combustion.

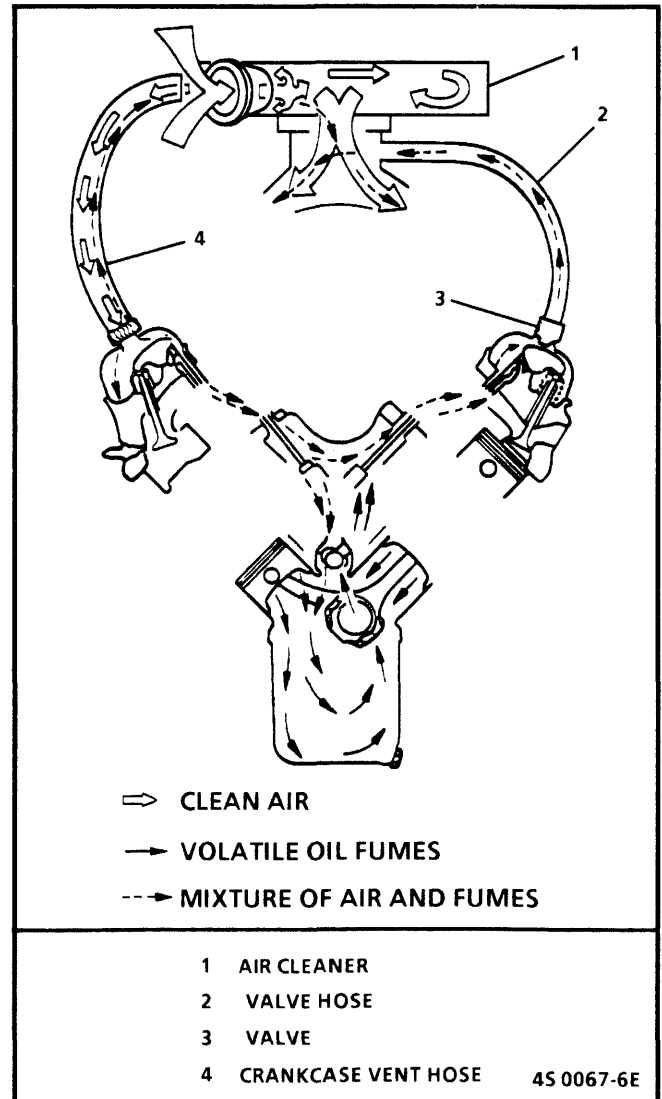


Figure 11-1 - Crankcase Ventilation Flow

## DIAGNOSIS

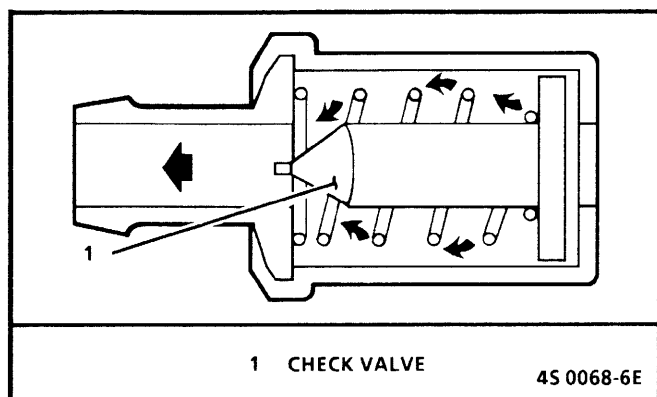


Figure 11-2 - Crankcase Ventilation Valve Cross Section

## RESULTS OF INCORRECT OPERATION

- A plugged valve or hose may cause:
  - Rough idle.
  - Stalling or slow idle speed.
  - Oil leaks.
  - Oil in air cleaner.
  - Sludge in engine.
- A leaking crankcase ventilation valve or hose would cause:
  - Rough idle.
  - Stalling.
  - High idle speed.

## FUNCTIONAL CHECK

With these systems, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner and is drawn into the engine.

Proper operation of the crankcase ventilation system is dependent upon a sealed engine. If oil sludging or dilution is noted and the crankcase ventilation system is functioning properly, check engine for possible cause and correct to ensure that system will function as intended.

If an engine is idling rough, check for a clogged crankcase ventilation valve, dirty vent filter, air cleaner element, or plugged hose. Replace as required. Use the following procedure:

1. Remove crankcase ventilation valve from rocker arm cover.
2. Operate engine at idle.
3. Place your thumb over end of valve to check for vacuum. If there is no vacuum at valve, check:
  - For plugged hoses.
  - Manifold port.
  - Crankcase ventilation valve.
4. Turn "OFF" the engine and remove crankcase ventilation valve. Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.

## ON-VEHICLE SERVICE

An engine can be damaged if it is operated without crankcase ventilation filter. Therefore, it is important to perform the "Functional Check" at intervals shown in SECTION 0B of the appropriate service manual or the vehicle's maintenance schedule.

Replace crankcase ventilation components as diagnosis requires. The recommended replacement parts are listed in the "Specifications" section of the vehicle's owners manual.

Periodically, inspect the hoses and clamps and replace any showing signs of deterioration.

## PARTS INFORMATION

| PART NAME                   | GROUP |
|-----------------------------|-------|
| Tube, C/Case Vent .....     | 1.762 |
| Hose, C/Case Vent Vlv ..... | 1.762 |

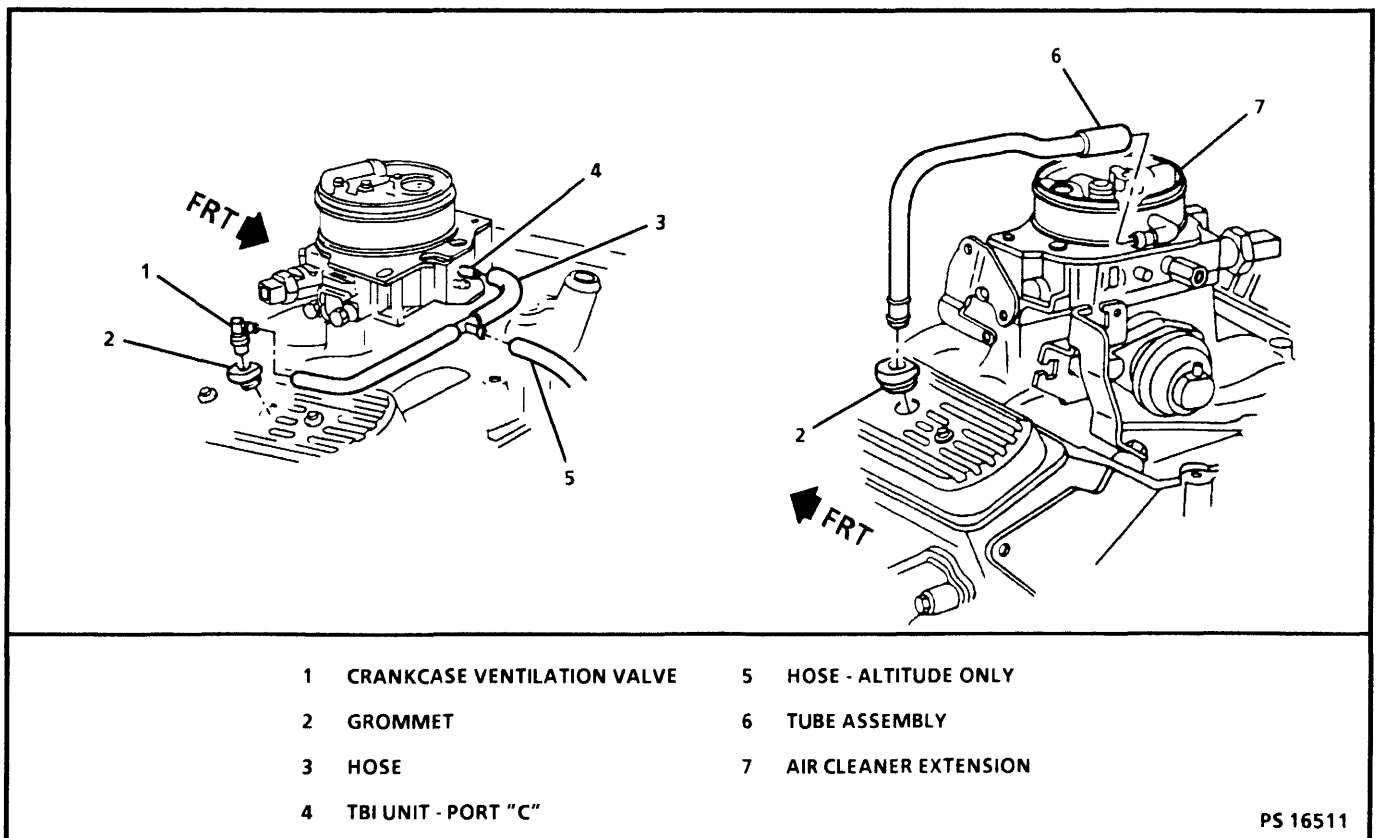


Figure 11-3 - Crankcase Ventilation System Components - 4.3L, 5.0L, 5.7L

## 11-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

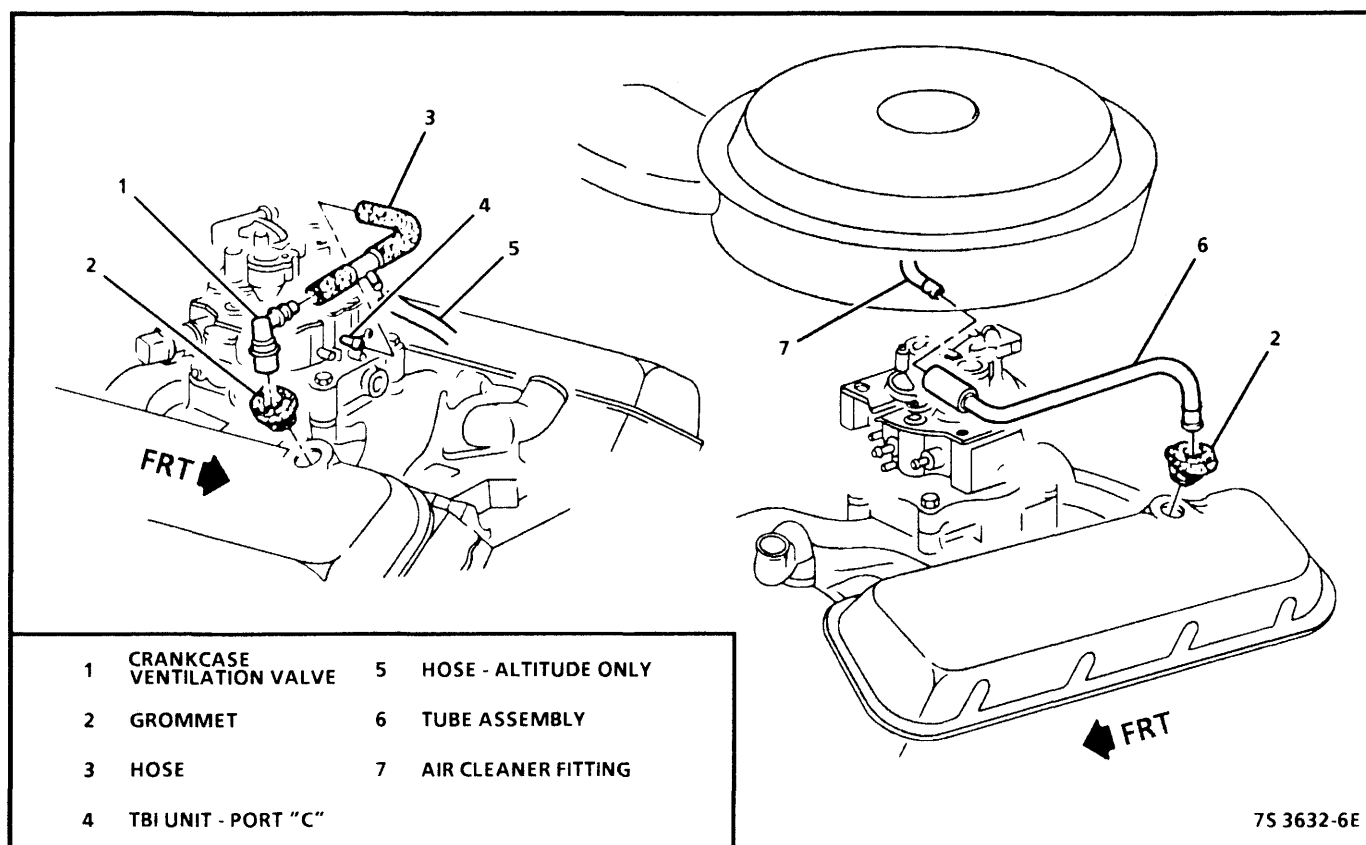


Figure 11-4 - Crankcase Ventilation System Components - 7.4L

## SECTION 12

# AIR INTAKE SYSTEM

### CONTENTS

|                                      |      |                           |      |
|--------------------------------------|------|---------------------------|------|
| General Description .....            | 12-1 | On-Vehicle Service .....  | 12-3 |
| Operation .....                      | 12-1 | Air Cleaner Element ..... | 12-3 |
| Diagnosis .....                      | 12-2 | Air Cleaner .....         | 12-3 |
| Results of Incorrect Operation ..... | 12-2 | Wax Pellet .....          | 12-3 |
| Air Cleaner Functional Check .....   | 12-2 | Parts Information .....   | 12-4 |

### GENERAL DESCRIPTION

To route cool air from the exterior of the engine compartment to the intake manifold, an air intake system is used. A filter is incorporated into the system to keep dirt from entering the engine. Some applications also have a heated air intake system for better driveability while the vehicle is warming up. Below is a description of that system operation.

#### OPERATION

The heated air intake system (Figure 12-1) regulates incoming air temperature without the use of vacuum. The air regulating damper is controlled by a self-contained, wax-pellet actuated assembly mounted in the air cleaner (Figure 12-2). When the incoming air is cold, the wax material sealed in the actuator is in a solid (contracted) phase and the damper closes off the cold air inlet. This causes all incoming air to become heated by the exhaust manifold. As the incoming air warms, the wax material expands by changing to liquid phase and forces out a piston to reposition the damper. This allows for a cold/hot air mix, or for cold air only to enter the engine.

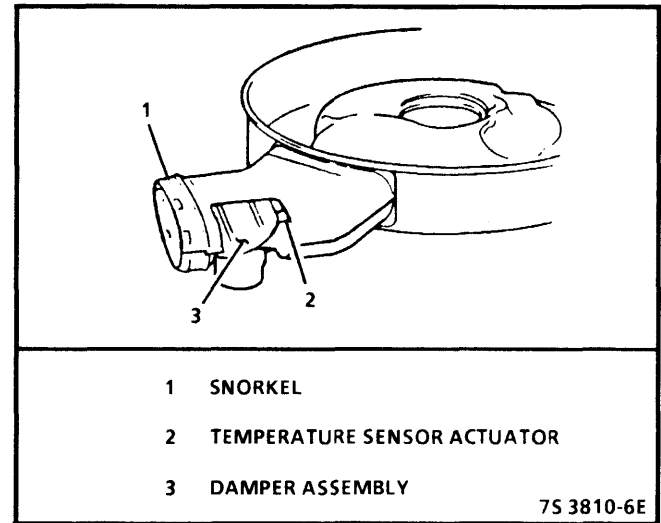


Figure 12-1 - Air Cleaner with Heated Air Intake System



### DIAGNOSIS

#### RESULTS OF INCORRECT OPERATION

- Hesitation during warm-up can be caused by:
  - Heat stove tube disconnected.
  - Missing or damaged air cleaner-to-TBI gasket.
  - Loose air cleaner cover and air cleaner.
  - Missing air cleaner cover seal.
  - Stuck open damper door.
- Lack of power, sluggish, or spongy (on a hot engine) can be caused by:
  - Stuck closed damper door.

#### AIR CLEANER FUNCTIONAL CHECK

1. Remove air cleaner assembly and cool to below 4°C (40°F). The damper door should close to outside air (cold air).
2. Check the condition of air cleaner to throttle body gasket.
3. Reinstall air cleaner assembly and connect the heat stove tube at air cleaner snorkel and exhaust manifold.
4. Start the engine. As the air cleaner warms, the damper door should open slowly to outside air (cold air).
5. If the air cleaner fails to operate as described, check that the calibrated spring is properly installed and damper door is not binding.
6. If still inoperative after Step 5, replace wax pellet assembly and re-check.

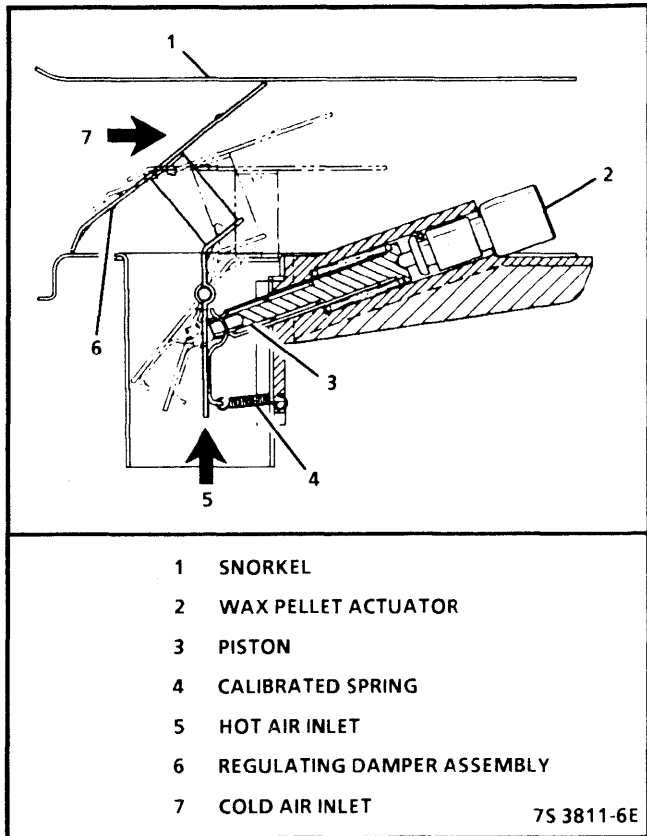


Figure 12-2 - Operation - Heated Air Intake

## ON-VEHICLE SERVICE

### AIR CLEANER ELEMENT

#### ↔ Remove or Disconnect

1. Nut(s).
2. Air cleaner cover.
3. Element.
4. Clean housing.

#### →↔ Install or Connect

1. Element.
2. Air cleaner cover.
3. Nut(s).

#### ⌚ Tighten

- Nut(s) securely to 2 N·m (15 lb. in.).

### AIR CLEANER

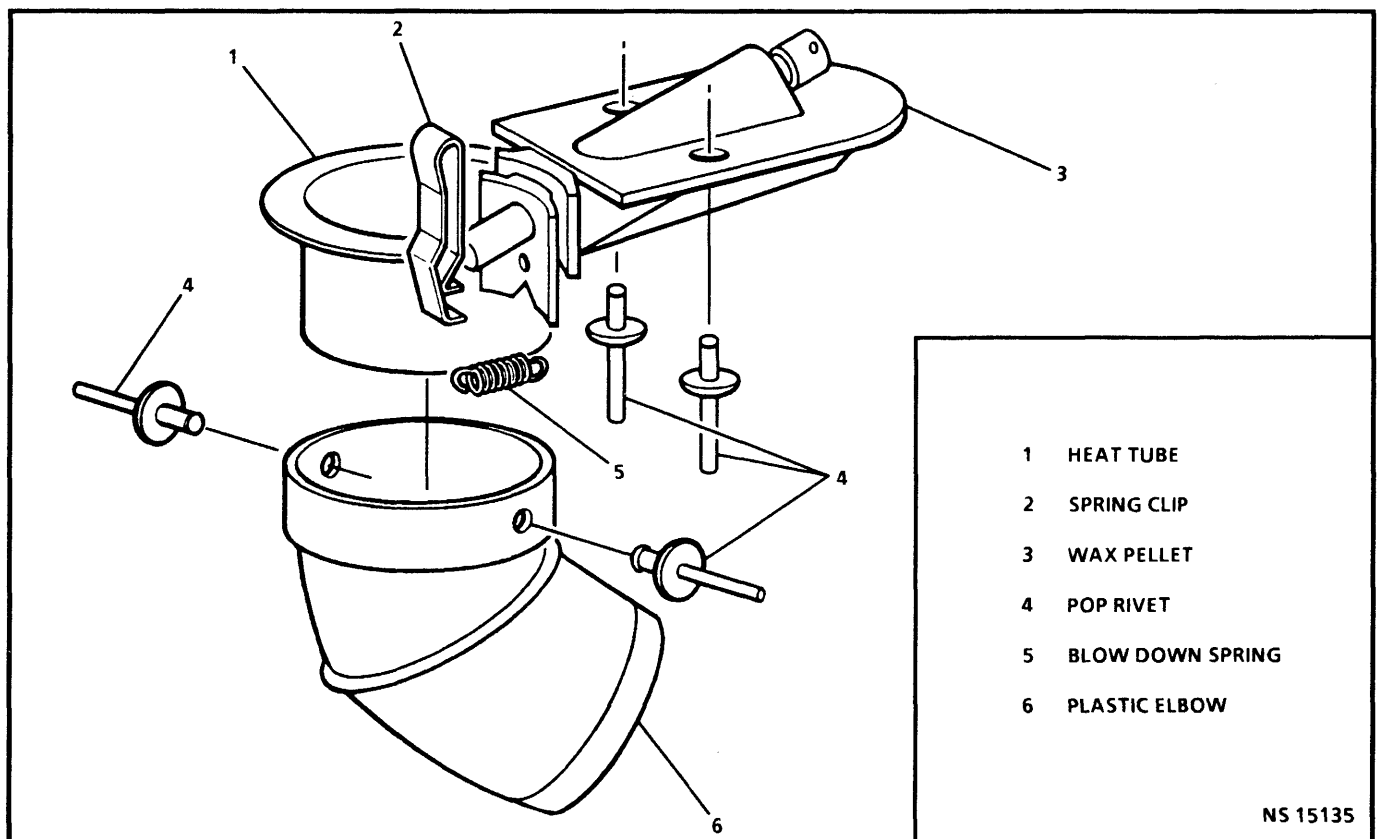
Refer to Figures 12-4 and 12-5 for repair or replacement of air cleaner.

### WAX PELLET

Figure 12-3

#### ↔ Remove or Disconnect

1. Vehicle air cleaner assembly.
2. If application has a plastic heat tube elbow, use a 1/8" bit to drill out the two rivets that secure it to the heat tube and remove elbow. If application does not have an elbow, skip this step.
3. Use a 1/8" bit to drill out the two rivets that secure the wax pellet carrier assembly.
4. The blow down spring.
5. The wax pellet carrier assembly.
6. Examine spring clip on the hot air damper. Replace if necessary.
7. Install new blow down spring.
8. Reinstall plastic heat tube elbow in the correct orientation, using two pop rivets.
9. Reinstall air cleaner assembly on vehicle.



NS 15135

Figure 12-3 - Wax Pellet Installation

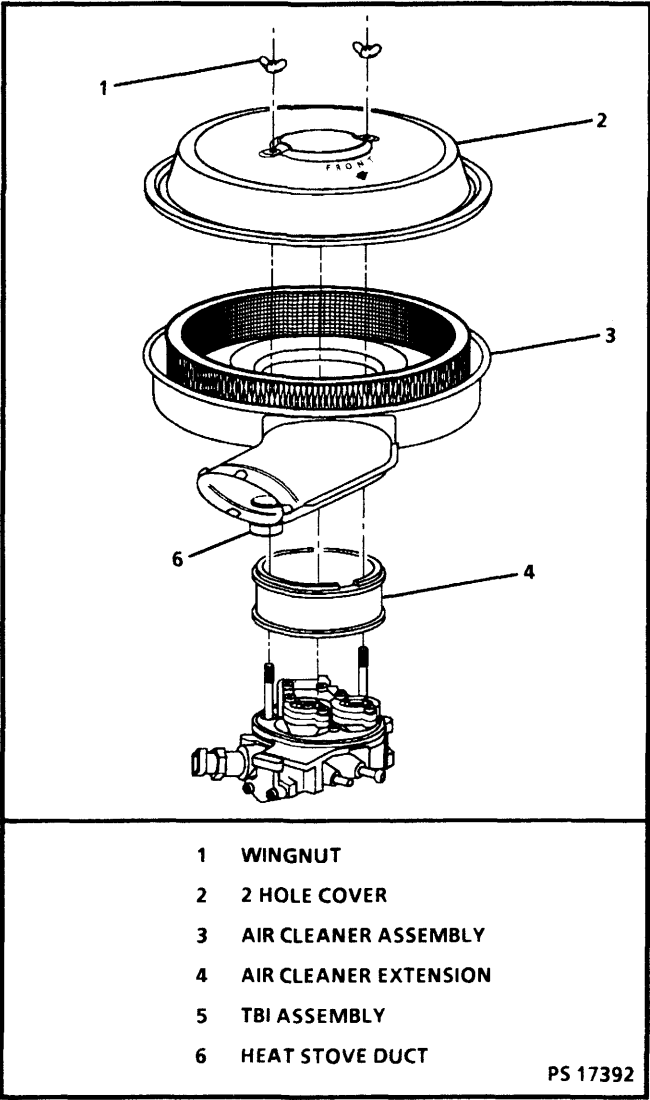


Figure 12-4 - Air Cleaner - 4.3L, 5.0L, 5.7L

**Install or Connect**

1. New wax pellet carrier assembly, using two pop rivets.
2. New blow down spring.
3. Plastic heat tube elbow in the correct orientation, using two pop rivets. If application does not have an elbow, skip this step.
4. Air cleaner assembly on vehicle.

**PARTS INFORMATION**

| PART NAME       | GROUP |
|-----------------|-------|
| Air Cleaner     | 3.402 |
| Element (Paper) | 3.410 |
| Nut, A/Ci       | 3.403 |

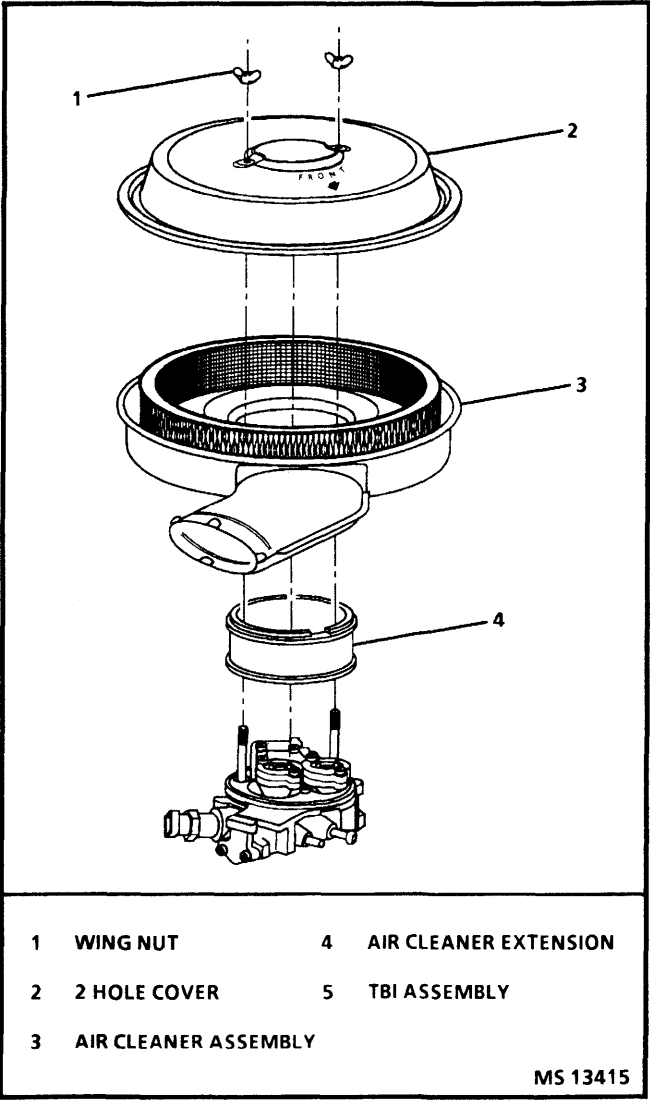


Figure 12-5 - Air Cleaner - 7.4L

|                          |       |
|--------------------------|-------|
| Seal, Air Cleaner        | 3.403 |
| Sensor, A/Ci             | 3.415 |
| Tube, Eng Air Heat Stove | 3.417 |
| Stove, Eng Air Heat      | 3.417 |
| Separator, Prelim Air    | 3.415 |
| Nut, Wing                | 8.920 |
| Stud, A/Ci               | 3.403 |
| Resonator, A/Ci          | 3.417 |
| Extension, A/Ci          | 3.405 |

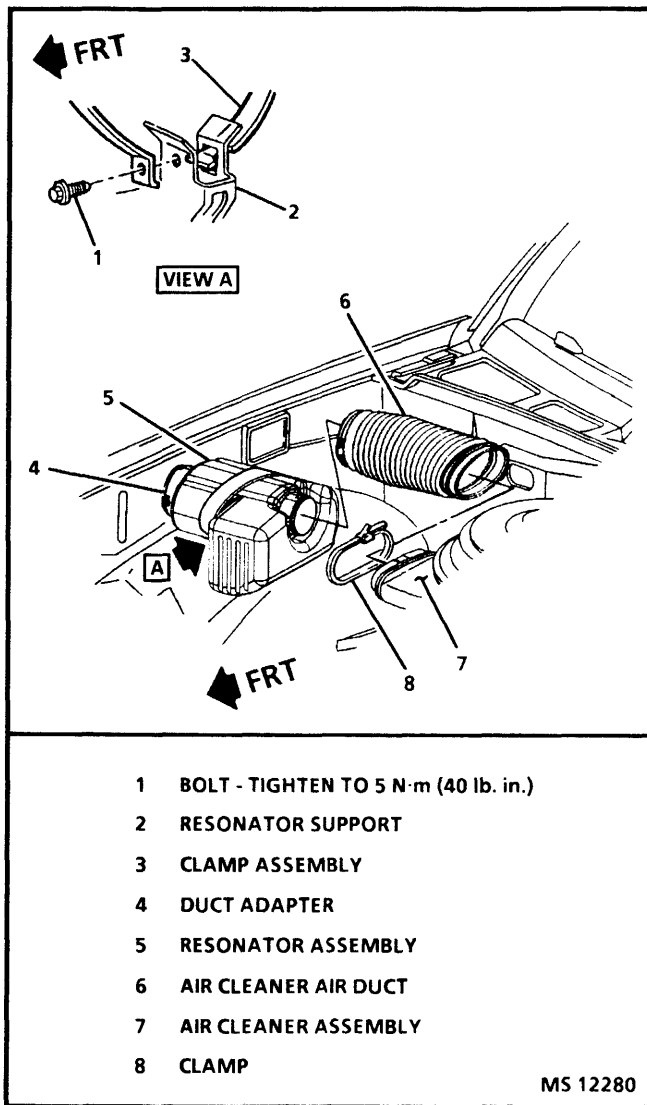


Figure 12-6 - Air Intake Ducts

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## SECTION 13

# SPECIAL TOOLS

## CONTENTS

|                           |      |                              |      |
|---------------------------|------|------------------------------|------|
| General Description ..... | 13-1 | Special Tools (1 of 5) ..... | 13-2 |
| Scan Tool .....           | 13-1 |                              |      |

## GENERAL DESCRIPTION

The special tools required for service of the fuel and emission systems are illustrated in Figures 13-1 through 13-5. These tools will be needed in specialized procedures listed in other sections. The knowledge of the tool's abilities and limitations must be known before they are used. This knowledge should include, scan tool operation, proper use of test lights, use of jumper wires to bypass components for circuit tests and proper usage of a Digital Volt Ohmmeter (DVOM).

### SCAN TOOL

The control module system's Data Link Connector (DLC) under the dash near the steering column allows an easy link for connecting scan tools to the system. There are several scan tools available for reading this information.

Scan tools do not replace the use of diagnostic charts or even locate exactly where a problem is in a given circuit. However, with an understanding of the equipment and the circuit involved, the tools can be very useful in obtaining information which could be more time consuming than with other equipment.

**NOTICE:** A scan tool that displays faulty data should not be used and the problem should be reported to the manufacturer. The use of a faulty scan tool can result in misdiagnosis and unnecessary replacement of good parts.

Tree Diagnostic Trouble Code (DTC) charts incorporate diagnosis procedures using a DLC scan tool when possible.

Some control modules use three modes for transmitting information but some only read data in the open mode. For further information on use of the scan tool, refer to SECTION 3.

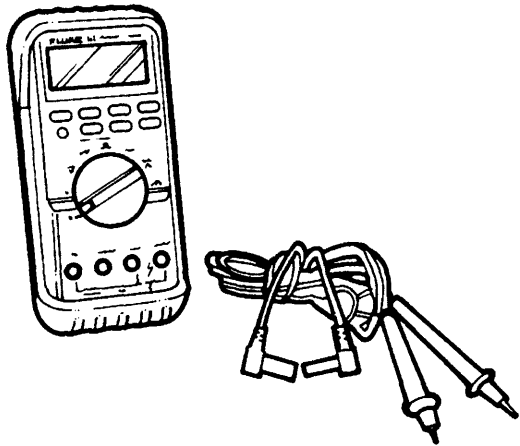
Special service tools that are shown in this service manual that have tool product numbers beginning with "J" or "BT" are available for worldwide distribution from:

Kent-Moore  
SPX Corporation  
29784 Little Mack  
Roseville, Mi 48066-2298  
1-800-345-2233  
Mon.- Fri. 8:00 p.m. EST  
Telex: 244040 KMTR VR  
Fax: 313-578-7375

General Motors dealers can purchase Tech 1 scan tools and accessories through Kent-Moore at the above address and phone number. Non-General Motors dealer repair facilities can purchase Tech 1 scan tools and accessories from Kent-Moore at the above address or:

Sun Electric Corporation  
One Sun Parkway  
Crystal Lake, IL 60014  
1-800-CALLSUN (225-5786)  
6:45 a.m. - 7:00 p.m. CST

## 13-2 DRIVEABILITY AND EMISSIONS (GASOLINE)



HIGH IMPEDANCE MULTIMETER  
(DIGITAL VOLTMETER-DVM)  
J 39200

**VOLTMETER** - Voltage position measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used because some circuits require accurate low voltage readings, and some circuits in the Control Module have a very high resistance.

**AMMETER** - When used as ammeter, this meter also accurately measures extremely low current flow. Refer to meter instructions for more information.

- Selector must be set properly for both function and range. DC is used for most automotive measurements.

**OHMMETER** - Measures resistance of circuit directly in ohms. Refer to meter for more information.

- OL display in all ranges indicates open circuit.
- Zero display in all ranges indicates a short circuit.
- Intermittent connection in circuit may be indicated by digital reading that will not stabilize on circuit.
- Range switch.
  - 400 $\Omega$  - Reads ohms directly
  - 4k, 40k, 400k $\Omega$  - Reads ohms in thousands
  - 4M and 40M $\Omega$  - Reads ohms in millions

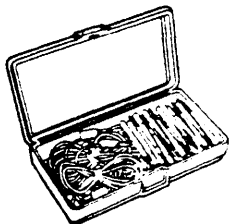


TK 0-A TECH 1A  
7000001 CARTRIDGE KIT

### TECH 1 DIAGNOSTIC COMPUTER

A hand-held scan tool used to analyze and diagnose fuel and emission system. Also can be used to analyze other computer system.

(With 81-94 GM Powertrain Software)



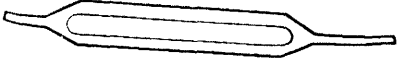
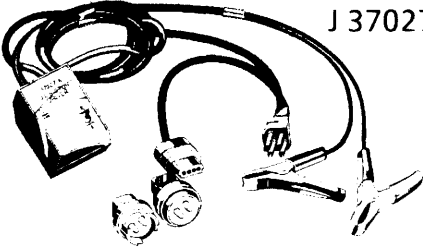
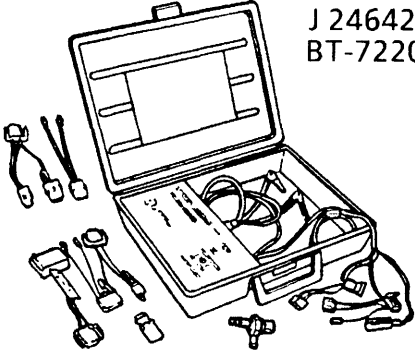
J 35616-A/BT 8637

### CONNECTOR TEST ADAPTER KIT

Used to make electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.

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75 3534-6E

Figure 13-1 - Special Tools (1 of 5)

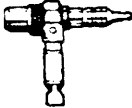
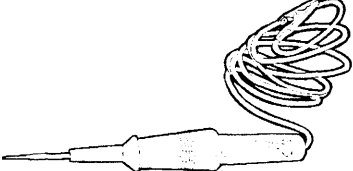
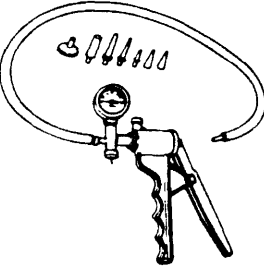
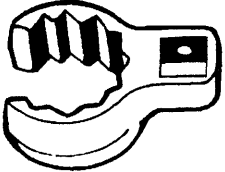
|                                                                                                                    |                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 35689-A</p>                 | <p><b>METRI-PACK TERMINAL REMOVER</b><br/>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors. Refer to wiring harness service in SECTION 3 for removal procedure.</p>    |
|  <p>J 28742-A</p>                 | <p><b>WEATHER PACK TERMINAL REMOVER</b><br/>Used to remove terminals from Weather Pack connectors. Refer to wiring harness service in SECTION 3 for removal procedure.</p>                          |
|  <p>J 33095/BT-8234-A</p>         | <p><b>CONTROL MODULE CONNECTOR TERMINAL REMOVER</b><br/>Used to remove terminal from Micro-Pack connectors. Refer to wiring harness service in SECTION 3 for removal procedure.</p>                 |
|  <p>J 37027-A</p>                 | <p><b>IAC SYSTEM MONITOR</b><br/>Used to test IAC motors for correct functioning and proper response to commands.<br/>22L IAC driver and node light kit.<br/>J 37027-3 IAC system check lights.</p> |
|  <p>J 24642-F/<br/>BT-7220-1</p> | <p><b>IGNITION MODULE TESTER</b><br/>Used to test ignition module in SECTION 6.</p>                                                                                                                 |

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Figure 13-2 - Special Tools (2 of 5)



## 13-4 DRIVEABILITY AND EMISSIONS (GASOLINE)

|                                                                                                           |                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <br>J 26792/BT-7220-1    | <b>SPARK TESTER</b><br>Used to check available secondary ignition voltage. Also called an ST125.                                       |
| <br>J 34142-B            | <b>UNPOWERED TEST LIGHT</b><br>Used to check wiring for complete circuit and short to ground or voltage.                               |
| <br>J 29698-B/BT-8251    | <b>FUEL LINE WRENCH</b><br>Used to disconnect or connect fuel lines at TBI unit by holding fuel nut at throttle body.                  |
| <br>J 36608              | <b>FUEL TANK SENDING AND PUMP UNIT</b><br>Used to remove and install cam lock nut on the fuel tank sending and pump unit in SECTION 4. |
| <br>J 35748            | <b>OIL PRESSURE SENDING UNIT SOCKET</b><br>Used to remove and install oil pressure sending unit.                                       |
| <br>J 23738-A/BT-8512A | <b>VACUUM PUMP 20 IN. HG. MINIMUM</b><br>Use gage to monitor manifold engine vacuum and check vacuum sensors, solenoids and valves.    |
| <br>J 33031/BT-8130    | <b>IDLE AIR CONTROL WRENCH</b><br>Used for removing or installing IAC valve on throttle body.                                          |
| <br>J 39194            | <b>HEATED OXYGEN SENSOR WRENCH</b><br>Used to remove or install the heated oxygen sensor.                                              |

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MS 12550

Figure 13-3 - Special Tools (3 of 5)

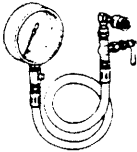
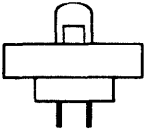
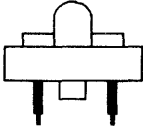
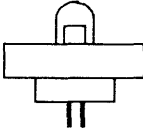
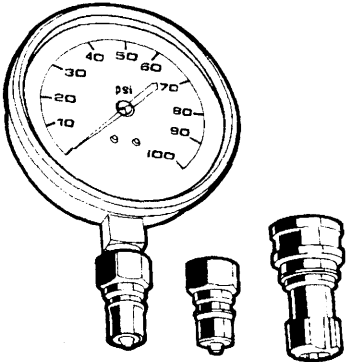
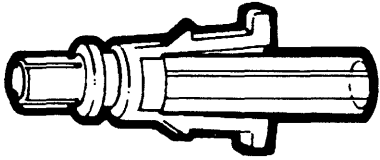
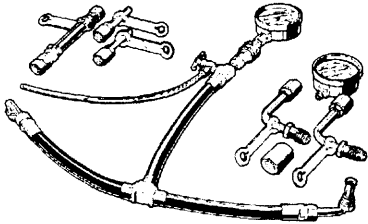
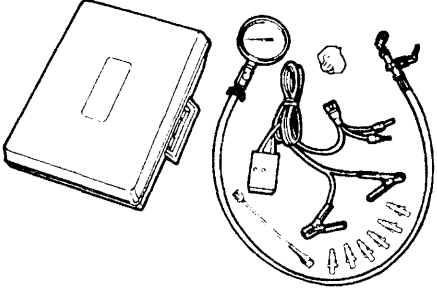
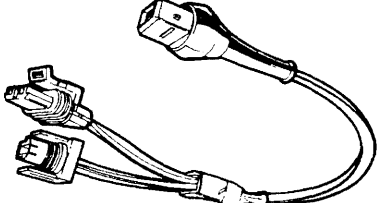
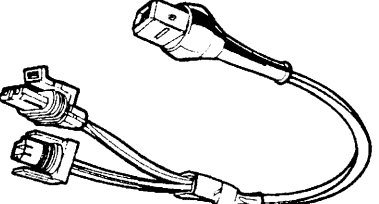
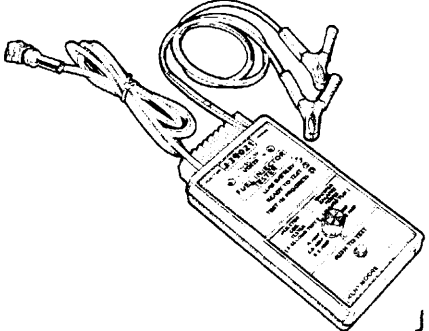
|                                                                                                               |                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 34730-1</p>            | <p><b>FUEL PRESSURE GAGE</b><br/>Used for checking and monitoring fuel line pressure of port fuel system.<br/>Part of diagnostic kit J 34730-D.</p>                                                          |
|  <p>J 34730-2C</p>           | <p><b>INJECTOR TEST LIGHT</b><br/>Used for checking the electrical circuit to a port fuel injector.<br/>Part of diagnostic kit J 34730-D.</p>                                                                |
|  <p>J 34730-350 BT-8320</p>  | <p><b>INJECTOR TEST LIGHT</b><br/>Used for checking the electrical circuit to the fuel injector on the 220 TBI, and CMFI internal injector connection.</p>                                                   |
|  <p>J 34730-2A/BT-8329-A</p> | <p><b>INJECTOR TEST LIGHT</b><br/>Used for checking the electrical circuit to the fuel injector connector on CMFI.</p>                                                                                       |
|  <p>J 34730-225</p>        | <p><b>INJECTOR HARNESS CONNECTOR</b><br/>Used as a harness for manually adapting the manual injector test to the injector harness. Part of diagnostic kit J 34730-D.</p>                                     |
|  <p>J 34730-250</p>        | <p><b>FUEL PRESSURE GAGE AND ADAPTOR</b><br/>Used for high fuel pressure testing. Gauge modification kit, from low pressure to high pressure gauge. (For use with MFI kits supplied with 60 psi gauges.)</p> |
|  <p>J 34730-230</p>        | <p><b>INJECTOR POPPET TESTERS</b><br/>Six testers used on the CMFI to test for fuel flow.<br/>Part of diagnostic kit J 347 30-D.</p>                                                                         |

Figure 13-4 - Special Tools (4 of 5)

## 13-6 DRIVEABILITY AND EMISSIONS (GASOLINE)

|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 29658-D/BT-8205</p>        | <p><b>FUEL PRESSURE GAGE</b></p> <p>Used to check and monitor fuel line pressure on TBI.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  <p>J 34730-D</p>                | <p><b>MULTIPORT FUEL INJECTION DIAGNOSTIC KIT</b></p> <p>Used to diagnose multiport fuel injection systems.</p> <p>The kit includes:</p> <ul style="list-style-type: none"><li>• Fuel Pressure Gage - used for checking fuel pump pressure and compare injector pressure drop for equal fuel distribution.</li><li>• Injector Test Light - used for checking electrical circuit to an injector.</li><li>• Injector Tester - used for checking coil condition and energizing each fuel injector for a precise amount of time to perform injector balance test.</li></ul> |
|  <p>J 39021-60</p>             | <p><b>INJECTOR HARNESS CONNECTOR</b></p> <p>Used as a harness for manually adapting the injector test to the injector harness. Part of diagnostic kit J 34730-D. 2.2 L (S/T) Truck</p>                                                                                                                                                                                                                                                                                                                                                                                  |
|  <p>J 39021-22/J 34730-200</p> | <p><b>INJECTOR HARNESS CONNECTOR</b></p> <p>Used as a harness for manually adapting the manual injector test to the injector harness. Part of diagnostic kit J 34730-D.</p>                                                                                                                                                                                                                                                                                                                                                                                             |
|  <p>J 39021</p>                | <p><b>INJECTOR TESTER</b></p> <p>Used to diagnose fuel injectors by first checking coil condition and then by performing an injector balance test where applicable. Part of diagnostic kit J 34730-D.</p>                                                                                                                                                                                                                                                                                                                                                               |

4-26-93  
PS 17029

Figure 13-5 - Special Tools (5 of 5)

## SECTION 14

## ABBREVIATIONS AND GLOSSARY OF TERMS

Abbreviations used in this manual are listed below in alphabetical order with an explanation of the abbreviation. All the terms listed below subscribe fully to the S.A.E. requirements for 1993.

**AIR/FUEL (RATIO)** - The amount of air-to-fuel for combustion of fuel. Ideal ratio is 14.7 parts of air to 1 part of fuel.

**AIR INJECTION REACTION** - Air flow from pump is directed into engine exhaust manifold and/or converter to reduce exhaust emissions.

**AMPERAGE OR CURRENT** - The rate of flow of electrons is similar to gallons of water per minute flowing in a water pipe.

**ANALOG SIGNAL** - An electrical signal which varies in voltage within a given parameter.

**B +** - Battery Positive Terminal (12 volts).

**BARO** - Sensor which measures atmospheric pressure.

**CAPACITOR** - An electrical device used to store a temporary charge.

**CATALYTIC CONVERTER** - Containing platinum and palladium to speed up conversion of HC and CO.

**CLOSED LOOP (CL)** - Designed with feedback information from the oxygen sensor to the control module to maintain an optimum air/fuel ratio (14.7:1), output.

**CMFI - CENTRAL MULTIPOINT FUEL INJECTION** - Fuel metering system consisting of one central fuel injector and separate poppet nozzles.

**CO - CARBON MONOXIDE** - One of the pollutants found in engine exhaust.

**CONTROL MODULE SYSTEM** - Utilizes one of three control modules (ECM, PCM and VCM) to control air/fuel and emission systems.

**CONTROL SOLENOID** - An electrical switching device used to operate another system.

**CRANKCASE VENT VALVE** - Prevents fumes in crankcase from passing into atmosphere.

**DIAGNOSTIC TERMINAL** - Grounding terminal "B" of Data Link Connector (DLC) will flash or display a DTC. When grounded with the engine operating the vehicle will enter the "Field Service Mode."

**DIAGNOSTIC TROUBLE CODE (DTC)** - A specific set of numbers obtained from flashing the MIL (Service Engine Soon), or displaying on a scan tool. These DTC(s) are used to determine the system malfunctions.

**DIODE** - An electrical device that restricts current flow in one direction.

**DISTRIBUTOR IGNITION (DI)** - An ignition system that uses an electronic module and pick-up coil in place of contact points.

**DLC - DATA LINK CONNECTOR** - Used at the assembly plant to evaluate the vehicle's control module system and for service for diagnostic trouble codes. Also can be used by scan tools to obtain control module serial data, for service diagnosis.

**DRIVER MODULE** - An electrical device, that operates like a switch, used to command something "ON" or "OFF."

**ECM - ENGINE CONTROL MODULE** - A metal case (located in passenger compartment) containing electronic circuitry. The ECM electrically controls, air/fuel, emission systems, and turns "ON" the MIL (Service Engine Soon) when a malfunction occurs in the system.

**ELECTRONIC ERASABLE PROGRAM READ ONLY MEMORY (EEPROM)** - An electronic component which can be specifically programmed for engine operating requirements for each vehicle model. It is located in the Vehicle Control Module (VCM).

**EMI OR NOISE** - An unwanted signal interfering with another needed signal; like an electrical razor upsets a television picture, or driving under high voltage power lines upsets the AM radio in a vehicle.

**ENERGIZE/DE-ENERGIZE** - When current is passed through a coil (energized) such as a solenoid, a plunger is pulled or pushed. When the voltage to the solenoid is turned "OFF," (de-energized), a spring raises or lowers the plunger.

**ENGINE COOLANT TEMPERATURE (ECT) SENSOR** - Device that senses the engine coolant temperature, and passes that information to the control module system.

**ENGINE SPEED CONTROL GOVERNOR MODULE** - Electronic device which is mounted into the throttle body assembly used to control vehicle speed.

## 14-2 DRIVEABILITY AND EMISSIONS (GASOLINE)

---

**EVAPORATIVE EMISSION (EVAP) CANISTER PURGE** - Control module controlled solenoid valve that permits manifold vacuum to purge the evaporative emissions from the charcoal canister.

**EVAPORATIVE EMISSIONS (EVAP) CONTROL SYSTEM** - Used to prevent gasoline vapors of the fuel tank from entering the atmosphere.

**EXHAUST GAS RECIRCULATION (EGR)** - Method of reducing NO<sub>x</sub> emission levels.

**EXHAUST GAS RECIRCULATION ELECTRONIC VACUUM REGULATOR SOLENOID VALVE** - Controls EGR vacuum to the EGR valve.

**FEDERAL** - Vehicle/engine available in all states except California.

**GROUND** - A wire shorted to ground. A common return path for an electrical circuit. A reference point from which voltage measurements may be made.

**HC - HYDROCARBONS** - One of the pollutants found in engine exhaust. Hydrogen and carbon in gasoline.

**HEATED OXYGEN SENSOR (HO2S)** - An internal heater to accelerate the time the oxygen sensor becomes active. This allows for fuel/air control in a shorter period of time. Sensor should vary from 0.1 mV to 0.9 mV after "Closed Loop" condition.

**HIGH IMPEDANCE DVM** - Has high opposition to the flow of electrical current. Used for reading circuits with low current flow found in electronic systems.

**IDEAL MIXTURE** - An air/fuel ratio which provides the best performance, while maintaining maximum conversion of exhaust emissions, typically 14.7 to 1 ratio.

**IDLE AIR CONTROL (IAC)** - A valve used by the control module regulate idle speed.

**IDLE SPEED CONTROL ACTUATOR** - A vacuum diaphragm device used by the control module to regulate idle speed.

**IGN - IGNITION** - Refers to switched ignition voltage.

**IGNITION CONTROL (IC)** - Control module controlled timing of ignition spark.

**INPUTS** - Information from sources (such as, engine coolant temperature sensors, exhaust oxygen sensor, etc.) which tell the control module how the systems are performing.

**INSTRUMENT PANEL (I/P)** - Contains instrument gages and indicator lights to indicate performance of the vehicle.

**INTERMITTENT** - Occurs now and then; not continuously. In electrical circuits, refers to occasional open, short, or ground.

**KILOMETER PER HOUR (km/h)** - A metric unit measuring distance (1000 meters) in one hour.

**KNOCK SENSOR (KS) SYSTEM** - Used to sense detonation and retard spark advance when detonation occurs.

**LINEAR EXHAUST GAS RECIRCULATION VALVE** - An electric valve used to control EGR.

**LITER (L)** - A metric unit of capacity.

**LONG TERM FUEL TRIM (FORMERLY BLOCK LEARN)** - Long term fuel trim is derived from the short term fuel trim (formerly fuel integrator) and is used for long-term correction of fuel delivery. A value of 128 counts indicates that fuel delivery requires no compensation to maintain a 14.7:1 air/fuel ratio. A value less than 128 counts means that the fuel system is too rich and fuel delivery is being reduced (decreased injector pulse width). A value greater than 128 counts indicates that a lean condition exists and the control module is compensating by adding fuel (increased injector pulse width).

**MALFUNCTION** - A fault that causes the system to operate incorrectly. Typical malfunctions are; wiring harness opens or shorts, failed sensors, or circuit components.

**MALFUNCTION INDICATOR LAMP (MIL)** - Lights when a malfunction occurs in the control module system.

**MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR** - Compares pressure changes in intake manifold with reference to zero pressure. It puts out a voltage which is highest when the pressure is highest. The minimum voltage is approximately 1.25 volts at idle to 4.74 (WOT) 4-5 volts.

**MERCURY (Hg)** - A calibration material used as a standard for vacuum measurement.

**MILES PER HOUR (mph)** - A unit measuring distance (5280 feet) in one hour.

**MODE** - A particular state of operation.

**NEWTON METERS (N·m)** - A metric unit of force.

**NITROGEN NO<sub>x</sub>** - One of the pollutants found in engine exhaust. Nitrogen that combines with oxygen to form oxides of nitrogen.

**NORMALLY CLOSED (N.C.)** - State of relay contacts or solenoid plunger when no voltage is applied.

**NORMALLY OPEN (N.O.)** - State of relay contacts or solenoid plunger when no voltage is applied.

**ON-BOARD DIAGNOSTIC SYSTEM CHECK** - The control module will detect malfunctions in the system. If a malfunction occurs, the control module turns "ON" the MIL (Service Engine Soon). A diagnostic trouble code can be obtained from the control module through the MIL (Service Engine Soon) or scan tool. This DTC will indicate the area of the malfunction.

**OPEN LOOP (OL)** - Describes control module fuel control without use of oxygen sensor information.

**OUTPUT** - Functions, typically solenoids, which are controlled by the control module.

**OXYGEN SENSOR (O2S)** - Monitors the oxygen content of the exhaust system and generates a voltage signal to the control module.

**PNP SWITCH - PARK/NEUTRAL POSITION SWITCH** - Used to indicate the position of the automatic transmission.

**PORT - EXHAUST OR INTAKE PORT**

**POWERTRAIN CONTROL MODULE (PCM)** - Used on some vehicles to control and monitor not only fuel/air ratio and emissions, but also to control the electronic transmission operation.

**PRESSURE CONTROL SOLENOID (FORMERLY FORCE MOTOR)** - A solenoid used in the transmission to control shift quality.

**PROGRAMMABLE READ ONLY MEMORY (PROM)** - An electronic component which is specifically programmed to each vehicle model for control of fuel and emissions. The PROM is located in the control module.

**PROM (CAL-PAK)** - A device used with fuel injection to allow fuel delivery in the event of a control module malfunction.

**PROM (MEM-CAL)** - Contains specific calibrations to meet the requirements of a specific engine.

**PULSE WIDTH MODULATED (PWM)** - A device operated by a digital signal controlled by the time duration the device is turned "ON" or "OFF."

**QUAD-DRIVER** - A "chip" device that is capable of operating four separate outputs. Some have digital and some have pulse width modulated control.

**RESISTANCE** - The ability of a circuit to limit current flow; like a restriction in a water pipe.

**REVOLUTIONS PER MINUTE (RPM)** - A measure of rotational speed.

**SECONDARY AIR INJECTION BYPASS VALVE** - Used to divert air flow to air switching valve or atmosphere.

**SHORT TERM FUEL TRIM (FORMERLY FUEL INTEGRATOR)** - Represents a short-term correction to fuel delivery by the control module. This adjustment is made by amount of time the oxygen sensor voltage spends away from the 450 mV threshold. If the oxygen sensor voltage has mainly been less than 450 mV indicating a lean air/fuel mixture, the short term fuel trim will increase the injector pulse width. If the oxygen sensor voltage has mainly been greater than the threshold, the short term fuel trim will decrease the injector pulse width to compensate for the indicated rich condition.

**TACHOMETER (TACH)** - A device for indicating rotational speed of the crankshaft.

**THERMOSTATIC AIR CLEANER** - Provides preheated air into the intake manifold for better drivability when engine is cold. Also filters intake air.

**THROTTLE BODY FUEL INJECTION (TBI)** - Is controlled by the control module to supply precise air/fuel mixture into the intake manifold.

**THROTTLE POSITION (TP) SENSOR** - Device that tells the control module the throttle position.

**TORQUE CONVERTER CLUTCH - TCC** - Control module controlled solenoid in transmission which positively couples the transmission to the engine.

**TRANSMISSION RANGE (TR) PRESSURE SWITCH ASM** - Gear range sensing device used on electronic controlled transmissions.

**V6 - SIX CYLINDER ENGINE** - Arranged in a "V".

**V8 - EIGHT CYLINDER ENGINE** - Arranged in a "V".

**VACUUM** - Less than atmospheric pressure.

**VACUUM, MANIFOLD** - Vacuum source in manifold below throttle plate.

**VACUUM, PORTED** - A vacuum source above (atmospheric side) closed throttle plate.

**VEHICLE SPEED SENSOR (VSS)** - Sensor which sends vehicle speed information to the control module.

**VIN - VEHICLE IDENTIFICATION NUMBER** - Appears on a plate attached to the windshield pillar.

**VOLT (V)** - A measurement of electrical pressure.

**VOLTAGE** - The pressure of force pushing the current in a circuit; like pressure in a water pipe.

**VSS BUFFER** - An electrical signal that is either "ON" or "OFF" with no in between.

**WIDE OPEN THROTTLE (WOT)** - Refers to the throttle plate or accelerator pedal when fully open.

#### **14-4 DRIVEABILITY AND EMISSIONS (GASOLINE)**

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**1-2 SHIFT SOLENOID** - Used to shift gears when commanded by the control module. Used on 4L60E and 4L80E electronic transmissions.

**2-3 SHIFT SOLENOID** - Used to shift gears when commanded by the control module. Used on 4L60E and 4L80E electronic transmissions.

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# **DRIVEABILITY AND EMISSIONS (DIESEL)**

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## SECTION 1

# GENERAL INFORMATION

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**ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.**

**NOTICE:** Before performing any welding, disconnect negative battery cable and any control module connectors. Damage may occur to control module or to other system components.

## GENERAL DESCRIPTION

### FUEL AND EMISSIONS CONTROL

A control module is designed to maintain exhaust emissions levels at federal standards while providing good driveability and fuel efficiency. The functions of the system are based on data gathered by sensors and switches located throughout the vehicle. The control module maintains control over fuel delivery and other system components, while monitoring the system for faulty operation with its diagnostic capabilities. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The control module language for communicating the source of the malfunction is a system of diagnostic trouble codes.

When it finds a problem, it lights a Malfunction Indicator Lamp (MIL) "Service Engine Soon" on the instrument panel and a Diagnostic Trouble Code (DTC) will be stored in the control module memory. This does not mean that the engine should be stopped right away, but that the cause of the light coming "ON" should be checked as soon as reasonable possible.

It is important to review the system sections and control module wiring diagrams for a specific engine to determine what is controlled by the control module and what systems are non-control module controlled. Abbreviations which are used in driveability and emissions are listed in "Abbreviations," SECTION 14.



### VEHICLE EMISSIONS CONTROL INFORMATION LABEL

The Vehicle Emissions Control Information label contains important emission specifications and procedures. On the upper left corner is exhaust emission information. Refer to Figure 1-1 for further break out clarification. Also, there is an illustrated emission components and a vacuum hose schematic. This label is located in the engine compartment of every vehicle. If the label has been removed, a replacement label can be ordered from General Motors Service Parts Operation (GMSPO). Refer to the standard Parts Catalog.

### MAINTENANCE SCHEDULE

Refer to "Maintenance and Lubrication," SECTION 0B of the proper Light Duty Truck Service Manual or in the vehicle glove box for the maintenance service. Proper schedule maintenance should be performed to retain emission control performance.

### BLOCKING DRIVE WHEELS

The vehicle drive wheels should always be blocked with parking brake firmly set while checking system.

### VISUAL/PHYSICAL UNDERHOOD INSPECTION

One of the most important checks that must be done as part of any diagnostic procedure is a careful visual/physical underhood inspection. This can often lead to fixing a problem without further steps. Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects. Be sure to inspect hoses that are difficult to see beneath the air cleaner, compressor, generator, etc. Inspect all the wires in the engine compartment for correct and good connections, burned or chafed spots, pinched wires, or contact with sharp edges or hot exhaust manifolds. This visual/physical inspection is very important. It must be done carefully and thoroughly. Refer to component locations at end of this section.

### BASIC KNOWLEDGE AND TOOLS REQUIRED

To use this manual most effectively, a general understanding of basic electrical circuits and circuit testing tools is required. You should be familiar with wiring diagrams, the meaning of voltage, ohms, amps, the basic theories of electricity, and understand what happens in an open or shorted wire.

To perform system diagnosis, the use of the Tech 1 Diagnostic computer or equivalent scan tool is required. A tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance, vacuum gauge, and jumper wires are also required. Please become acquainted with the tools and their use before attempting to diagnose a vehicle. Special tools which are required for system service and the ones described above are illustrated in "Special Tools," SECTION 13.

### WHAT THIS MANUAL CONTAINS

The Diesel Fuel and Emissions service manual has been developed to describe the function and operation of the control module control system that controls the driveability and emissions of the vehicle. Emphasis is placed on the diagnosis and repair of problems related to the system.

The diagnostic charts and functional checks for each system are found in "Diagnosis" of each section.

The "Fuel and Emissions" service manual is divided into sections, each dealing with diagnosis and repair. These sections can be summarized as follows.

#### Section 2: Driveability Symptoms

This section assists in the diagnosis of intermittent problems or problems which don't result in the storing of Diagnostic Trouble Codes (DTCs). It is arranged by symptoms of poor driveability and emissions and lists probable causes of the problems.

#### Section 3: Control Module System

This is an electronically controlled exhaust emission system that uses a control module to control fuel delivery, injection timing, turbo boost and exhaust recirculation.

This section deals with the diagnosis and repair of each control module system with the use of a Tech 1 scan tool.

This section contains:

- Description and Details of Basic Operation.
- On-Board Diagnostic System Check. This must be the first step of any diagnostic procedure.
- Functional Checks/Diagnostic Charts.
- Diagnostic Trouble Code (DTC) Tree Charts with facing pages containing circuit diagrams, circuit operation information, and helpful diagnostic aids.
- Wiring Diagrams.
- Control Module Connector Terminal End View and Terminal Definitions.
- On-Vehicle Service.
- Part Names and Group Numbers.

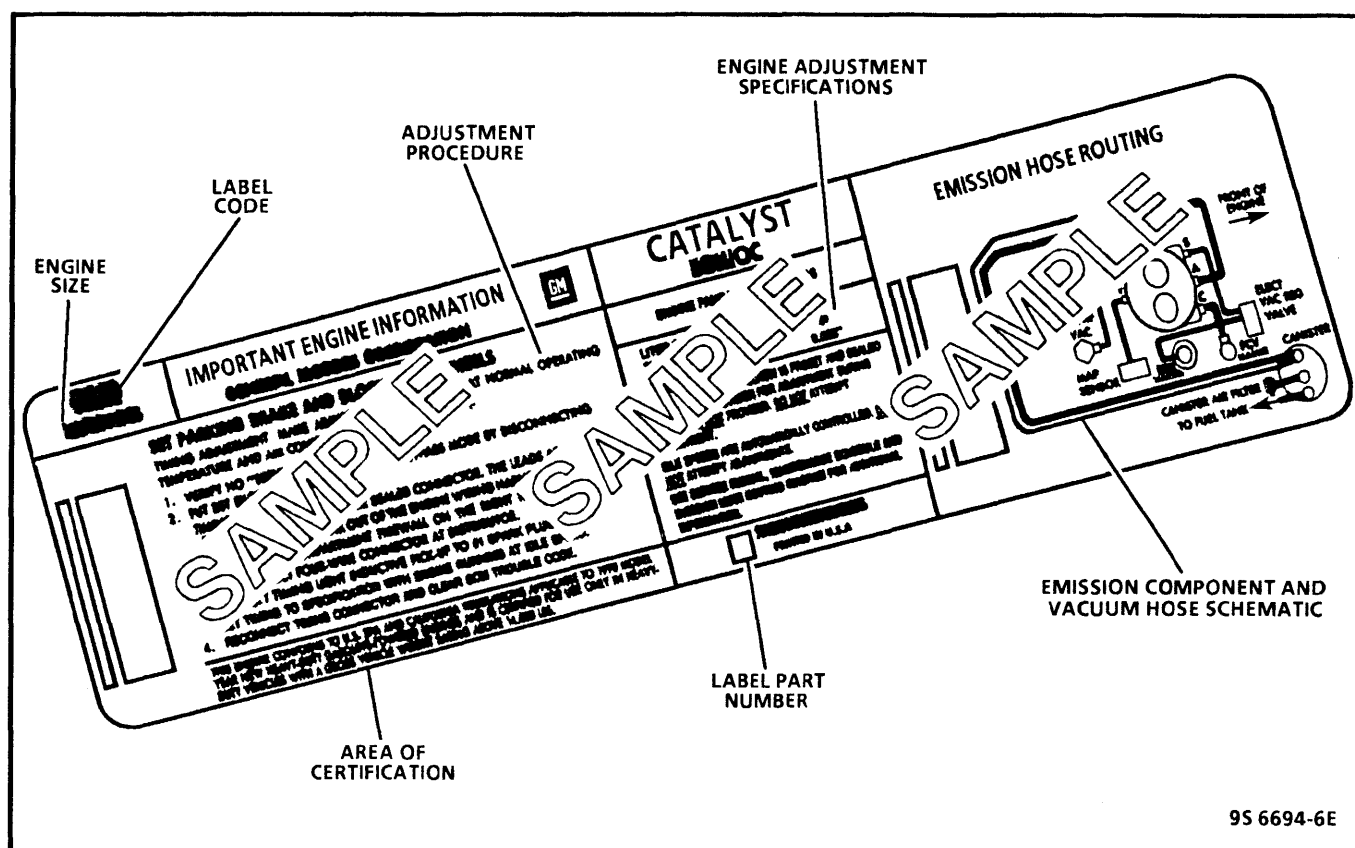


Figure 1-1 - Vehicle Emission Control Information Label

## Section 4: Fuel System

The fuel system is controlled by a Powertrain Control Module (PCM) located in the passenger compartment. The basic function of the fuel system is to control fuel delivery to the engine under all operating conditions. Fuel is delivered to the injector nozzles by a fuel injection pump.

This section describes in detail the fuel system.

This section contains:

- Description and Details of Operation.
- Diagnosis and Repair of the Fuel System.
- Fuel Pressure Test Procedure.
- On-Vehicle Service.
- Part Names and Group Numbers.

## Section 7: Glow Plug System

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures. This system is used on all diesel engines and is controlled by the control module.

This section contains:

- Description and Details of Operation.
- Diagnosis Including System Check Chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

## Section 9: Exhaust Gas Recirculation (EGR) System

The EGR system uses a valve to feed a small amount of exhaust gas back into the intake manifold to control formation of NOx. This system is used only on engines that require the system to meet emission standards, and is controlled by the control module.

This section contains:

- Description and Details of Operation.
- Diagnosis Including System Check Chart.
- On-Vehicle Service.
- Part Names and Group Numbers.

## Section 10: Transmission Controls

The electronic 4L60E/4L80E transmission is controlled by the Powertrain Control Module (PCM), which controls all transmission and torque converter operations. Refer to SECTION 7A in the appropriate service manual.

This section contains:

- Description and Details of Operation.
- Diagnosis Including Functional Check.
- On-Vehicle Service.
- Part Names and Group Numbers.

## 1-4 DRIVEABILITY AND EMISSIONS (DIESEL)

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### Section 11: Crankcase Ventilation System

The crankcase ventilation system used on diesel engines is designed to reduce the crankcase pressure at idle. The lower pressure reduces engine oil leaks.

This section contains:

- Description and Details of Operation.
- Diagnosis Including Functional Check.
- On-Vehicle Service.
- Part Names and Group Numbers.

### Section 12: Air Intake System

The air intake system directs air through the air cleaner to the intake manifold. This system is not controlled by the control module.

This section contains:

- Description and Details of operation including the Air Cleaner.
- Diagnosis including functional check.
- On-Vehicle Service.
- Part Names and Group Numbers.

### Section 13: Special Tools

This section lists and briefly describes the use of the special tools required for diagnosis and repair of the diesel fuel and emission systems.

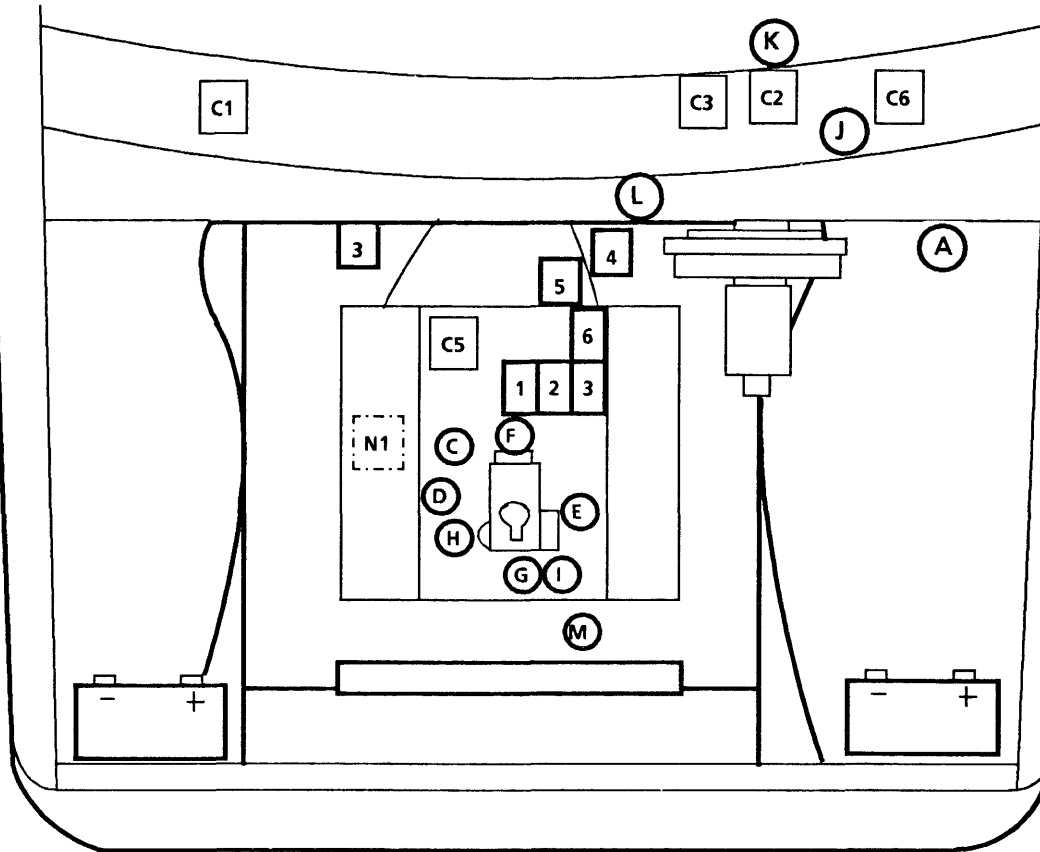
### Section 14: Abbreviations and Glossary of Terms

This section list the abbreviations and acronyms used in this manual along with an explanation of each.

### COMPONENT LOCATIONS

There are many components used to control fuel and emissions. Each system is described in a section which includes general description of the system, diagnosis and On-Vehicle Service. Component locations for all series vehicles and all engines are illustrated in the following figures. The "Component Location" views show all emission systems that may be used for the particular vehicle/engine combination. Not every vehicle requires all the systems or components shown, but only the ones needed to meet emission standards for the area of certification.

'C/K' SERIES RPO:L49,L56,L65 VIN CODE: P, S, F 6.5L V8 DIESEL



**CONTROL MODULE SYSTEM**

- C1 Powertrain Control Module (PCM)
- C2 Data Link Connector (DLC)
- C3 Malfunction Indicator Lamp (MIL) (Service Engine Soon)
- C5 PCM harness ground
- C6 Fuse block

**PCM CONTROLLED COMPONENTS**

- 1 Boost solenoid
- 2 EGR solenoid
- 3 EGR vent solenoid
- 4 Transmission connector
- 5 Glow plug relay

**PCM INFORMATION SENSORS**

- A EGR control pressure/BARO
- B Coolant Temp Sensor (ECT)
- C Intake Air Temp (IAT)
- D Boost sensor
- E Fuel solenoid driver
- F Fuel solenoid
- G High Resolution Sensor
- H Injection timing stepper motor
- I Engine shut off solenoid
- J Accelerator Pedal Position (APP) sensor
- K Cruise control
- L Output and vehicle speed sensors
- M Crankshaft position sensor

**EMISSION COMPONENTS (NOT PCM CONTROLLED)**

- N1 Crankcase Depression Regulator (CDR)

Figure 1-2 - Component Locations - 6.5L Diesel

**BLANK**

**SECTION 2**  
**DRIVEABILITY SYMPTOMS**  
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| Poor Fuel Economy .....                           | Page 2-11 |
| Excessive Smoke (1 of 2) .....                    | Page 2-12 |

### IMPORTANT PRELIMINARY CHECKS

#### BEFORE USING THIS SECTION

Before using this section you should have performed the "On-Board Diagnostic System Check" and determined that:

1. The control module and MIL (Service Engine Soon) are operating correctly.
  2. There are no diagnostic trouble codes stored, or there is a diagnostic code but no MIL (Service Engine Soon).
- Several of the following symptom procedures call for a careful visual/physical check. The importance of visual/physical checks cannot be over stressed, because they can lead to correcting a problem without further checks and can save valuable time.

#### BEFORE STARTING

This check should include:

- Control module grounds for being clean, tight, and in their proper location. Refer to SECTION 1.
- Fuel lines, pipes and hoses for leaks or restrictions.
- Vacuum hoses for splits, kinks and proper connections, as shown on "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Wiring for proper connections, pinches, and cuts. Refer to SECTION 3.
- The following symptom charts contain groups of possible causes for each symptom and cover several engines. **These procedures are not necessarily meant to be done in consecutive order.** If Tech 1 scan tool readings do not indicate the problems, then proceed in a logical order, easiest to check or most likely cause first. To determine if a particular system or component is used on a specific vehicle, refer to the "Control Module Wiring Diagrams" for application.

#### SYMPTOM

Verify the customer complaint, and locate the correct symptom in the table of contents. Check the items indicated under that symptom.

**INTERMITTENTS****(Page 1 of 2)**

**Definition:** Problem may or may not turn "ON" the Malfunction Indicator Lamp (MIL) or store a Diagnostic Trouble Code (DTC).

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- DO NOT use the Diagnostic Trouble Code (DTC) charts in SECTION 3 for intermittent problems. The fault must be present to locate the problem. If a fault is intermittent, use of diagnostic trouble code charts may result in replacement of good parts.

**FAULTY ELECTRICAL CONNECTIONS OR WIRING**

- Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful check of suspect circuits for:
  - Poor mating of the connector halves, or terminals, not fully seated in the connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed or replaced to insure proper contact tension.
  - Poor terminal to wire connection. This requires removing the terminal from the connector body to check. Refer to "On-Vehicle Service" in SECTION 3.

**ROAD TEST**

- If a visual/physical check does not locate the cause of the problem, the vehicle can be driven with a voltmeter connected to a suspected circuit or a Tech 1 scan tool may be used. An abnormal voltage or scan reading, when the problem occurs, indicates the problem may be in that circuit. If the wiring and connectors check OK, and a diagnostic trouble code was stored for a circuit having a sensor, replace the sensor.



### INTERMITTENTS

(Page 2 of 2)

**Definition:** Problem may or may not turn "ON" the Malfunction Indicator Lamp (MIL), or store a Diagnostic Trouble Code (DTC).

#### INTERMITTENT "MALFUNCTION INDICATOR LAMP (MIL)"

- An intermittent MIL and No Diagnostic Trouble Codes (DTCs), may be caused by:
  - Electrical system interference caused by a defective relay, control module driven solenoid, or switch. They can cause a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
  - Improper installation of electrical devices, such as lights, 2-way radios, electric motors, etc.
  - Ignition secondary shorted to ground.
  - CKT 419 Malfunction Indicator Lamp (MIL) or CKT 451 (diagnostic "test" terminal) intermittently shorted to ground.
  - Control module grounds. Refer to "Component Locations," in SECTION 1.

#### LOSS OF DIAGNOSTIC TROUBLE CODE MEMORY

- To check, disconnect Engine Coolant Temperature (ECT) sensor and idle engine until the "Malfunction Indicator Lamp" comes "ON." DTC 15 should be stored, and kept in memory when the ignition is turned "OFF" for at least 10 seconds. If not, the control module is faulty.

**HARD START****(Page 1 of 2)**

**Definition:** Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Make sure the driver is using the correct starting procedure.
- Check fuel quality. Refer to "Fuel Specific Gravity Check" in SECTION 4.
- Check engine oil level and quality.
- Remove air cleaner filter and check for being plugged, replace as necessary.

**SENSORS**

- **CHECK:** Engine Coolant Temperature (ECT) sensor - Using a scan tool, compare engine coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reading is 5 degrees greater than or less than ambient air temperature on a cold engine, check for high resistance in coolant sensor circuit or sensor itself. Refer to "DTC 15" in SECTION 3 and compare resistance values.

**FUEL SYSTEM**

- **CHECK:** Supply to injection pump. Refer to SECTION 4.
- **CHECK:** Fuel return from injection pump. Refer to SECTION 4.
- **CHECK:** Engine shut-off solenoid operation. Refer to SECTION 3.
- **CHECK:** Fuel injection nozzles. Refer to SECTION 4.
- **CHECK:** Fuel tank cap vent.
- **CHECK:** Internal injection pump problem.

### HARD START

(Page 2 of 2)

**Definition:** Engine cranks OK, but does not start for a long time. Does eventually operate, or may start but immediately stalls.

#### ELECTRICAL SYSTEMS

- **CHECK:** Glow plug operation. Refer to SECTION 7.
- **CHECK:** Slow cranking speed. Refer to SECTION 6A in appropriate service manual.

#### AIR INTAKE SYSTEMS

- **CHECK:** Air cleaner and air intake ducts for restriction.
- **CHECK:** Restriction in turbo charger inlet duct.
- **CHECK:** Restriction in intake manifold.

#### EXHAUST SYSTEM

- **CHECK:** Exhaust system for possible restriction. Refer to SECTION 3.

#### ADDITIONAL CHECKS

- **CHECK:** No crank signal. Refer to SECTION 3.
- **CHECK:** Service Bulletins for PROM updates.

**SURGES AND/OR CHUGGLES**

**Definition:** Engine power variation, under steady throttle or cruise. Feels like the vehicle speeds up and slows down, with no change in the accelerator pedal.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Be sure driver understands Torque Converter Clutch (TCC) and A/C compressor operation in owners manual.
- Use a scan tool to make sure reading of VSS matches vehicle speedometer except vehicles with electronic transmissions where some variation between VSS and speedometer is normal. Refer to "DTC 24 Diagnostic Aids" in SECTION 3.

**FUEL SYSTEM**

- **CHECK:** Fuel pressure while condition exists. Refer to SECTION 4.

**ADDITIONAL CHECKS**

- **CHECK:** Control module grounds for being clean, tight, and in their proper locations.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.
- **CHECK:** Vacuum lines for kinks or leaks.
- **CHECK:** For intermittent EGR. Refer to SECTION 9.
- **CHECK:** TCC operation. Refer to SECTION 10 or SECTION 7 of the appropriate vehicle service manual.

### LACK OF POWER, SLUGGISH, OR SPONGY

(Page 1 of 2)

**Definition:** Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is partially applied.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Compare customer's vehicle with a similar unit. Make sure the customer has an actual problem.
- Remove air filter and check for dirt, or for air ducts being plugged clean or, replace as necessary.
- Transmission shift pattern and down shift operation. Refer to "Functional Test Procedure," SECTION 7 of appropriate service manual.
- Check fuel quality refer to fuel specific gravity check in SECTION 4.
- Check engine oil level and quality.

#### FUEL SYSTEM

- **CHECK:** Fuel supply to injection pump and fuel return from inspection pump. Refer to SECTION 4.
- **CHECK:** For faulty fuel injection nozzles. Refer to SECTION 4.

#### EXHAUST SYSTEM

- **CHECK:** For restricted exhaust system. Refer to SECTION 3.

#### TURBO CHARGER

- **CHECK:** For air leakage or restriction in air inlet ducts or intake manifold.
- **CHECK:** For worn or damaged turbo charger turbine wheel, shaft or compressor wheel. Refer to SECTION 6J of appropriate service manual.

## LACK OF POWER, SLUGGISH, OR SPONGY

(Page 2 of 2)

**Definition:** Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is pushed down part way.

### ADDITIONAL CHECKS

- **CHECK:** Control module grounds for being clean, tight, and in their proper location. Refer to "Component Locations" in SECTION 1.
- **CHECK:** EGR operation for being open or partly open all the time. Refer to SECTION 9.
- **CHECK:** Torque Converter Clutch (TCC) operation. Refer to SECTION 10 or SECTION 7 of the appropriate vehicle service manual.
- **CHECK:** A/C operation. Refer to SECTION 3.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.

### ENGINE MECHANICAL

- **CHECK:** Engine compression, valve timing, and for proper or worn camshaft. Refer to SECTION 6A of the appropriate service manual.

### FUEL KNOCK/COMBUSTION NOISE

**Definition:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

#### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Make sure the customer has an actual problem.
- Check fuel quality. Refer to "Specific Gravity Check" in SECTION 4.

#### FUEL SYSTEM

- **CHECK:** For air leaks in fuel supply to injection pump. Refer to "Fuel System Diagnosis" in SECTION 4.
- **CHECK:** Injection pump static timing. Refer to SECTION 4.
- **CHECK:** Injection nozzles. Refer to SECTION 4.

#### SENSOR

- **CHECK:** Engine Coolant Temperature (ECT) sensor - Using a scan tool, compare engine coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reading is 5 degrees greater than or less than ambient air temperature on a cold engine, check for high resistance in coolant sensor circuit or sensor itself. Refer to "DTC 15" in SECTION 3 and compare resistance values.

#### ENGINE MECHANICAL

- **CHECK:** For incorrect basic engine parts such as cam, heads, pistons, etc.
- **CHECK:** For excessive oil entering combustion chamber.

#### ADDITIONAL CHECKS

- **CHECK:** Service Bulletins for PROM updates.

**POOR FUEL ECONOMY**

**Definition:** Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

**PRELIMINARY CHECKS**

- Refer to "Important Preliminary Checks."
- Check air cleaner element (filter) for dirt or being plugged.
- Visually (physically) check: Vacuum hoses for splits, kinks, and proper connections.
- Perform "On-Board Diagnostic System Check."
- Check owners driving habits.
  - Is A/C "ON" full time (Defroster mode "ON")?
  - Are tires at correct pressure?
  - Are excessively heavy loads being carried?
  - Is acceleration too much, too often?
- Suggest owner fill fuel tank and recheck fuel economy.
- Suggest driver read "Important Facts on Fuel Economy" in Owners Manual.

**FUEL SYSTEM**

- **CHECK:** Fuel type, quality. Refer to "Diagnosis" in SECTION 4.
- **CHECK:** Fuel pressure. Refer to "CHART A-6" in SECTION 3.

**COOLING SYSTEM**

- **CHECK:** Engine coolant level.
- **CHECK:** Engine thermostat for faulty part (always open) or for wrong heat range. Refer to SECTION 6B1 of appropriate service manual.

**ADDITIONAL CHECKS**

- **CHECK:** Transmission shift pattern.
- **CHECK:** TCC operation - Refer to SECTION 10 or SECTION 7 of appropriate vehicle service manual. A scan tool should indicate an RPM drop when the TCC is commanded "ON."
- **CHECK:** For proper calibration of speedometer.
- **CHECK:** For dragging brakes. Refer to SECTION 5 of the appropriate service manual.



### EXCESSIVE SMOKE

(Page 1 of 2)

**Definition:** White, black, gray or blue smoke under load or at idle hot or cold engine.

### PRELIMINARY CHECKS

- Refer to "Important Preliminary Checks."
- Make sure the customer has an actual problem.
- Check fuel quality. Refer to "Specific Gravity Check" in SECTION 4.

### FUEL SYSTEM

- **CHECK:** For air leaks in fuel supply to injection pump. Refer to "Fuel System Diagnosis" in SECTION 4.
- **CHECK:** Injection pump timing. Refer to SECTION 4.
- **CHECK:** Injection nozzles. Refer to SECTION 4.

### SENSOR

- **CHECK:** Engine Coolant Temperature (ECT) sensor - Using a scan tool, compare engine coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reading is 5 degrees greater than or less than ambient air temperature on a cold engine, check for high resistance in coolant sensor circuit or sensor itself. Refer to "DTC 15" in SECTION 3 and compare resistance values.
- **CHECK:** Glow plug system operation. Refer to SECTION 7.
- **CHECK:** Exhaust Gas Recirculation (EGR) system operation. Refer to SECTION 9.

**EXCESSIVE SMOKE****(Page 2 of 2)**

**Definition:** White, black, gray or blue smoke under load or at idle hot or cold engine.

**AIR INTAKE SYSTEM**

- **CHECK:** Air cleaner and air intake ducts for restriction.
- **CHECK:** Restriction in turbo charger inlet duct.
- **CHECK:** Restriction in intake manifold.

**ENGINE MECHANICAL**

- **CHECK:** For incorrect basic engine parts such as cam, heads, pistons, ect.
- **CHECK:** For excessive oil entering combustion chamber.

**ADDITIONAL CHECKS**

- **CHECK:** Service Bulletins for PROM updates.

**BLANK**

## SECTION 3

# CONTROL MODULE SYSTEM

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## GENERAL DESCRIPTION

The control module system has a computer, Powertrain Control Module (PCM) to control fuel delivery, timing, and some emission control systems.

The control module system, monitors a number of engine and vehicle functions (Figure 3-1) and controls the following operations:

- Fuel control.
  - Fuel injection timing.
  - Exhaust gas recirculation.
  - Transmission shift and shift quality functions.
- Specific transmission control diagnostics are covered in SECTION 10 of this service manual.

### POWERTRAIN CONTROL MODULE (PCM)

#### Figure 3-2

The diesel Powertrain Control Module (PCM) is located in the passenger compartment and is the control center of the control module system. The PCM used on the electronic fuel injected 6.5L diesel is referred to as PCME.

The PCM constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational

problems, alert the driver through the MIL (Service Engine Soon), and store one or more DTCs which identify the problem areas to aid the technician in making repairs. See diagnosis section for more information.

The PCM is designed to process the various input information (Figure 3-1) and then sends the necessary electrical responses to control fuel delivery, timing and other emission control systems. The input information has an interrelation to more than one output, therefore, if the one input failed it could effect more than one systems operation.

### PCM Learning Ability

The PCM has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected to clear DTCs, or for repair, the "learning" process has to begin all over again.

A change may be noted in the vehicle's performance. To "teach" the vehicle, make sure the engine is at operating temperature, and drive at part throttle, with moderate acceleration and idle conditions, until normal performance returns.

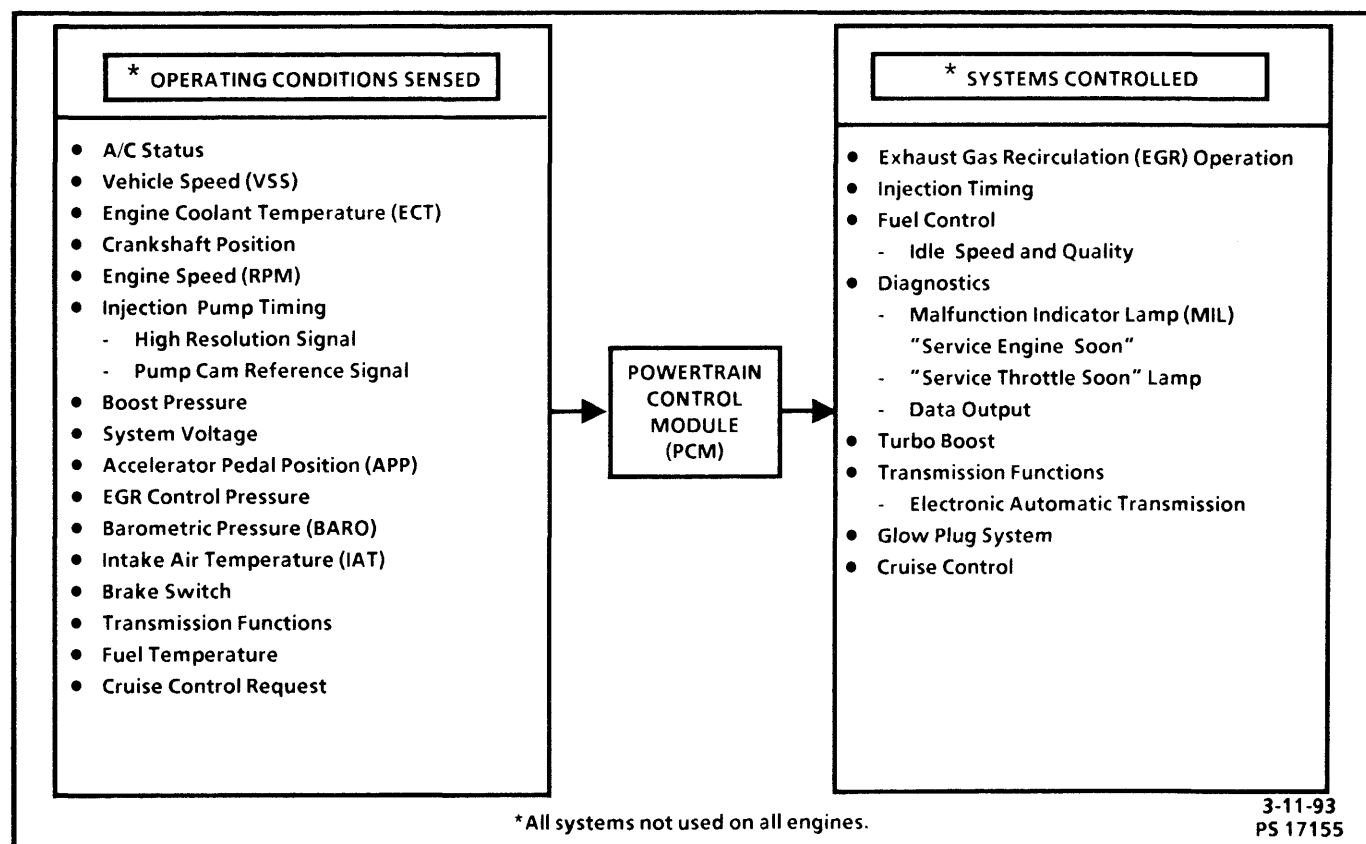


Figure 3-1 - Control Module System

### 3-4 DRIVEABILITY AND EMISSIONS (DIESEL)

**NOTICE:** The PCM must be maintained at a temperature below 85°C (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85°C (185°F). Therefore, it is recommended that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature processes.

#### Electrostatic Discharge Damage

Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

**NOTICE:** To prevent possible Electrostatic Discharge damage:

- Do Not touch the PCM connector pins or soldered components on the PCM circuit board.
- When handling a PROM, Do Not touch the component leads, and Do Not remove integrated circuit from carrier.
- Be sure to follow the guidelines listed below if servicing any of these electronic components.
  1. Do not open the replacement part package until it is time to install the part.
  2. Avoid touching electrical terminals of the part.
  3. Before removing the part from its package, ground the package to a known good ground on the vehicle.
  4. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance.

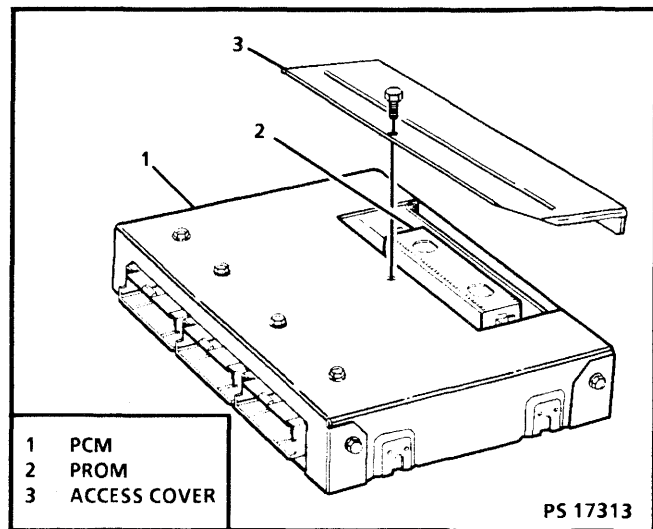


Figure 3-2 - Powertrain Control Module

#### PCM FUNCTION

The PCM supplies a buffered 5 or 12 volts to power various sensors or switches. This is done through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, the use of a 10 megohm input impedance digital voltmeter is necessary to assure accurate voltage readings.

The input/output devices in the PCM include analog to digital converters, signal buffers, counters, and special drivers. The PCM controls output circuits such as the inject solenoids, etc. by controlling the ground circuit through transistors or a device called a driver in the PCM.

#### MEMORY

There are three types of memory storage within the PCM: ROM, RAM and PROM.

##### ROM

Read Only Memory (ROM) is a permanent memory that is physically soldered to the circuit boards within the PCM. The ROM contains the overall control algorithms. Once the ROM is programmed, it cannot be changed. The ROM memory is non-volatile, and does not need power to be retained.

##### RAM

Random Access Memory (RAM) is the microprocessor "scratch pad." The processor can write into, or read from this memory as needed.

This memory is volatile and needs a constant supply of voltage to be retained. If the voltage is lost, the memory is lost.

### PROM Figure 3-4

Programmable Read Only Memory (PROM) is the portion of the PCM that contains the different engine calibration information that is specific to year, model and emissions.

The PROM also contains specific calibration information used to allow fuel delivery if other parts of the PCM are damaged. The PROM is a non-volatile memory that is read only by the PCM.

While one PCM part number can be used by many vehicle lines, a PROM is very specific and must be used for the right vehicle. For this reason, it is very important to check the latest parts book and service bulletin information for the correct part number when replacing a PROM.

A PCM used for service comes without a PROM. The PROM should be retained with the vehicle following PCM replacement. The PROM from an old PCM must be carefully removed and installed in the new PCM refer to "On-Vehicle Service."

### PCM SENSORS AND INPUT SIGNALS

In addition to the PCM, the control module system has some or all of the following information sensors:

- Engine Coolant Temperature (ECT) sensor.
- Accelerator Pedal Position (APP) module.
- Optical sensor.
- Fuel temperature sensor.
- Crankshaft position sensor.
- Intake Air Temperature (IAT) sensor.
- EGR control pressure sensor.
- Barometric Pressure (BARO) sensor.
- Boost sensor.
- Vehicle Speed Sensor (VSS).

And some or all of the following input signals:

- Fuel inject signal.
- Brake switch signals.
- Glow plug signal.
- Cruise control signals.
- A/C signal.
- Automatic transmission sensors and signals.

### Engine Coolant Temperature (ECT) Sensor Figure 3-3

The Engine Coolant Temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

The PCM supplies a 5 volt signal to the Engine Coolant Temperature (ECT) sensor through a resistor in the PCM and measures the voltage. The voltage will be high when the engine is cold, and low when the engine is hot. By measuring the voltage, the PCM knows the engine coolant temperature. Engine coolant temperature affects fuel control and the glow plug system.

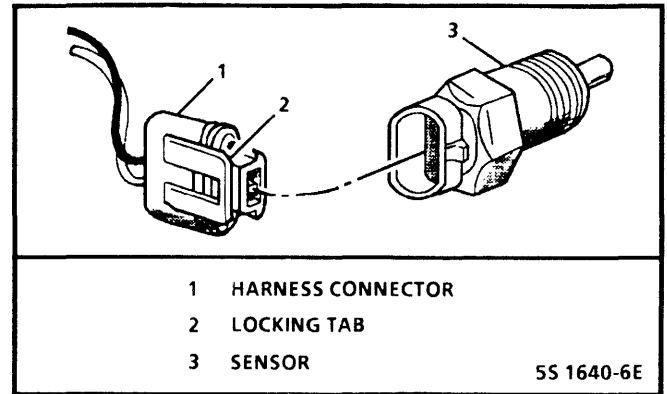


Figure 3-3 - Engine Coolant Temperature (ECT) Sensor

### Accelerator Pedal Position (APP) Module Figure 3-4

The APP module contains three potentiometers (a device for measuring an unknown voltage or potential difference by comparison to a standard voltage). Each of the APP sensors send a varying voltage to the PCM.

By monitoring the output voltage from the Accelerator Pedal Position (APP) module, the PCM can determine fuel delivery based on the accelerator pedal position (driver demand).

### Optical Sensor

The optical sensor sends what is called a High Resolution Signal and a Pump Cam signal to the PCM.

### High Resolution Signal

The PCM uses this signal to determine injection timing and for fuel control and is one of the most important inputs to the PCM.

### Pump Cam Signal

The Pump Cam signal reference pulses are used by the PCM to calculate injection timing and is one of the most important inputs to the PCM.



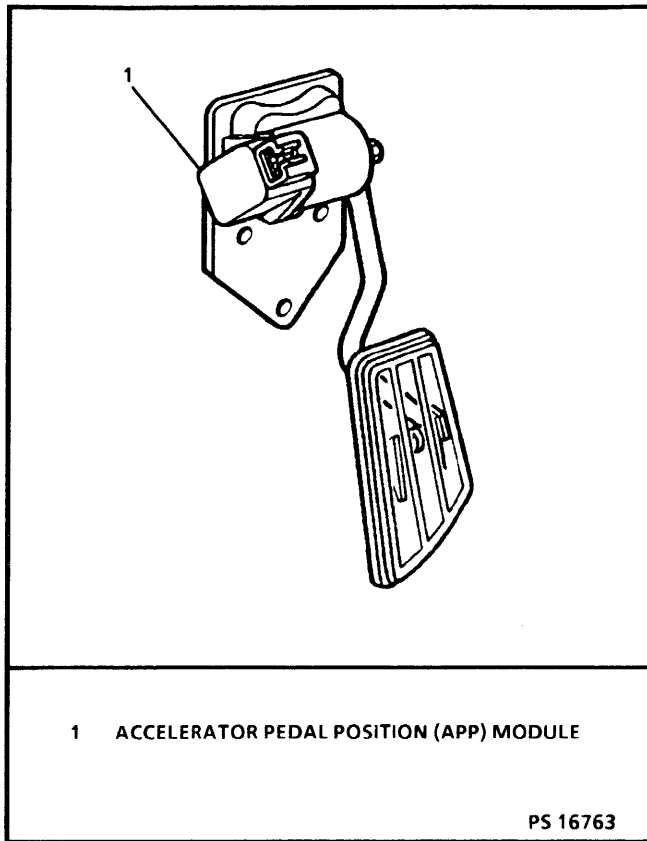


Figure 3-4 - Accelerator Pedal Position (APP) Module

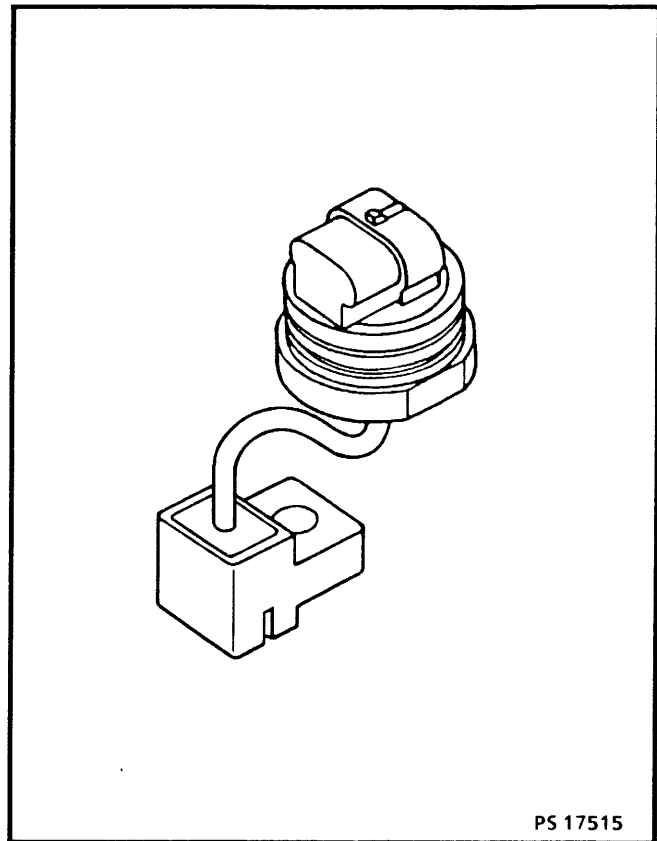


Figure 3-5 - Optical/Fuel Temperature Sensor

#### Fuel Temperature Sensor Figure 3-5

The fuel temperature sensor is part of the optical/fuel temperature sensor. The PCM uses the fuel temperature signal for fuel control.

#### Crankshaft Position Sensor

The crankshaft position sensor provides a signal which the PCM uses as reference to calculate RPM and crankshaft position.

#### Intake Air Temperature (IAT) Sensor Figure 3-6

The Intake Air Temperature (IAT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the intake manifold.

Low temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

The control module supplies a 5 volt signal to the sensor through a resistor in the control module and measures the voltage. The voltage will be high when the intake air is cold, and low when the air is hot. By measuring the voltage, the control module knows the intake air temperature.

The IAT signal is used by the control module to control fuel.

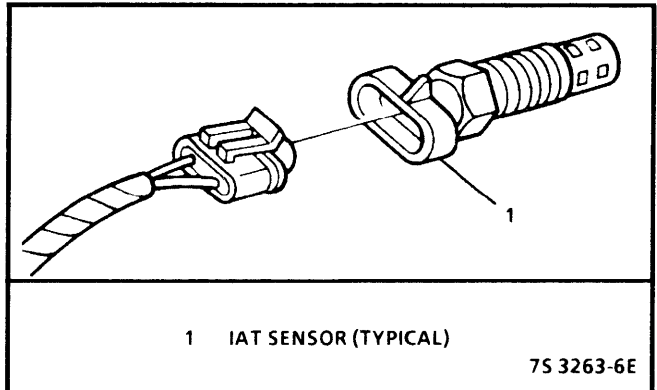


Figure 3-6 - Intake Air Temperature (IAT) Sensor

#### EGR Control Pressure/BARO Sensor Figure 3-7

On vehicles equipped with EGR, the EGR control pressure/BARO sensor, mounted on the left side of the cowl, is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. The signal is compared to the desired EGR calculated by the PCM. If there is a difference in the PCM command and what is at the EGR valve sensed by the EGR control pressure/BARO sensor on vehicles not equipped with EGR this sensor is used only to measure BARO, the PCM makes minor adjustments to correct.

When a major difference is sensed, the PCM recognizes a fault and sends a maximum EGR signal. This sensor is also used to measure barometric pressure (BARO) under certain conditions, which allows the PCM to automatically adjust for different altitudes.

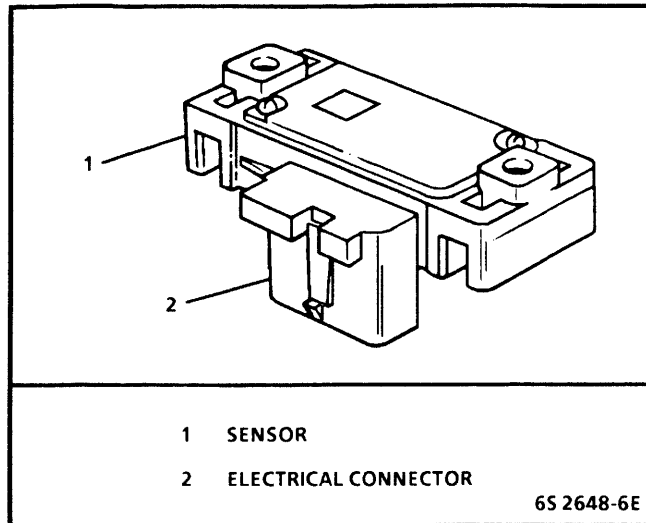


Figure 3-7 - EGR Control Pressure/BARO Sensor

### Boost Sensor Figure 3-8

The boost sensor measures the changes in the intake manifold pressure. The boost sensor converts engine load and speed changes, then converts the change in readings to voltage output.

The PCM sends a 5 volt reference signal to the boost sensor. As the manifold pressure changes, the electrical resistance of the boost sensor also changes. By monitoring the sensor output voltage, the PCM detects the boost pressure. A high pressure (high voltage) requires more fuel. A lower pressure (low voltage) required less fuel.

The control module uses the boost pressure signal to control fuel delivery.

### Vehicle Speed Sensor (VSS)

The VSS is attached to the output shaft housing. This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth pressed on an output shaft. As the rotor interrupts the magnetic field an AC voltage is generated in the circuit.

### Vehicle Speed Signal (VSS) Buffer Module

The VSS buffer module is an electronic device. The VSS buffer module process inputs from the vehicle speed sensor and outputs various signals. The VSS buffer module outputs a 4000 pulse per mile signal. This signal is used by the PCM to determine vehicle speed. The PCM uses vehicle speed signal input for cruise control and fuel cutoff. The VSS buffer module is matched to the vehicle based on transmission, final drive ratio and tire size. The VSS buffer module is located behind the instrument panel.

### Fuel Inject Signal

The fuel injector driver receives an inject command signal from the PCM and provides a current regulated output to the fuel solenoid that controls injection. It also returns an injection pulse width signal back to the PCM to inform it when the fuel solenoid has actually seated.

### Brake Switch Signals

The TCC normally closed brake switch supplies a B+ signal into the PCM. The signal voltage is opened when the brakes are applied.

The cruise control normally open brake switch supplies a B+ signal to the PCM when the brake is applied. These signals are used by the PCM to control transmission and cruise control functions. The brake switches are part of the stoplamp switch.

### Glow Plug Signal

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures.

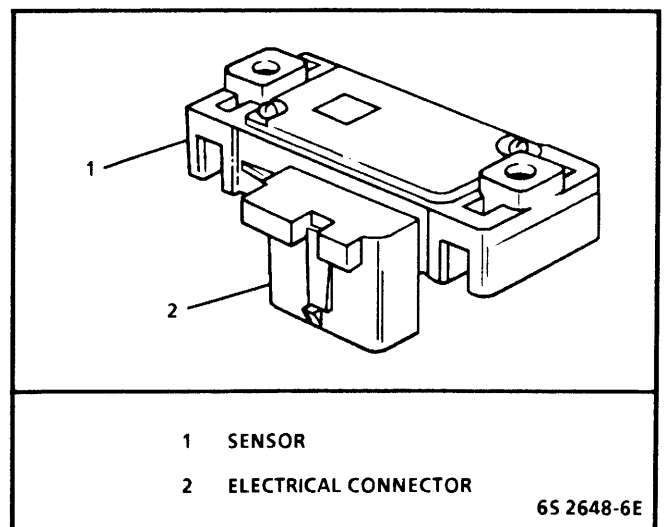


Figure 3-8 - Boost Sensor

### **3-8 DRIVEABILITY AND EMISSIONS (DIESEL)**

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The glow plugs are heated before and during cranking, as well as initial engine operation. The PCM monitors the glow plug relay output.

#### **Cruise Control Signal**

The cruise control switches are part of the multifunction turn signal lever. These switches enable the driver to control the cruise on/off, set/coast and resume/accel signals. These signals are inputs to the fuel control portion of the PCM and allow the PCM to maintain a desired vehicle speed under normal driving conditions.

#### **A/C Signal**

This signal indicated that the A/C compressor clutch is engaged. The PCM uses this signal to adjust the idle speed.

#### **Automatic Transmission Sensors and Signals**

Refer to SECTION 10 of this service manual for a description of automatic transmission sensors and signals.

## DIAGNOSIS

### DIAGNOSTIC INFORMATION

The diagnostic "tree" charts and functional checks in this manual are designed to locate a faulty circuit or component through logic based on the process of elimination.

The charts are prepared with the requirements that the vehicle functioned correctly at the time of assembly and that there are no multiple failures.

The PCM performs a continual self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The PCM's language for communicating the source of a malfunction is a system of Diagnostic Trouble Codes (DTCs). The DTCs are two digit numbers that can range from 12 to 99. When a malfunction is detected by the PCM, a DTC is set and the Malfunction Indicator Lamp (MIL) is illuminated.

#### Malfunction Indicator Lamp (MIL) "Service Engine Soon"

This light is on the instrument panel and has the following functions:

- It informs the driver that a problem has occurred and that the vehicle should be taken in for service as soon as reasonably possible.
- It displays DTCs stored by the PCM which help the technician diagnose system problems.

As a bulb and system check, the light will come "ON" with the key "ON" and the engine not running. When the engine is started, the light will turn "OFF." If the light remains "ON", the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a DTC will remain stored in the PCM.

When the light remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, an "On-Board Diagnostic (OBD) System Check" must be performed. This check will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

#### "Service Throttle Soon" Lamp

This light is on the instrument panel and has the following functions:

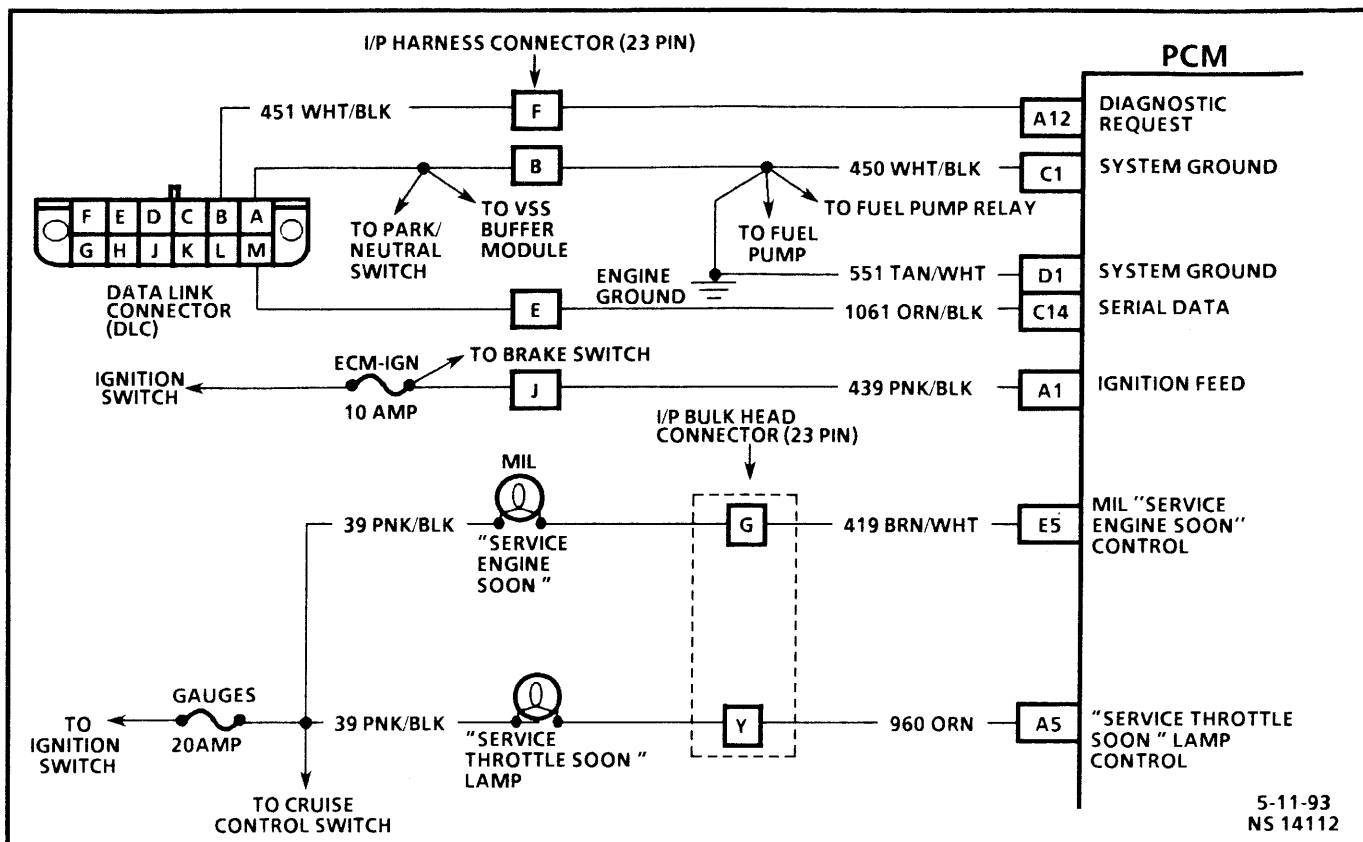
- It informs the driver that a problem has occurred in the Accelerator Pedal Position (APP) circuit and the vehicle should be taken in for service as soon as reasonably possible.
- If APP DTCs are stored by the PCM, the MIL will display these. The "Service Throttle Soon" Lamp will not display DTCs.

As a bulb and system check, the light will come "ON" with the key "ON" for 2 seconds. When the engine is started, the light will turn "OFF." If the light remains "ON," the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a DTC will remain stored in the PCM.

When the light remains "ON" while the engine is running, or when a malfunction is suspected, an "On-Board Diagnostic (OBD) System Check" must be performed. This check will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

### ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

After the visual/physical underhood inspection, the on-board diagnostic system check, is the starting point for all diagnostic procedures or finding the cause of an emission test failure.



## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)

### Circuit Description:

The "On-Board Diagnostic (OBD) System Check" is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, this will direct the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it properly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

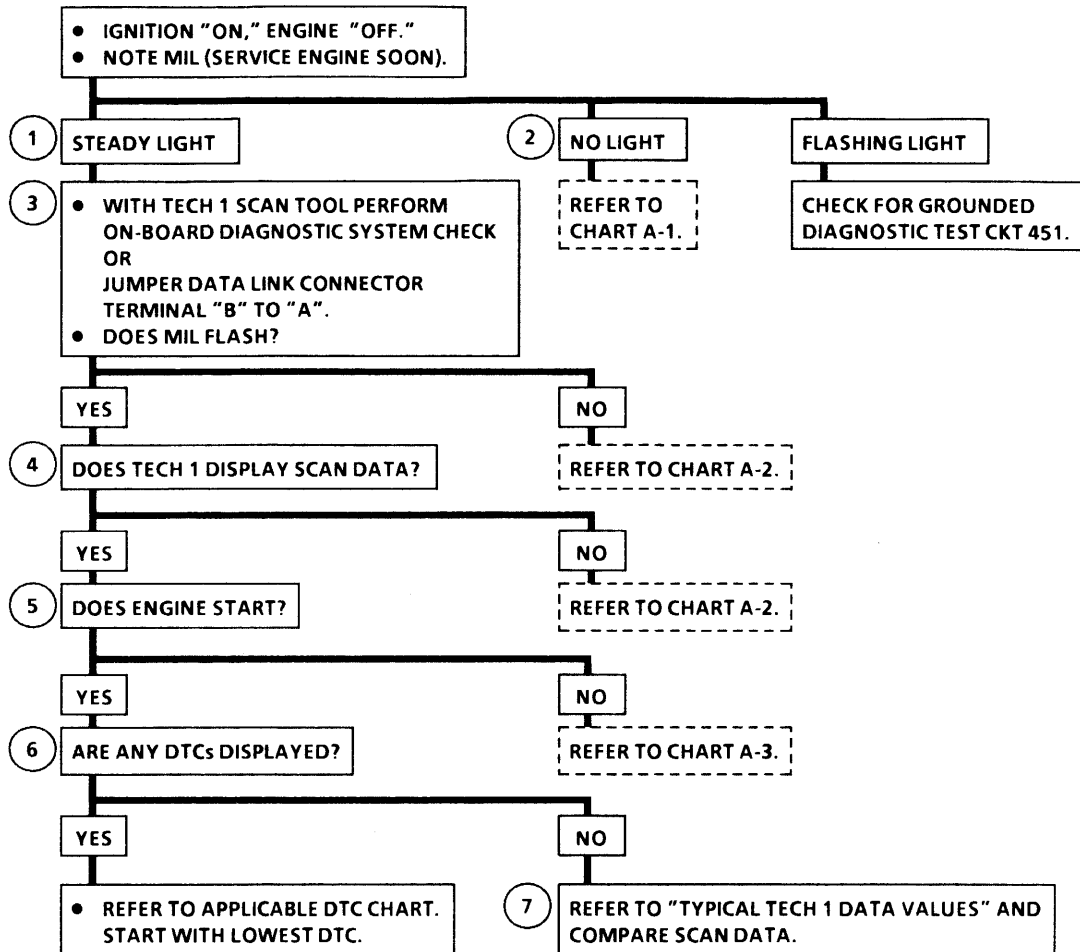
1. When the ignition switch is cycled to "ON," the MIL should turn "ON" briefly, then "OFF" briefly, then remain "ON" steady. This sequence will determine that the vehicle diagnostics are operational.
2. This step will isolate if the customer complaint is a MIL or driveability problem.
3. Although the control module is powered up, a symptom could exist because of a system fault.
4. Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
5. Although the PCM is powered up, a "Crank But Will Not Run" symptom could exist because of a PCM or system problem.

6. This step will isolate if the customer complaint is a MIL or driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM or PCM.
7. Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. A base engine problem (i.e., advanced cam timing may substantially alter sensor values).

**NOTICE:** The PCM utilizes a 24 pin "Pink" connector, a 32 pin "Pink" connector and a 32 pin "Blue" connector. The 24 pin "Pink" connector is labeled "A" and "B", the 32 pin "Pink" connector is labeled "C" and "D" and the 32 pin "Blue" connector is labeled "C" and "D". When referencing PCM connector pin outs, the "Blue" PCM connector will be referred to as the "E" and "F" connector.

# ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

(WITH TECH 1 SCAN TOOL)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

### 3-12 DRIVEABILITY AND EMISSIONS (DIESEL)

If after completing the On-Board Diagnostic (OBD) system check and finding the Tech 1 diagnostics functioning properly and no DTC(s) displayed, the "Typical Tech 1 Engine Data Values" may be used for comparison with values obtained on the vehicle being diagnosed. The "Typical Tech 1 Engine Data Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosing. For more description on the values and use of the Tech 1 to diagnosis PCM inputs, refer to the applicable diagnosis section in "Component Systems." If all varies are within the range illustrated, refer to "Symptoms," section.

#### TYPICAL TECH 1 ENGINE DATA VALUES

| Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Accessories Off |                                                                 |                                         |                          |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------|--------------------------|
| <u>SCAN Position</u>                                                                 | <u>Units Displayed</u>                                          | <u>Typical Data Value</u>               | <u>Refer To Section:</u> |
| ENGINE SPEED                                                                         | RPM                                                             | ± 100 RPM from desired                  |                          |
| DESIRED IDLE                                                                         | RPM                                                             | PCM commanded (based on temp.)          |                          |
| ENG COOL TEMP.                                                                       | C°/F°                                                           | 85°C - 105°C (185°F - 221°F)            |                          |
| INTAKE AIR TEMP.                                                                     | C°/F°                                                           | 10°C - 87°C (50°F - 194°F)              |                          |
|                                                                                      |                                                                 | (depends on underhood temperature)      |                          |
| BARO                                                                                 | kPa/Volts                                                       | 70 - 100/3.5-4.5 (varies with altitude) |                          |
| EGR PRESSURE                                                                         | kPa/Volts                                                       | 50 - 100 kPa/2.8 - 3.0V (varies)        |                          |
| EGR DUTY CYCLE                                                                       | Percentage                                                      | 50 - 100% (may vary)                    |                          |
| WASTEGATE SOL DC                                                                     | Percentage                                                      | 60 - 100% (may vary)                    |                          |
| BOOST PRESSURE                                                                       | kPa/Volts                                                       | 99 - 160 kPa/1.0-2.5 volts              |                          |
| FUEL TEMPERATURE                                                                     | C°/F°                                                           | 21°C-43°C (70°F - 110°F)                |                          |
| FUEL RATE                                                                            | Millimeters                                                     | 0-40 mm (varies with engine load)       |                          |
| GLOW PLUG RELAY                                                                      | Volts                                                           | 12.0-14.5                               |                          |
| GLOW PLUG VOLTS                                                                      | Volts                                                           | 12.0-14.5                               |                          |
| DESIRED INJ TIM                                                                      | # of degrees                                                    | Varies                                  |                          |
| MEASURED INJ TIM                                                                     | # of degrees                                                    | Varies                                  |                          |
| THROTTLE ANGLE                                                                       | Percentage                                                      | 0%                                      |                          |
| ACCEL PED POS 1                                                                      | Volts                                                           | 0.35-0.95V                              |                          |
| ACCEL PED POS 2                                                                      | Volts                                                           | 4.0-4.5V                                |                          |
| ACCEL PED POS 3                                                                      | Volts                                                           | 3.6-4.0V                                |                          |
| CRUISE CONTROL                                                                       | On/Off                                                          | Off                                     |                          |
| C/C BRAKE SWITCH                                                                     | Open/Closed                                                     | Open                                    |                          |
| TCC BRAKE SWITCH                                                                     | Closed/Open                                                     | Closed                                  |                          |
| TDC OFFSET                                                                           | # of degrees                                                    | 0-2.02 (varies)                         |                          |
| A/C CLUTCH                                                                           | On/Off                                                          | Off                                     |                          |
| SYSTEM VOLTAGE                                                                       | Volts                                                           | 12.0 - 14.5                             |                          |
| ENG SHUT OFF                                                                         | On/Off                                                          | On                                      |                          |
| INJ PULSE WIDTH                                                                      | Milliseconds                                                    | 1.70-1.90 ms (may vary)                 |                          |
| CRANK REF MISSED                                                                     | Counts                                                          | 0                                       |                          |
| CAM REF MISSED                                                                       | Counts                                                          | 0                                       |                          |
| 1-2 SOL/2-3 SOL                                                                      | On/Off                                                          | On/On                                   |                          |
| TCC SOLENOID                                                                         | On/Off                                                          | Off                                     |                          |
| 4WD LOW SWITCH                                                                       | On/Off                                                          | Off                                     |                          |
| TRANS RANGE SW                                                                       | Invalid, Rev<br>Drive 4, Drive 3,<br>Drive 2, Low,<br>Park/Neut | Park/Neut                               |                          |
| CALIBRATION ID                                                                       | 0-9999                                                          | Internal                                |                          |
| TIME FROM START                                                                      | Hrs/Mins/Sec                                                    | Varies                                  |                          |

## ENGINE TECH 1 DATA DEFINITIONS

A list of each data message displayed on the Tech 1 scan tool will be explained in two groups; "Engine" or "Transmission." This information will assist in emission or driveability problems. The displays can be viewed while the vehicle is being driven. Always perform the "On-Board Diagnostic (OBD) System Check" first. The "OBD System Check" will confirm proper system operation.

For transmission data refer to SECTION 10.

### ENGINE DATA

**ENGINE SPEED - Range 0-9999 RPM** - Engine speed is computed by the PCM from the distributor reference input (low resolution circuit). It should remain close to desired idle under various engine loads with engine idling.

**DESIRED IDLE - Range 0-3187 RPM** - The idle speed that is commanded by the PCM. The PCM will compensate for various engine loads based on engine coolant temperature to keep the engine at the desired speed.

**ENG COOL TEMP - Range -40°C to 151°C, -40°F to 304°F** - The Engine Coolant Temperature (ECT) sensor is mounted in the coolant pump and sends engine temperature information to the PCM. The PCM supplies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the PCM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

**INTAKE AIR TEMP - Range -40°C to 151°C, -40°F to 304°F** - The PCM converts the resistance of the intake air temperature sensor to degrees. Intake Air Temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

**BARO - Range 10-105 kPa/0.00-5.00 Volts** - The BARO reading displayed is determined from the MAP sensor at ignition "ON," engine "OFF," and WOT conditions. The BARO reading displayed represents barometric pressure and is used to compensate for altitude differences.

**THROTTLE ANGLE - Range 0 - 100%** - Computed by the PCM from APP module voltage (throttle position) and should display 0% at idle and 100% at wide open throttle. Refer to DTC 21 if TP sensor angle is not 0% at idle.

**ACCELERATOR PEDAL POSITION (APP 1) - Range 0-5 Volts** - Used by the PCM to determine the amount of throttle demanded by the driver. Should read about .35-.95 volts at idle to above 4.0 volts at Wide Open Throttle (WOT).

**ACCELERATOR PEDAL POSITION (APP 2) - Range 0-5 Volts** - Used by the PCM to determine the amount of throttle demanded by the driver. Should read about 4.5 volts at idle and steadily decrease to about 1.0 volt at wide open throttle.

**ACCELERATOR PEDAL POSITION (APP 3) - Range 0-5 Volts** - Used by the PCM to determine the amount of throttle demanded by the driver. Should read about 4.0 volts at idle and steadily decrease to about 2.5 volts at wide open throttle.

**CRANK REFERENCE PULSE - Range 0-8 Counts** - This is used by the PCM to determine crankshaft position. The scan tool will display the number of crank pulses missed. At idle it should read 0.

**CAM REFERENCE PULSE - Range 0-8 Counts** - This is used by the PCM to determine injection pump cam position. The scan tool will display the number of cam pulses missed. At idle it should read 0.

**BOOST PRESSURE - Range 10-200 kPa/0-5.0 Volts** - The amount of turbo boost pressure in the intake manifold. This is measured in kPa and volts. True boost pressure is determined by subtracting BARO from the actual reading.

**FUEL TEMP - Range -40°C to 151°C, -40°F to 304°F** - There is a thermistor located in the high resolution sensor that determines fuel temperature. When the sensor is cold (internal resistance high) the PCM monitors a high signal voltage which it interprets as low fuel temperature. As the sensor warms (internal resistance low) the voltage signal will decrease and the PCM will interpret the low voltage as warm fuel.

**FUEL RATE - Range 0-80 mm** - This reading is displayed in millimeters (mm). This is the amount of fuel the PCM is requesting.



### 3-14 DRIVEABILITY AND EMISSIONS (DIESEL)

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**GLOW PLUG RELAY - Range 0-25.5 Volts** - This is the amount of volts the PCM is requesting to be sent to the glow plug relay. The PCM will cycle the voltage "ON" and "OFF." Cycling timing will increase when engine is cold and decrease at warmer temperatures.

**GLOW PLUG VOLTS - Range 0-25.5 Volts** - This is used by the PCM to determine if there is voltage coming out of the relay and going towards the glow plugs. During normal operation the volts reading will be lower than glow plug relay voltage because of the high resistance in the glow plugs.

**DESIRED INJECTION TIMING - Range 0-25.5 Volts** - The amount of injection timing requested by the PCM.

**MEASURED INJECTION TIMING - Range 0-25.0 Degrees** - Current actual injection timing.

**TDC OFFSET - Range 0-4.00 Degrees** - The PCM has the ability to determine the amount of offset needed to bring the engine to top dead center. This is used by the PCM to determine proper injection timing and fuel delivery. This value may be displayed as a positive or negative number.

**EGR DESIRED POSITION - Range 10-103 kPa** - The PCM command for EGR vacuum that is desired.

**EGR ACTUAL POSITION - Range 10-103 kPa** - Current actual EGR vacuum.

**4WD LOW SWITCH** - Indicator to PCM when driver selects 4WD.

**MPH/km/h** - Vehicle speed is a PCM internal parameter. It is computed by timing pulses coming from the Vehicle Speed Sensor (VSS). Vehicle speed is used in checking TCC lock-up speed or speedometer accuracy. Speed is displayed in both Miles Per Hour (mph) and Kilometers Per Hour (km/h).

**PROM ID** - The PROM identification parameter describes the particular PROM used in the PCM being tested. The PROM contains the PCM program. PROM ID is used when it is necessary to replace the PROM. PROM ID must be specified when ordering new PROMs. PROM ID should not be confused with "Part Number."

**INJECTOR PULSE WIDTH - Tech 1 Range 0.0-4.00 milliseconds** - Indicates the closure time of the fuel solenoid. When engine load is increased, injector pulse width will fluctuate.

**EGR DUTY CYCLE - Range 0-100%** - The PCM cycles the EGR solenoid valve "ON" and "OFF." The "ON" time (duty cycle) of the EGR solenoid valve, expressed as a percent, determines how much the exhaust gas is recirculated.

**A/C REQUEST - Tech 1 displays "YES"/"NO"** - Represents if the A/C request from the control head is being received by the PCM.

**PARK/NEUTRAL POS - Tech 1 displays - "P-N"-- or -"R-DL"** - "P-N"-- displayed indicates that the gear select lever is in park or neutral.

**CRUISE CONTROL - Tech 1 Displays "OFF"/"ON"** - This will indicate when the cruise control has been enabled. This signal is used by the PCM to adjust TCC engagement scheduling.

**1 - 2 SHIFT SOL - Tech 1 displays "ON"/"OFF"** - When the transmission is in first or fourth gear, the Tech 1 should display "ON." When the transmission is in second or third gear, the Tech 1 should indicate "OFF."

**2 - 3 SHIFT SOL - Tech 1 displays "ON"/"OFF"** - When the automatic transmission is in first or second gear, the Tech 1 should indicate "ON." When the transmission is in third or fourth gear, the Tech 1 should display "OFF."

**C/C BRAKE SWITCH - Tech 1 displays "OPEN"/"CLOSED"** - When the brake pedal is applied, the switch sends a signal to the PCM to disengage cruise control.

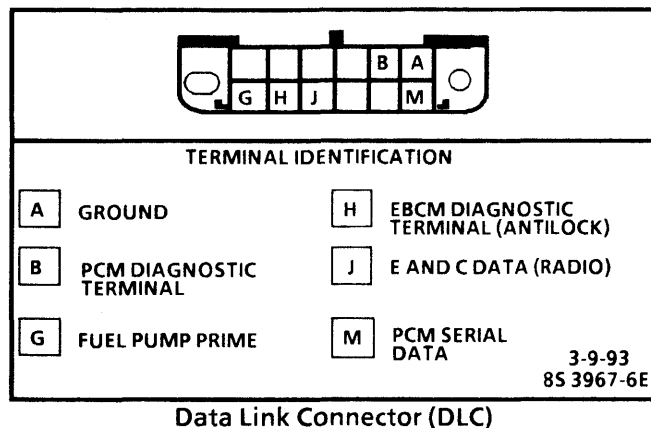
**TCC BRAKE SWITCH - Tech 1 displays "CLOSED"/"OPEN"** - When the brake pedal is applied, the switch sends a signal to the PCM to disengage the TCC solenoid.

**TIME FROM START - Range 0:00:00-18:12:15 HR/MIN/SEC** - A measure of how long the engine has been operating. When the ignition is cycled to "OFF" the value is reset to zero.

## TECH 1 SCAN TOOL

The diagnostic procedures in this manual assume the use of a Tech 1 scan tool. Since the Tech 1, produced by Expertec, is able to perform functions, such as, bidirectional communication that other scan tools are unable to perform, it has been made an essential tool. Although, the term scan tool will continue to be used for simplicity's sake, we recommend the Tech 1 be used whenever possible. Explicit instructions on connecting and using the various Tech 1 functions are contained in the Tech 1 owner's manual.

The PCM can communicate a variety of information through Data Link Connector (DLC) terminal "M". This data is transmitted at high frequency which requires a scan tool for interpretation.



With an understanding of the data which the scan tool displays, and knowledge of the circuits involved, the scan tool can be very useful in obtaining information which would be more difficult or impossible to obtain with other equipment.

Scan tools do not make the use of diagnostic charts unnecessary, nor can they indicate exactly where a problem is in a particular circuit. Diagnostic tree charts incorporate diagnosis procedures using a scan tool where possible and most charts *require* the use of a scan tool when it is applicable.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

The scan tool has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the scan tool successfully for diagnosis lies in the technician's ability to understand the system being diagnosed, as well as an understanding of the scan tool's limitations.

## PCM INFORMATION MODES

The PCM has two modes for transmitting information. The following information will describe the system operation in each of the modes.

### Normal (Open) Mode

On engines that can be monitored in the "Open" mode, certain parameters can be observed without changing the engine operating characteristics. The parameters capable of being read vary with engine families.

### Diagnostic Mode

When the diagnostic terminal is grounded with the ignition "ON" and the engine "OFF," the system will enter what is called the diagnostic mode. In this mode the PCM will:

1. Display a DTC 12 by flashing the MIL.
  2. Display any stored DTC by flashing the MIL.
- Each DTC will be flashed three times.

### Reading Diagnostic Trouble Codes

The means of communicating with the control module is the Data Link Connector (DLC) (refer to Figure 3-9) located under the instrument panel and is sometimes covered by a plastic cover labeled "DIAGNOSTIC CONNECTOR." The DLC is used in the assembly plant to receive engine information to determine proper operation before it leaves the plant. The DTC(s) stored in the control module memory can be displayed either through the Tech 1 scan tool, a hand-held diagnostic scanner plugged into the DLC connector, or by counting the number of flashes of the Malfunction Indicator Lamp (MIL) "Service Engine Soon" when the diagnostic terminal of the DLC is grounded. The DLC terminal "B" (diagnostic terminal) is the second terminal from the right of the DLC top row. The terminal is most easily grounded by connecting it to terminal "A" (internal control module ground), which is located to the right of terminal "B" on top row of the DLC.

### DTC 12

When terminals "A" and "B" have been connected, the ignition switch turned to the "ON" position with the engine not operating, the MIL (Service Engine Soon) should flash DTC 12 three times consequently. This will be the following flash sequence: "flash, pause, flash-flash, long pause, flash, pause, flash-flash, long pause, flash, pause, flash-flash." DTC 12 indicates that the control module diagnostic system is operating properly.

## 3-16 DRIVEABILITY AND EMISSIONS (DIESEL)

If the DTC 12 is not indicated, a fault is present within the diagnostic system itself, and should be addressed by consulting the appropriate diagnostic chart in this section.

The malfunction indicator lamp will indicate a Diagnostic Trouble Code (DTC) three times if a DTC is present, or it will simply continue to output DTC 12. If more than one diagnostic trouble code has been stored in the control module memory, the DTC(s) will be displayed from the lowest to the highest with each DTC being displayed three times.

### Clearing Diagnostic Trouble Codes

To clear the DTC(s) from the memory of the control module, either to determine if the malfunction will occur again or because repair has been completed, the Tech 1 scan tool should be used to clear the DTC(s). If a scan tool is not available the following must be performed when all repairs have been completed. This will allow all DTC(s) to be cleared.

1. Ignition "OFF."
2. Ground diagnostic terminal "A" to "B" of DLC.
3. Ignition "ON."
4. Fully apply brake pedal.
5. Fully apply accelerator pedal.
6. Check MIL (Service Engine Soon) for DTC 12.
7. Release brake pedal.
8. Release accelerator pedal.
9. Check MIL (Service Engine Soon) for DTC 12.
10. Remove jumper from DLC connector.
11. Turn ignition "OFF."

**NOTICE:** To prevent control module damage, the key must be "OFF" when disconnecting or reconnecting module power.

### Intermittents

In case of an "Intermittent" problem, the MIL will light for ten (10) seconds and then will go out. However, the corresponding DTC will be stored in the memory of the PCM as a history DTC until DTCs have been cleared. When unexpected DTCs appear during the code reading process, one can assume that these DTCs were set by an intermittent malfunction and could be helpful in diagnosing the system.

An intermittent DTC may or may not re-set. If it is an intermittent failure, a Diagnostic Trouble Code (DTC) chart is not used. Consult the "Diagnostic Aids" on the page facing the diagnostic chart corresponding to the intermittent DTC. SECTION "2" also covers the topic of "Intermittents." A physical inspection of the applicable sub-system most often will not resolve the problem.

### Scan Tool Use With Intermittents

In some scan tool applications, the data update rate makes the tool less effective than a voltmeter, such as when trying to detect an intermittent problem which lasts for a very short time. However, the scan tool allows manipulation of wiring harnesses or components under the hood with the engine not running, while observing the scan tool readout.

The scan tool can be plugged in and observed while driving the vehicle under the condition when the MIL "Service Engine Soon" light turns "ON" momentarily or when the engine driveability is momentarily poor. If the problem seems to be related to certain parameters that can be checked on the scan tool, they should be checked while driving the vehicle. If there does not seem to be any correlation between the problem and any specific circuit, the scan tool can be checked on each position, watching for a period of time to see if there is any change in the readings that indicates intermittent operation.

The scan tool is also an easy way to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a DTC. Comparing the sensor's readings with those of a known good vehicle may uncover the problem.

The scan tool has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the scan tool successfully for diagnosis lies in the technician's ability to understand the system he is trying to diagnose as well as an understanding of the scan tool operation and limitations. The technician should read the tool manufacturer's operating manual to become familiar with the tool's operation.

### T100 - GM CAMS

The T100-GM CAMS (Computerized Automotive Maintenance System) is a computerized technician's terminal unit. When connected to a vehicle, performs engine, electronic circuits and systems test to find possible vehicle problems in the engine system or the PCM.

The terminal diagnoses as follows:

- Circuit diagnostic procedures provide information on how to isolate a problem and repair requirements.
- If no problem exists, engine performance problems are diagnosed.
- DTCs stored in the PCM are read and diagnosed by the system.

Also needed are a test light, ohmmeter, digital voltmeter with 10 megohms impedance (J 39200), vacuum gage and jumper wires for diagnosis. Special tools which are required for system service and the ones described above are illustrated in SECTION 13.

## PCM DIAGNOSIS

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section can reliably tell when a failure has occurred in the PCM. Also, a DTC 54 indicates a failure of the PCM.

If a diagnostic chart indicates that the PCM connections or PCM is the cause of a problem, and the PCM is replaced, but does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. - The diagnostic chart will say PCM connections or PCM. The terminals may have to be removed from the connector in order to check them properly.
- The PCM or PROM is not correct for the application. - The incorrect PCM or PROM may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. - This means that the problem is not present at the time the system is being checked. In this case, refer to "Driveability Symptoms" portion of the manual and make a careful physical inspection of all portions of the system involved.
- Shorted solenoid, relay coil, or harness. - Solenoids and relays are turned "ON" and "OFF" by the PCM, using internal electronic switches called "Drivers."

A shorted solenoid, relay coil, or harness will not damage the PCM, but will cause the circuit and controlled component to be inoperative. When the circuit fault is not present or has been repaired, the driver will again operate in a normal manner due to its fault protected design. If a fault has been repaired in a circuit controlled by a driver, the original PCM should be reinstalled and the circuit checked for proper operation. PCM replacement will not be necessary if the repair circuit or component now operates correctly.

J 34636 or BT-8405 testers or equivalent provide a fast, accurate means of checking for a shorted coil or a short to battery voltage.

- The PROM may be faulty. - Although the PROM rarely fails, it operates as part of the PCM. Therefore, it could be the cause of the problem. Substitute a known good PROM.
- The replacement PCM may be faulty. - After the PCM is replaced, the system should be rechecked for proper operation. If the diagnostic chart again indicates the PCM is the problem, substitute a known

good PCM. Although this is a rare condition, it could happen.

## PROM

A PROM that has failed or was installed improperly will generally set a DTC 51.

## FUEL CONTROL

Fuel delivery is controlled by the control module system.

The diagnosis of fuel control starts with "Engine Cranks But Will Not Run" CHART A-3. This chart will test the fuel system and if there is a problem, will lead you to checking the fuel lift pump, diagnosing the injection pump circuit or diagnosing the fuel system.

## PCM SENSORS AND INPUT SIGNALS

All of the sensors and input signals can be diagnosed by the use of a scan tool. Following is a short description of how the sensors and signals can be diagnosed by the use of a scan tool. A scan tool can also be used to compare the values for a normal running engine with the engine you're diagnosing. Refer to "Typical Scan Tech 1 Engine Data Values."

### Engine Coolant Temperature (ECT) Sensor

A scan tool displays engine coolant temperature in degrees (Celsius & Fahrenheit). After engine is started, the temperature should rise steadily to about 90°C (194°F) then stabilize when thermostat opens.

DTC 14 or DTC 15 indicates a failure in Engine Coolant Temperature (ECT) sensor circuit.

The DTC charts also contain a chart to check for ECT sensor resistance values relative to temperature.

### Accelerator Pedal Position (APP) Module

If the PCM has determined that there is a fault in one APP sensor, the PCM will store a current and history DTC, but, it will not turn on the "Service Throttle Soon" lamp. The vehicle and throttle pedal will operate normally if only one of the three APP sensors if found have a fault. If the PCM has determined two APP sensors are faulty, a current and history DTC will set and the PCM will turn on the "Service Throttle Soon" lamp. At this point, some engine performance will be lost. If three APP sensors malfunction, a current and history DTC will be stored, the "Service Throttle Soon" lamp will come "ON," and the PCM will only allow the vehicle to idle. If the PCM has recognized an intermittent fault (a fault not recognized by the normal APP DTC setting criteria), it will then only allow the vehicle to operate under limited performance and store a DTC 84.

### 3-18 DRIVEABILITY AND EMISSIONS (DIESEL)

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A scan tool reads APP 1 position in voltage, and should read about .50 volt while the engine is idling. Voltage should increase at a steady rate as accelerator pedal is moved to Wide Open Throttle (WOT). APP 2 position is also read in voltage, and should read about 4.5 volts at idle, and should steadily decrease to about 1.5 volts as accelerator pedal is moved to WOT. APP 3 is also read in voltage, and should read about 4.0 volts at idle, and should steadily decrease to about 2.0 volts. Its possible idle voltage may vary, because the PCM has a "learning" ability which allows it to make corrections for minor variations.

#### Pump Cam Signal

Loss of cam signal reference pulses will set a DTC 18. If the cam signal is lost while the engine is running, the fuel injection system will shift to a calculated fuel injection (backup fuel) mode based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated fuel injection mode as long as the fault is present.

See DTC 18 for further information.

#### Fuel Temperature Sensor

The scan tool displays fuel temperature in degrees (celsius/fahrenheit). DTC 42 or DTC 43 indicate a failure in the fuel temperature sensor circuit.

#### Crankshaft Position Sensor

A scan tool displays engine speed in RPM. RPM will still be displayed with a fault in this circuit. If the signal is lost while the engine is running, the fuel injection system will shift to a calculated fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the backup fuel mode as long as fault is present. See DTC 19 for further information.

#### Intake Air Temperature (IAT) Sensor

A scan tool displays temperature of the air entering the engine and should read close to ambient air temperature when the engine is cold, and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A failure in the IAT sensor circuit should set DTC 47 or 48. The DTC chart also contains a "Diagnostic Aid" to check for sensor resistance values relative to temperature.

#### EGR Control Pressure/BARO Sensor

A scan tool displays EGR pressure in volts. Low pressure (high vacuum) reads a low voltage while a high pressure (low vacuum) reads a high voltage. A failure in the EGR control pressure/BARO sensor circuit should set a DTC 31 or 33 and using the chart will find the cause of the problem. Any other failure in the EGR system should set a DTC 32, 44 or 45. On vehicles using only a BARO sensor a failure in the sensor circuit should set a DTC 31 or 33. Also refer to "EGR Control Pressure/BARO Sensor Output Check" in this section.

#### Boost Sensor

At idle, the scan tool will display boost pressure about the same reading as barometric pressure. When at a full load, with WOT the boost pressure will indicate high pressure or voltage. When at a decel with throttle closed, the boost sensor will display low pressure or voltage. The boost pressure reading is the opposite of what you would measure on a vacuum gage. When manifold pressure is high, vacuum is low. A failure in the boost sensor circuit should set a DTC 61 or 62.

#### Vehicle Speed Sensor (VSS)

A scan tool display of mph / km/h should closely match with the speedometer display. A failure in the VSS input circuit should set a DTC 24 or DTC 16.

#### Fuel Inject Signal

A scan tool will display the injection pulse width feedback in milliseconds. If the PCM detects an error in the fuel inject response time, a DTC 35 or DTC 36 will set.

#### Brake Switches

A scan tool will display the status of the brake switches. The cruise control brake switch is normally open and TCC brake switch normally closed. A malfunction in the brake switches circuit should set a DTC 37, 38 or 41.

#### Glow Plug Signal

A scan tool will display this signal in voltage. A malfunction in this system should set a DTC 29 or refer to SECTION 7 for diagnosis of the glow plug control system.

## **Cruise Control**

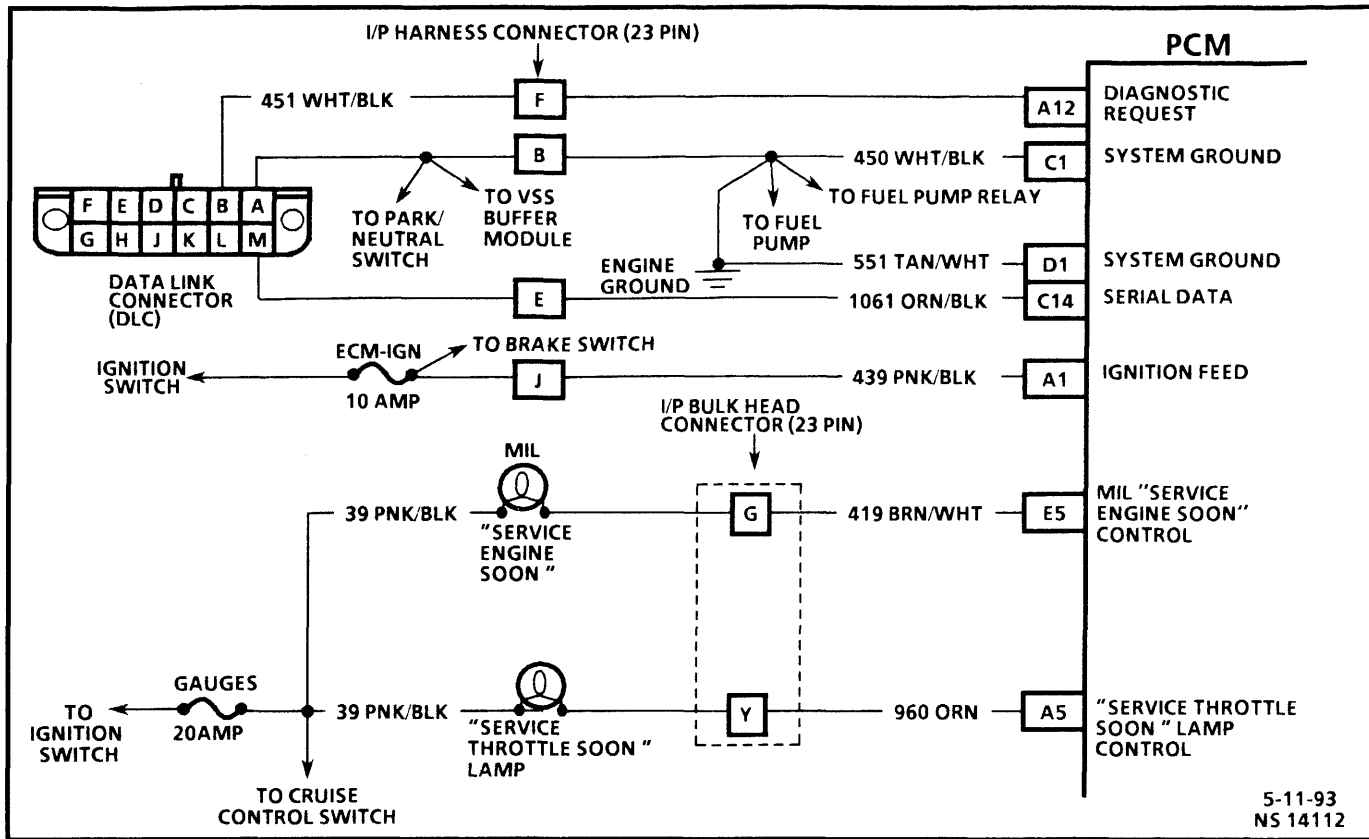
A scan tool will display cruise control "ON/OFF" status. For diagnosis of the cruise control refer to "Cruise Control Diagnosis." A malfunction in the set/coast switch circuit should set a DTC 71. A malfunction in the resume/accel switch circuit should set a DTC 76.

## **A/C Signal**

The scan tool should indicate A/C clutch "ON" when A/C is selected. Refer to "A/C Signal Diagnosis" for diagnosis of the A/C signal.

## **Automatic Transmission Sensors and Signals**

Refer to SECTION 10 of this service manual for diagnosis of automatic transmission sensors and signals.



## CHART A-1 NO MIL (SERVICE ENGINE SOON)

### Circuit Description:

There should always be a steady MIL with the ignition "ON" and engine "OFF." Switched battery voltage is supplied to the lamp. The PCM will control the lamp and turn it "ON" by providing a ground path through CKT 419.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

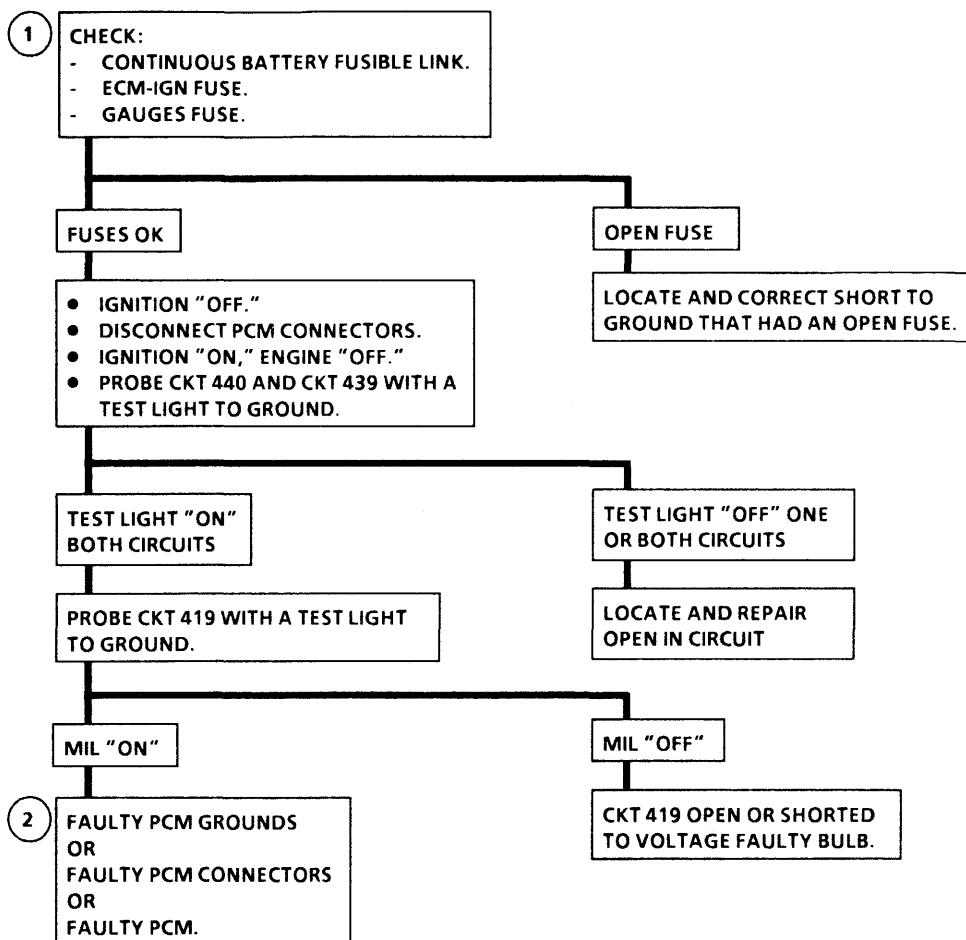
1. If the fusible link is open, refer to wiring diagrams for complete circuit.
2. Using a test light connected to 12 volts, probe each of the system ground circuits and check that a good ground is present. Refer to "PCM Terminal End View" in this section for PCM pin locations of ground circuits.

**Diagnostic Aids:** If the engine operates OK, check:

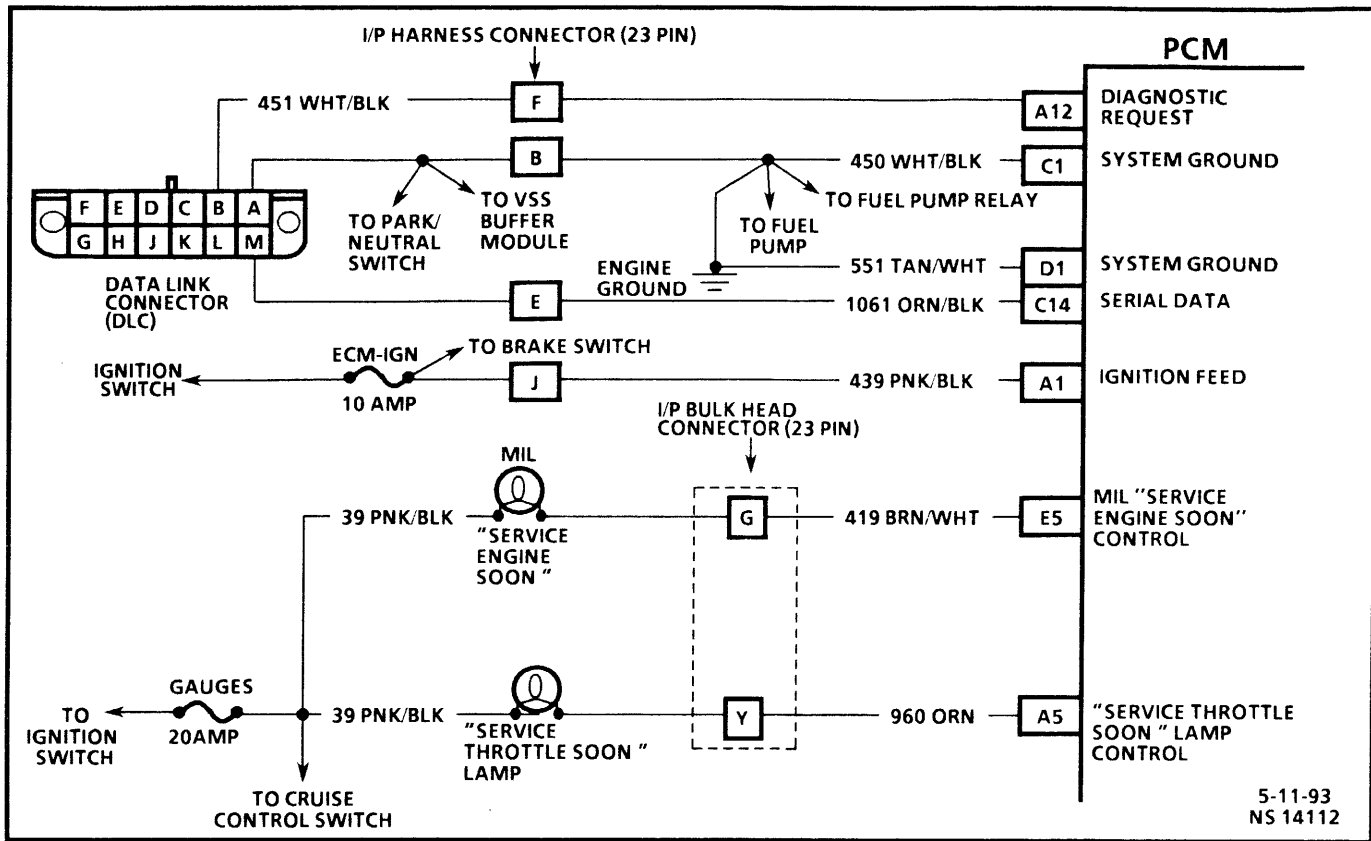
- Faulty light bulb.
- CKT 419 open.
- Gauges fuse open. This will result in no brake warning light, oil or generator lights, seat belt reminder, etc.

# CHART A-1

## NO MIL (SERVICE ENGINE SOON)







## CHART A-2

### NO SCAN DATA OR WILL NOT FLASH MIL OR MIL (SERVICE ENGINE SOON) "ON" STEADY

#### Circuit Description:

There should always be a steady Malfunction Indicator Lamp (MIL) when the ignition is "ON" and engine "OFF." Battery ignition voltage is supplied to the lamp. The PCM will turn the lamp "ON" by grounding CKT 419.

With the "diagnostic" terminal grounded, the lamp should flash a DTC 12, followed by any Diagnostic Trouble Code (DTC) stored in memory.

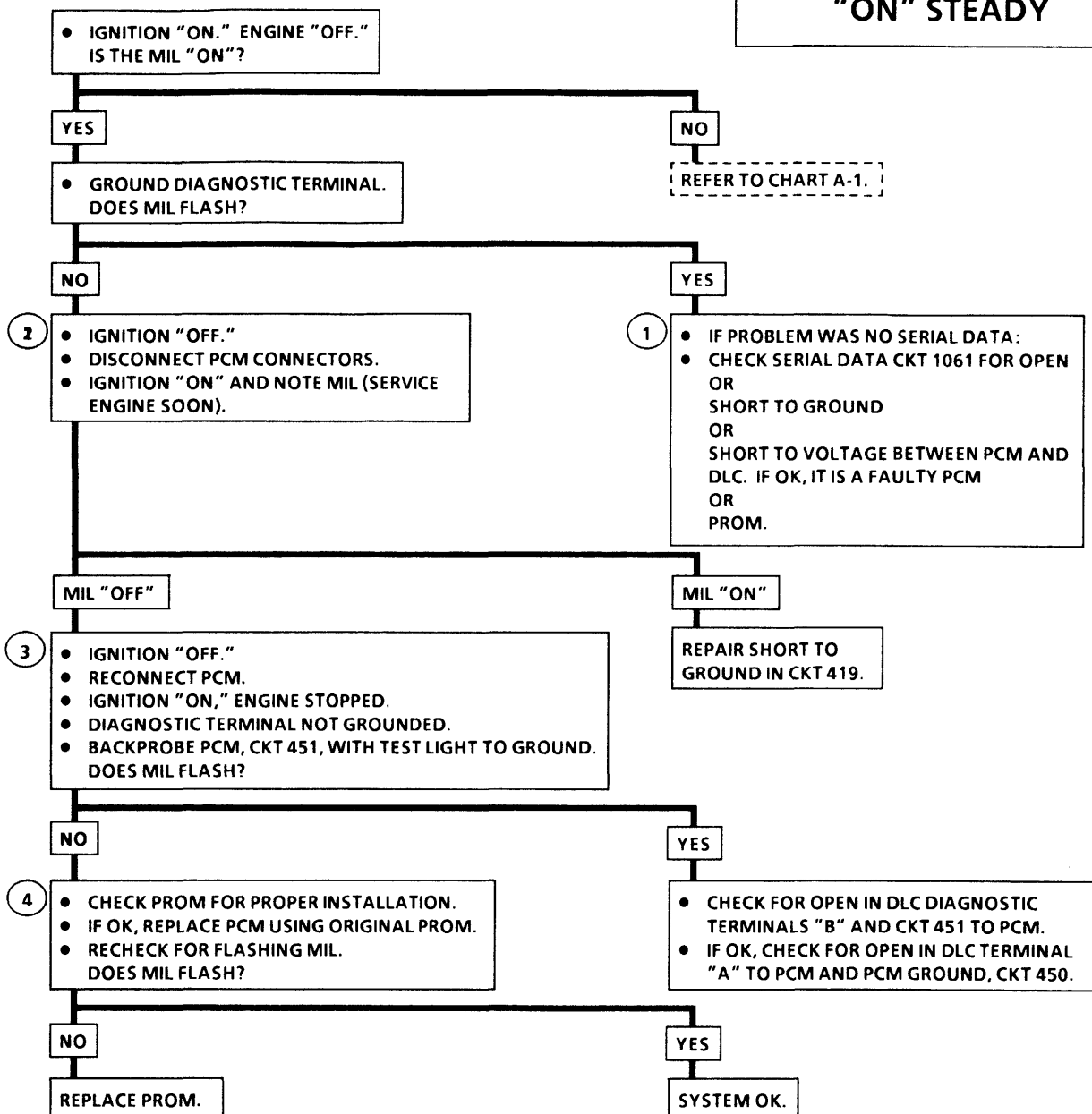
A steady lamp indicates a short to ground in the lamp control CKT 419 or an open in diagnostic CKT 451, or no engine speed sensor signal on the diesel.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart..

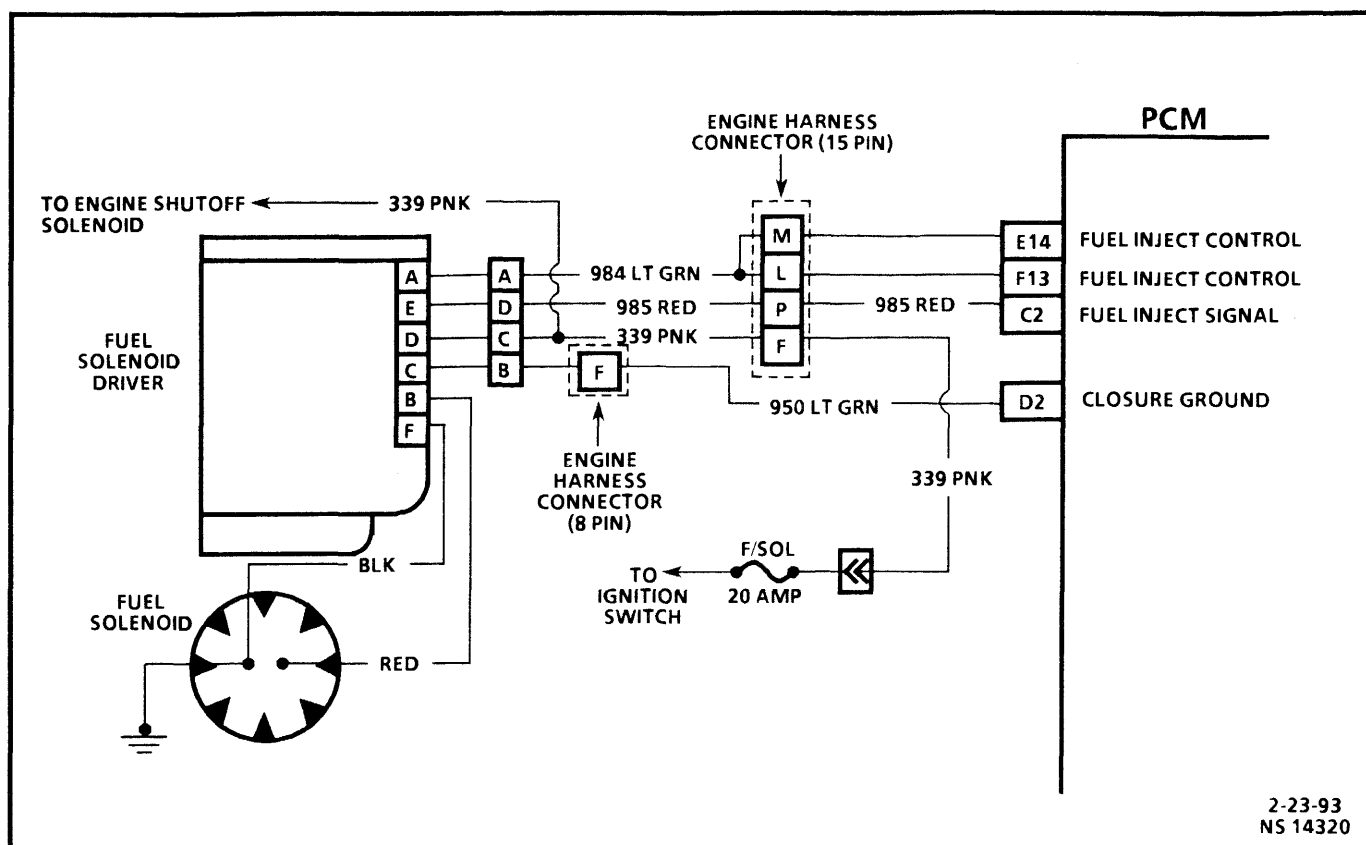
1. If there is a problem with the PCM that causes a scan tool not to read serial data, then the PCM should not flash a MIL. If MIL does flash, check that the scan tool is functioning properly on another vehicle. If the scan is functioning properly, and CKT 1061 is OK, the PROM or PCM may be at fault for the NO DLC symptom.
2. If the light goes "OFF" when the PCM connector is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point, the MIL wiring is OK. The problem is a faulty PROM. If MIL does not flash, the PCM should be replaced using the original PROM. Replace the PROM only after trying a PCM. A defective PROM usually is an unlikely cause of the problem.

**CHART A-2**

**NO SCAN DATA OR WILL  
NOT FLASH MIL OR MIL  
(SERVICE ENGINE SOON)  
"ON" STEADY**



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.



## CHART A-3

### ENGINE CRANKS BUT WILL NOT RUN

#### Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, adequate fuel in the tank, and glow plug system operating OK.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

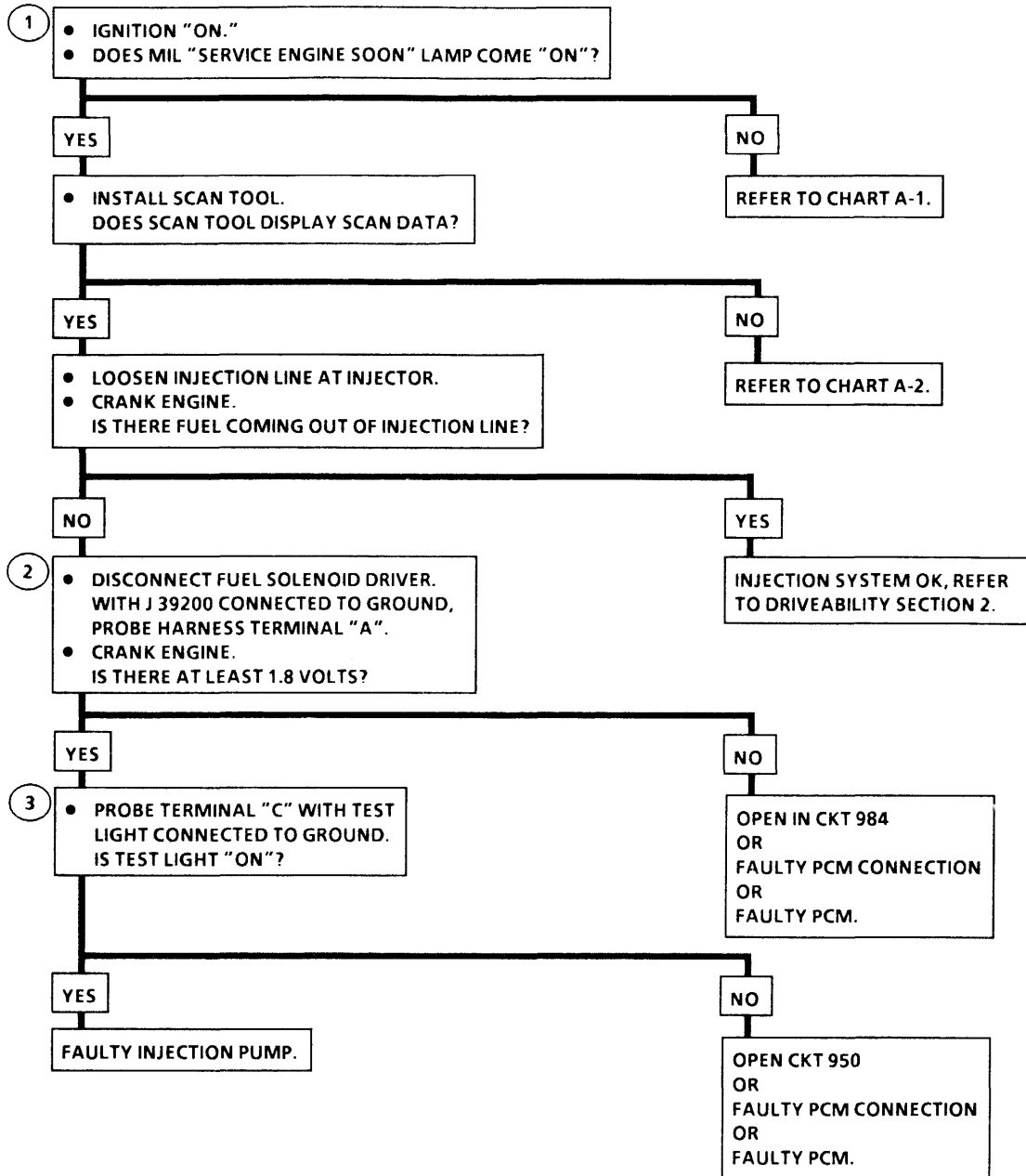
1. A Malfunction Indicator Lamp (MIL) "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to PCM. No DLC may be due to a PCM problem and CHART A-2 will diagnose the PCM.
2. This step will check to see if there is an inject command coming from the PCM.
3. This step will check ground circuit.

**Diagnostic Aids:** If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

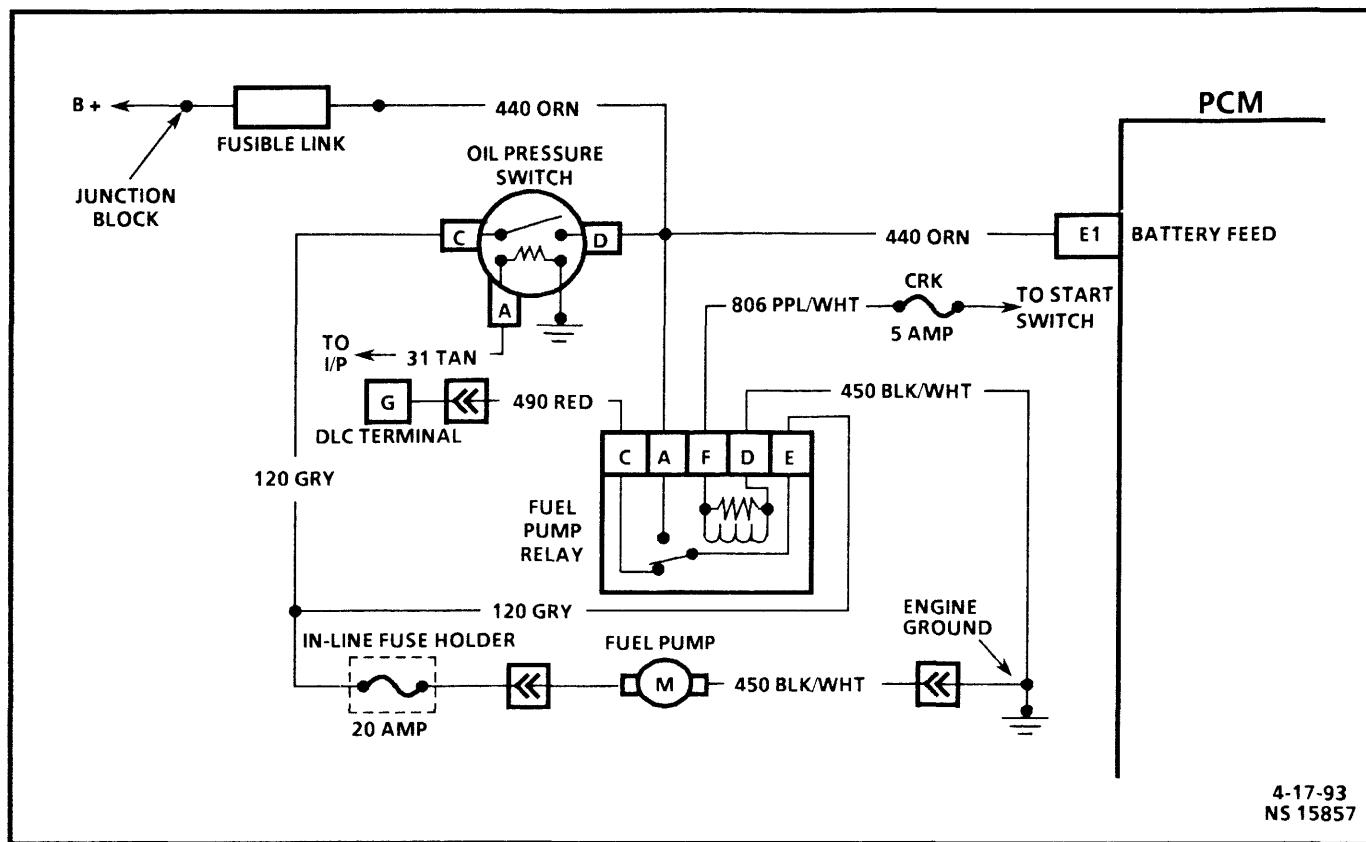
- Low fuel pressure.
- Water or foreign material in the fuel system.
- Basic engine problem.

## CHART A-3

### ENGINE CRANKS BUT WILL NOT RUN



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.



# CHART A-5

## FUEL PUMP RELAY CIRCUIT DIAGNOSIS

### Circuit Description:

When the ignition switch is in the CRANK position, the lift pump circuit is completed through the relay contacts. During this time, oil pressure is building to the point of closing the contacts of the oil pressure switch. A minimum of 28 kPa (4 psi) is required to close the switch contacts.

When the ignition is returned to the RUN position, the oil pressure of the running engine maintains electrical power to the lift pump.

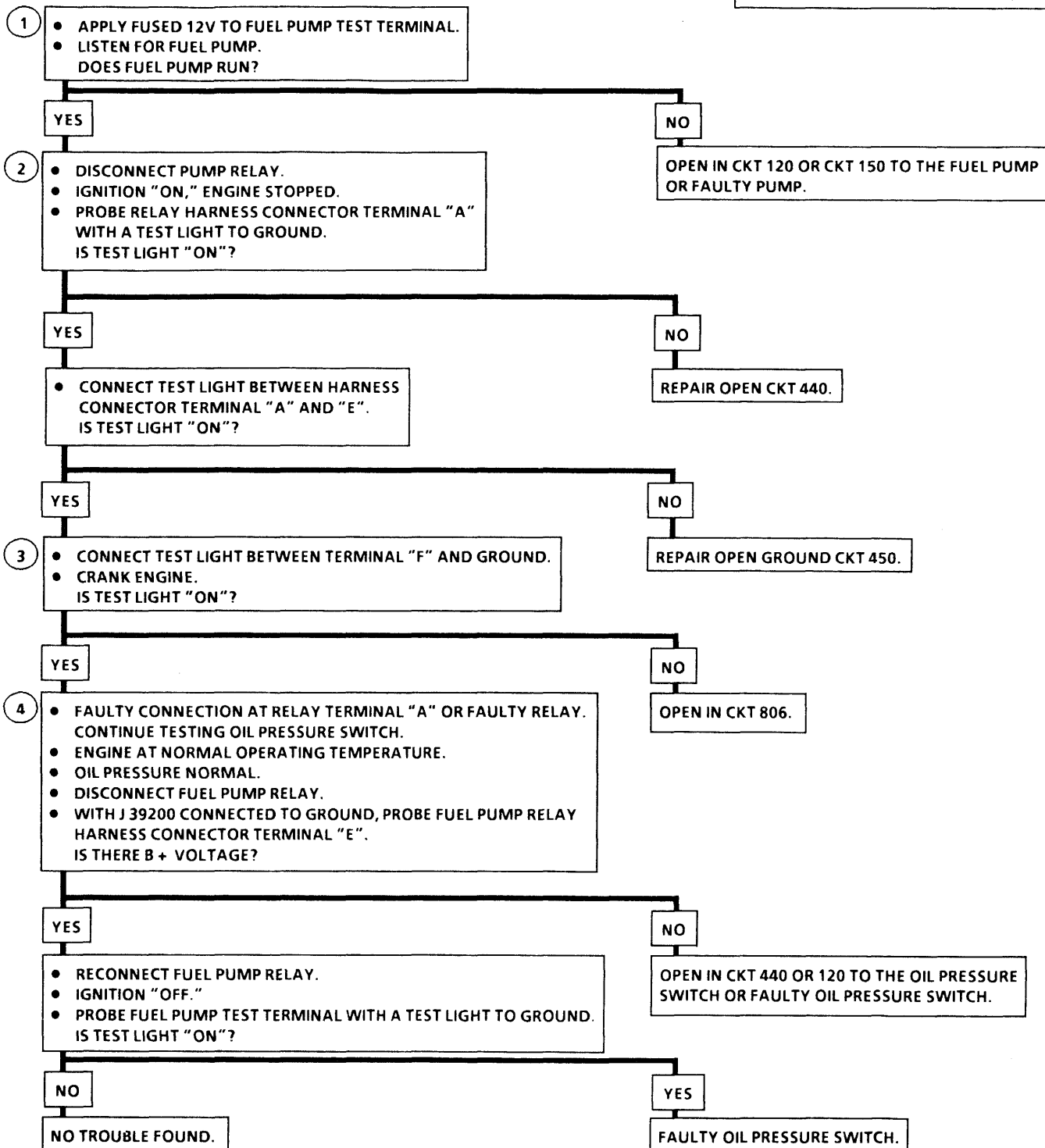
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This procedure applies direct voltage to run the fuel pump. If the pump runs, it may be a fuel pump relay circuit problem which the following step will locate.
2. This step checks voltage from the battery and the ground circuit to the relay.
3. This test determines if there is voltage from the PCM, terminal "A" to terminal "D" on the relay connector.
4. This completes the fuel pump relay circuit, but the oil pressure switch should also be diagnosed.

**Diagnostic Aids:** If engine oil pressure drops below 28 kPa (4 psi), the engine will run poorly or stall when the lift pump circuit opens.

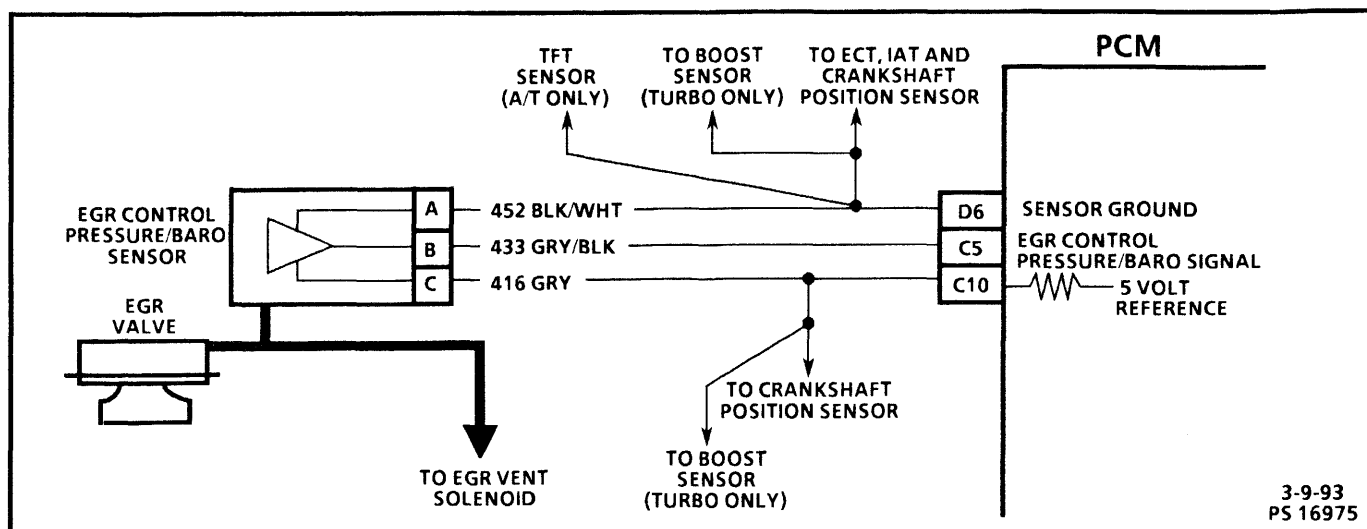
## CHART A-5

### FUEL PUMP RELAY CIRCUIT DIAGNOSIS



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-21-93  
PS 17142



3-9-93  
PS 16975

## EGR CONTROL PRESSURE/BARO SENSOR OUTPUT CHECK

### Circuit Description:

An EGR control pressure/BARO sensor is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. The signal is compared to the EGR duty cycle calculated by the PCM. On vehicles not equipped with EGR, this sensor is only used for a BARO reading.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

### Important

- Be sure to use the same diagnostic test equipment for all measurements.

- Checks sensor output voltage to the PCM. This voltage, without engine running, represents a barometer reading to the PCM.
  - When comparing Tech 1 scan readings to a known good vehicle, it is important to compare vehicles which use a sensor having the same color insert or having the same "Hot Stamped" number. Refer to figures on facing page.
- Applying 34 kPa (10" Hg) vacuum to the sensor should cause the voltage to change. Subtract second reading from the first. Voltage value should be greater than 1.5 volts. When applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.

- Check vacuum hose to sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the sensor hose.

**NOTICE:** Make sure electrical connector remains securely fastened.

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connection. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

# EGR CONTROL PRESSURE/BARO SENSOR OUTPUT CHECK

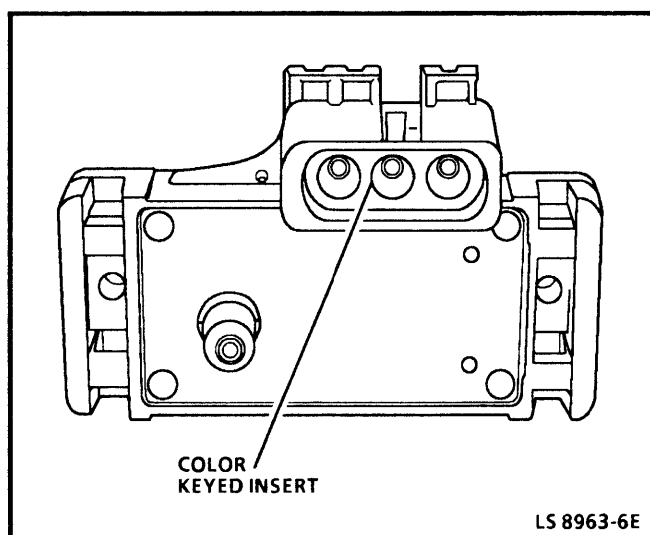
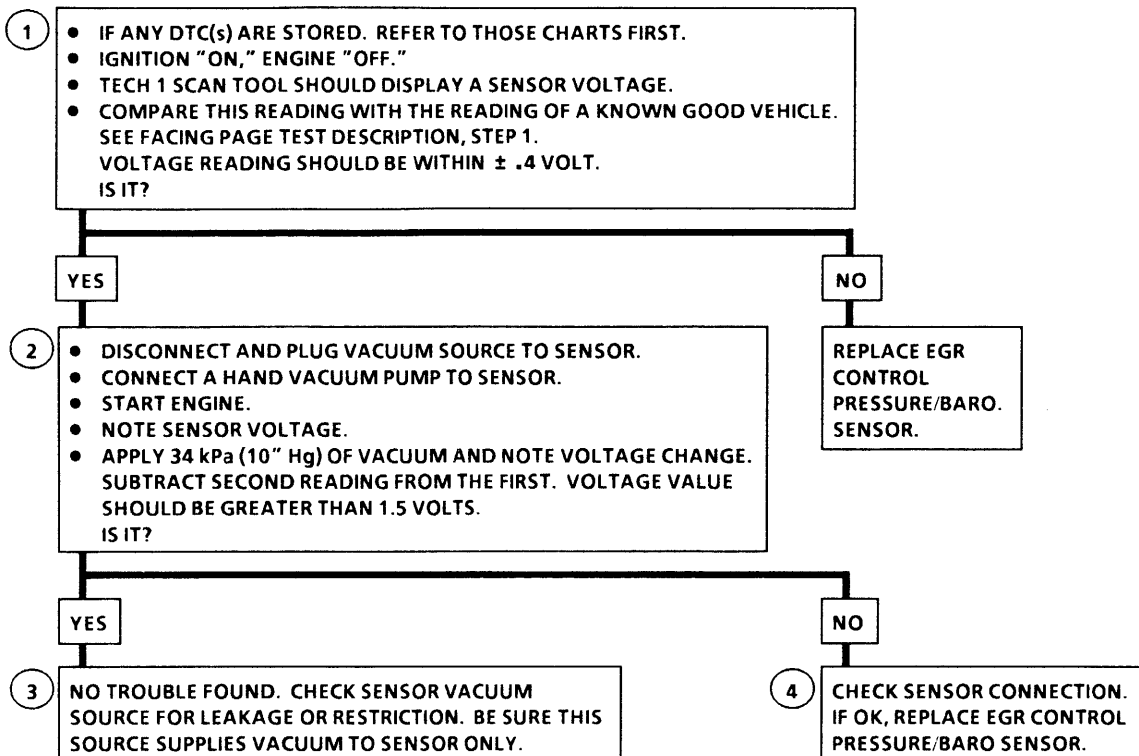


Figure 1 - Color Key Insert

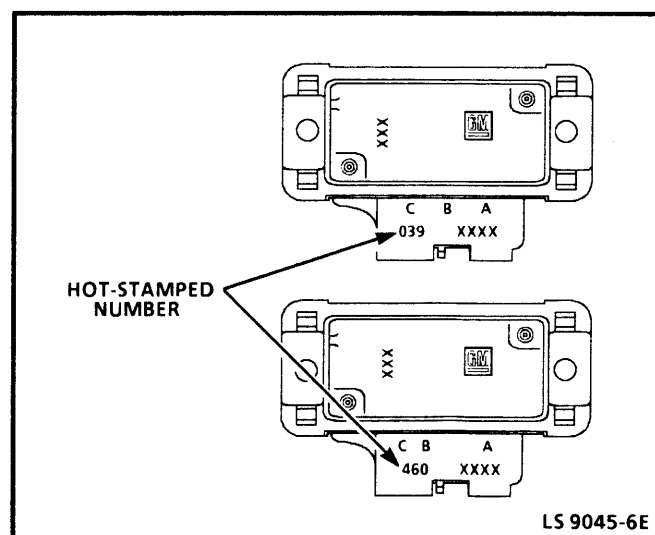
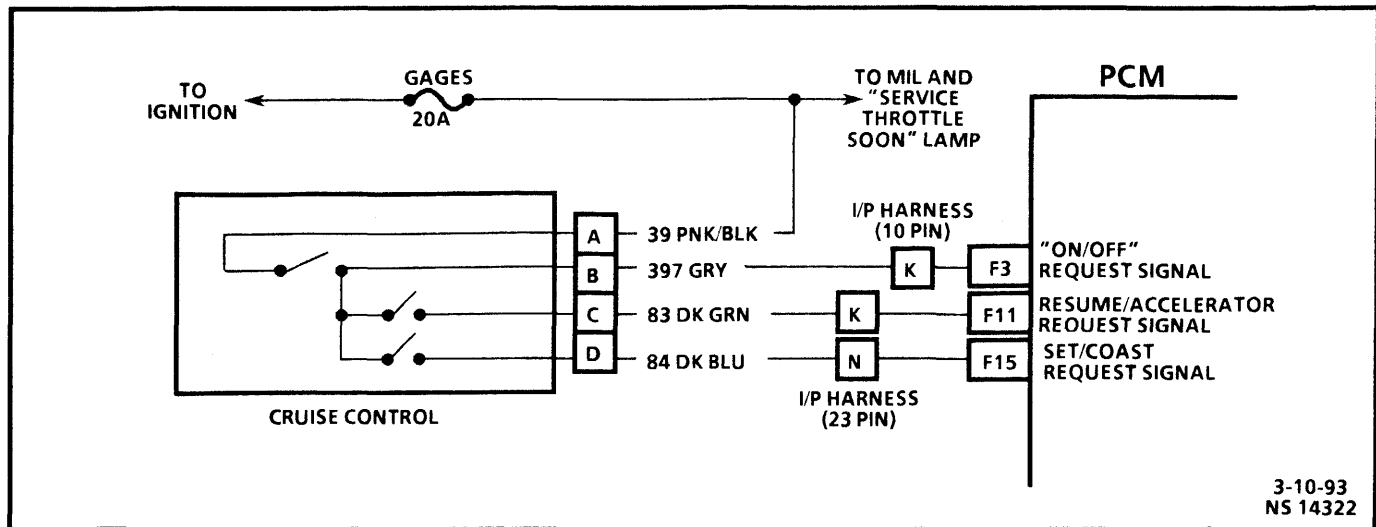


Figure 2 - Hot Stamped Number

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-19-93  
PS 17307

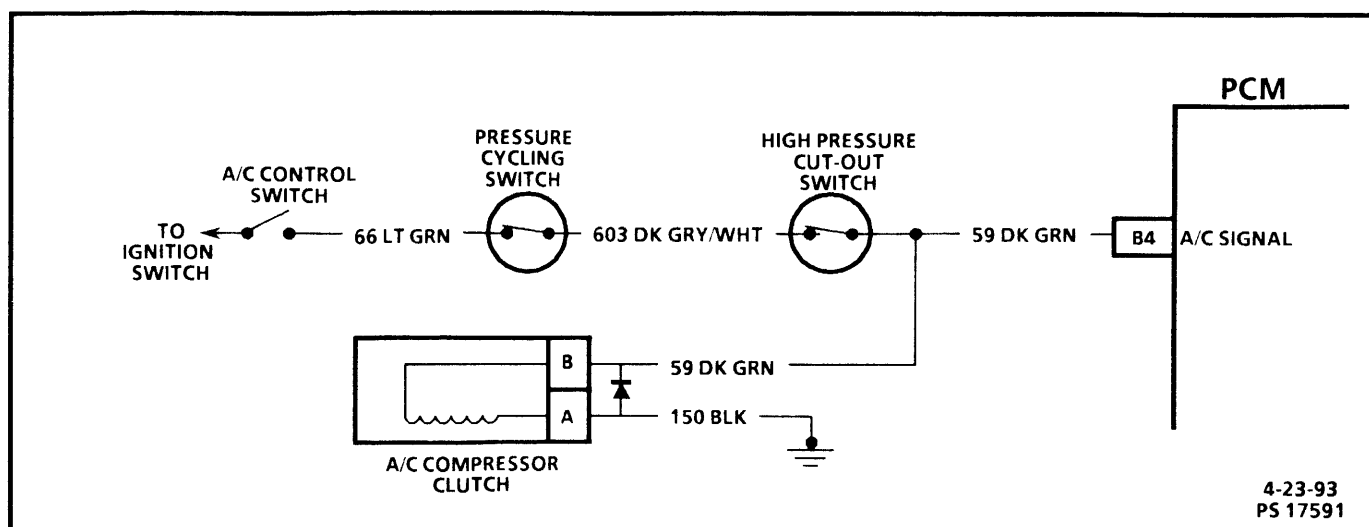




## CRUISE CONTROL SIGNAL DIAGNOSIS

### Circuit Description:

The cruise on/off, set/coast and resume/accel signals are inputs to the fuel control portion of the PCM. These inputs allow the PCM to control and hold a requested speed. If cruise is inoperative, and no DTC(s) are stored, check for faulty cruise switch, wiring harness for opens or faulty connections.



## A/C SIGNAL DIAGNOSIS

### Circuit Description:

Turning "ON" the air conditioning supplies CKT 59 battery voltage to the A/C compressor clutch and to terminal "B4" of the PCM to increase and maintain idle speed.

The PCM does not control the A/C compressor clutch. Therefore, if A/C does not function, refer to the A/C section of the service manual for diagnosis of the system.

If A/C is operating properly and idle speed dips too low when the A/C compressor turns "ON" or flares too high when the A/C compressor turns "OFF," check for an open CKT 59 to the PCM. If circuits are OK, it is a faulty PCM connector terminal "B4" or PCM.

## **RESTRICTED EXHAUST SYSTEM CHECK**

Proper diagnosis for a restricted exhaust system is essential before any components are replaced. The following procedure may be used for diagnosis:

### **DIAGNOSIS:**

1. Inspect the entire exhaust system for a collapsed pipe, heat distress, or possible internal muffler failure.
2. If there are no obvious reasons for the excessive backpressure, the catalytic converter is suspected to be restricted and should be replaced using current recommended procedures. Refer to SECTION 6F of the appropriate service manual.

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.



### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION | DTC NUMBER AND NAME                                                 | SECTION                    |
|-------------------------------------------------------------------------------------------|---------|---------------------------------------------------------------------|----------------------------|
| DTC 13 - Engine Shutoff Solenoid Circuit Fault                                            | 3       | DTC 23 - Accelerator Pedal Position 1 Circuit Range Fault           | 3                          |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3       | *DTC 24 - Vehicle Speed Sensor Circuit Low (Output Speed Signal)    | 10A (4L60E)<br>10B (4L80E) |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3       | DTC 25 - Accelerator Pedal Position 2 Circuit High                  | 3                          |
| DTC 16 - Vehicle Speed Sensor Buffer Fault                                                | 3       | DTC 26 - Accelerator Pedal Position 2 Circuit Low                   | 3                          |
| DTC 17 - High Resolution Circuit Fault                                                    | 3       | DTC 27 - Accelerator Pedal Position 2 Circuit Range Fault           | 3                          |
| DTC 18 - Pump Cam Reference Pulse Error                                                   | 3       | *DTC 28 - Trans Range Pressure Switch Circuit                       | 10A (4L60E)<br>10B (4L80E) |
| DTC 19 - Crankshaft Position Reference Error                                              | 3       | DTC 29 - Glow Plug Relay Fault                                      | 3                          |
| DTC 21 - Accelerator Pedal Position 1 Circuit High                                        | 3       | DTC 31 - EGR Control Pressure/Baro Sensor Circuit Low (High Vacuum) | 3                          |
| DTC 22 - Accelerator Pedal Position 1 Circuit Low                                         | 3       | DTC 32 EGR Circuit Error                                            | 3                          |

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                         | SECTION                    | DTC NUMBER AND NAME                                                      | SECTION                    |
|-------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------|----------------------------|
| DTC 33 - EGR Control Pressure/Baro Sensor Circuit High      | 3                          | DTC 47 - Intake Air Temperature Sensor Circuit Low (High Temp Indicated) | 3                          |
| DTC 34 - Injection Timing Stepper Motor Fault               | 3                          | DTC 48 - Intake Air Temperature Sensor Circuit High (Low Temp Indicated) | 3                          |
| DTC 35 - Injection Pulse Width Error (Response Time Short)  | 3                          | DTC 49 - Service Throttle Soon Lamp Circuit Fault                        | 3                          |
| DTC 36 - Injection Pulse Width Error (Response Time Long)   | 3                          | DTC 51 - PROM Error                                                      | 3                          |
| *DTC 37 - TCC Brake Switch Stuck "ON"                       | 10A (4L60E)<br>10B (4L80E) | *DTC 52 - System Voltage High Long                                       | 10A (4L60E)<br>10B (4L80E) |
| *DTC 38 - TCC Brake Switch Stuck "OFF"                      | 10A (4L60E)<br>10B (4L80E) | *DTC 53 - System Voltage High                                            | 10A (4L60E)<br>10B (4L80E) |
| *DTC 39 - TCC Stuck "OFF"                                   | 10B (4L80E)                |                                                                          | 3                          |
| DTC 41 - Brake Switch Circuit Fault                         | 3                          | DTC 56 - Injection Pump Calibration Resistor Error                       | 3                          |
| DTC 42 - Fuel Temperature Circuit Low (High Temp Indicated) | 3                          | DTC 57 - PCM 5 Volt Shorted                                              | 3                          |
| DTC 43 - Fuel Temperature Circuit High (Low Temp Indicated) | 3                          | *DTC 58 - Trans Fluid Temp Circuit Low                                   | 10A (4L60E)<br>10B (4L80E) |
| DTC 44 - EGR Pulse Width Error                              | 3                          | *DTC 59 - Trans Fluid Temp Circuit High                                  | 10A (4L60E)<br>10B (4L80E) |
| DTC 45 - EGR Vent Error                                     | 3                          | DTC 61 - Turbo Boost Sensor Circuit High                                 | 3                          |
| DTC 46 - Malfunction Indicator Lamp Circuit Fault           | 3                          | DTC 62 - Turbo Boost Sensor Circuit Low                                  | 3                          |

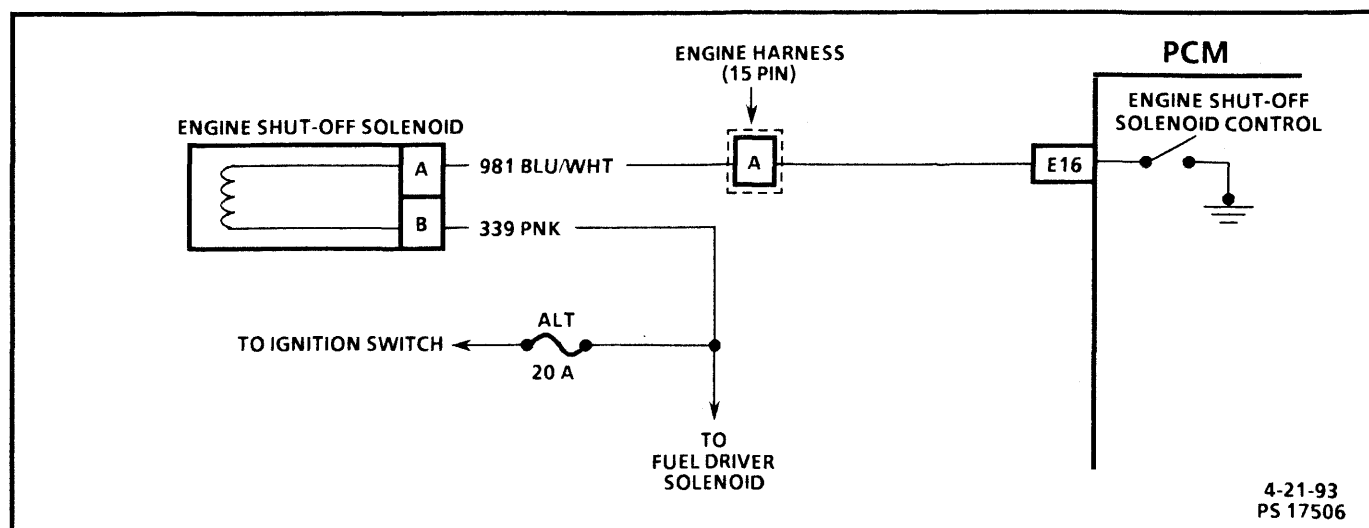
## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). **Remember**, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                               | SECTION                    | DTC NUMBER AND NAME                                            | SECTION                    |
|-------------------------------------------------------------------|----------------------------|----------------------------------------------------------------|----------------------------|
| DTC 63 - Accelerator Pedal Position 3 Circuit High                | 3                          | *DTC 82 - 1-2 Shift Solenoid Circuit                           | 10A (4L60E)<br>10B (4L80E) |
| DTC 64 - Accelerator Pedal Position 3 Circuit Low                 | 3                          | *DTC 83 - TCC Pwm Solenoid Circuit                             | 10B (4L80E)                |
| DTC 65 - Accelerator Pedal Position 3 Circuit Range Fault         | 3                          | *DTC 84 - Accelerator Pedal Position Circuit Fault             | 10B (4L80E)                |
| *DTC 66 - 3-2 Control Solenoid Circuit                            | 10A (4L60E)                | *DTC 85 - Undefined Ratio Error                                | 10B (4L80E)                |
| *DTC 67 - TCC Solenoid Circuit                                    | 10A (4L60E)                | *DTC 86 - Low Ratio Error                                      | 10B (4L80E)                |
| *DTC 68 - Trans Component Slipping                                | 10A (4L60E)<br>10B (4L80E) | *DTC 87 - High Ratio Error                                     | 10B (4L80E)                |
| *DTC 69 - TCC Stuck "ON"                                          | 10A (4L60E)<br>10B (4L80E) | DTC 88 - TDC Offset Error                                      | 3                          |
| DTC 71 - Set/Coast Switch Fault                                   | 3                          | DTC 91 - Cylinder Balance Fault #1 Cyl                         | 3                          |
| *DTC 72 - Vehicle Speed Sensor Circuit Loss (Output Speed Signal) | 10A (4L60E)<br>10B (4L80E) | DTC 92 - Cylinder Balance Fault #2 Cyl                         | 3                          |
| *DTC 73 - Pressure Control Solenoid Circuit                       | 10A (4L60E)<br>10B (4L80E) | DTC 93 - Cylinder Balance Fault #3 Cyl                         | 3                          |
| *DTC 74 - Trans Input Speed Sensor Circuit                        | 10B (4L80E)                | DTC 94 - Cylinder Balance Fault #4 Cyl                         | 3                          |
| *DTC 75 - System Voltage Low                                      | 10A (4L60E)<br>10B (4L80E) | DTC 95 - Cylinder Balance Fault #5 Cyl                         | 3                          |
| DTC 76 - Resume/Accel Switch Fault                                | 3                          | DTC 96 - Cylinder Balance Fault #6 Cyl                         | 3                          |
| DTC 78 - Wastegate Solenoid Fault                                 | 3                          | DTC 97 - Cylinder Balance Fault #7 Cyl                         | 3                          |
| *DTC 79 - Trans Fluid Overtemp                                    | 10A (4L60E)                | DTC 98 - Cylinder Balance Fault #8 Cyl                         | 3                          |
| *DTC 81 - 2-3 Shift Solenoid Circuit                              | 10A (4L60E)<br>10B (4L80E) | DTC 99 - Accelerator Pedal Position 2 (5 Volt Reference Fault) | 3                          |



## DTC 13

### ENGINE SHUTOFF SOLENOID CIRCUIT FAULT

#### Circuit Description:

When the ignition switch is in the "OFF" position, the engine shutoff solenoid is in the "No Fuel" position. By providing a ground path, the PCM energizes the solenoid which then allows fuel to pass into the injection pump.

**DTC 13 Will Set When:** No ignition voltage on terminal "E16" when PCM is requesting engine shutoff solenoid "ON."

**Action Taken (PCM will default to):** A current and history DTC 13 will be stored.

**DTC 13 Will Clear When:** The fault condition(s) no longer exist.

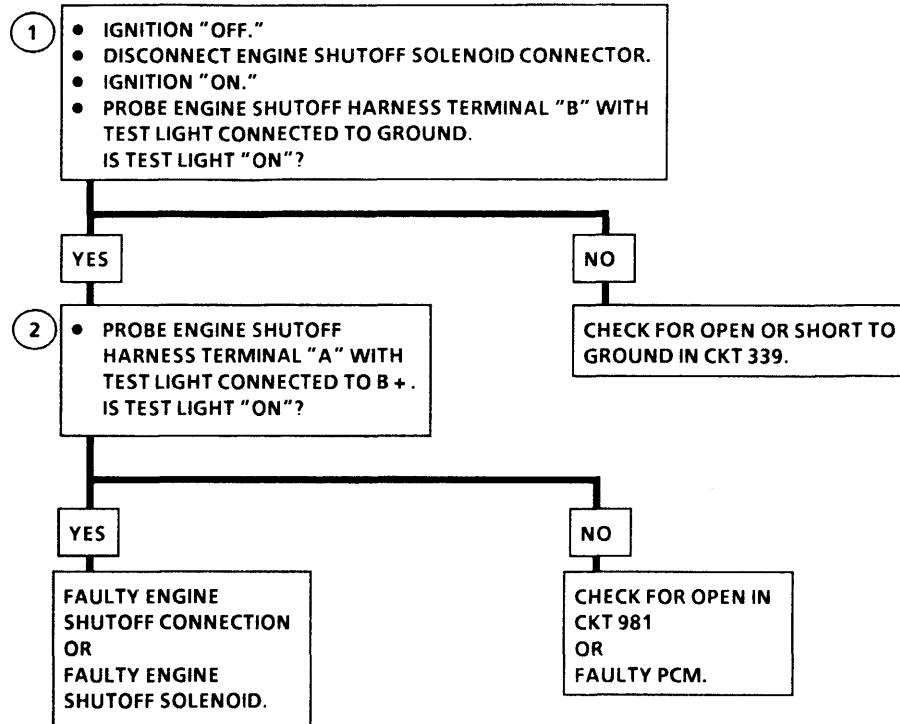
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Check for open circuit from ignition switch to the solenoid.
2. Check CKT 981 from solenoid to PCM for open.

**Diagnostic Aids:** An open in CKT 981 or 339 will cause a DTC 13.

Also a no start condition will exist.

# **DTC 13** **ENGINE SHUTOFF SOLENOID** **CIRCUIT FAULT**

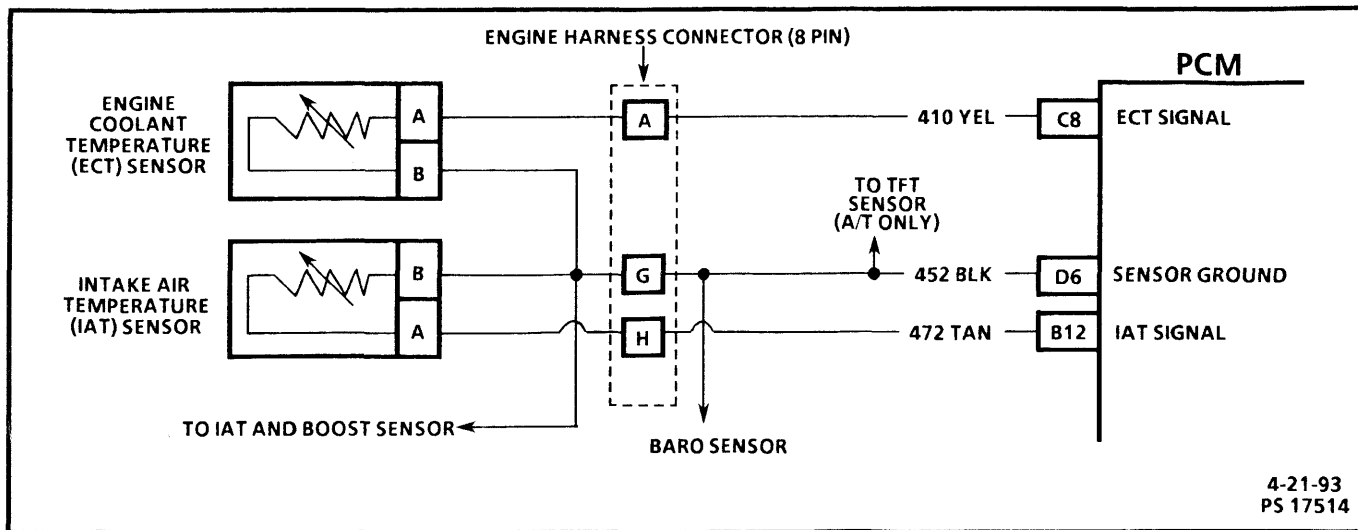


IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-22-93  
NS 14044





## DTC 14

### ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor that controls signal voltage to the PCM. When the engine is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As the engine warms, sensor resistance becomes less and voltage drops.

**DTC 14 Will Set When:** Engine coolant temperature greater than 151°C (304°F) for 2 seconds.

**Action Taken (PCM will default to):** The PCM will default to 77°C (171°F) and to fast idle.

**DTC 14 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 14 is a hard failure or an intermittent condition.
2. This test will determine if CKT is shorted to ground.

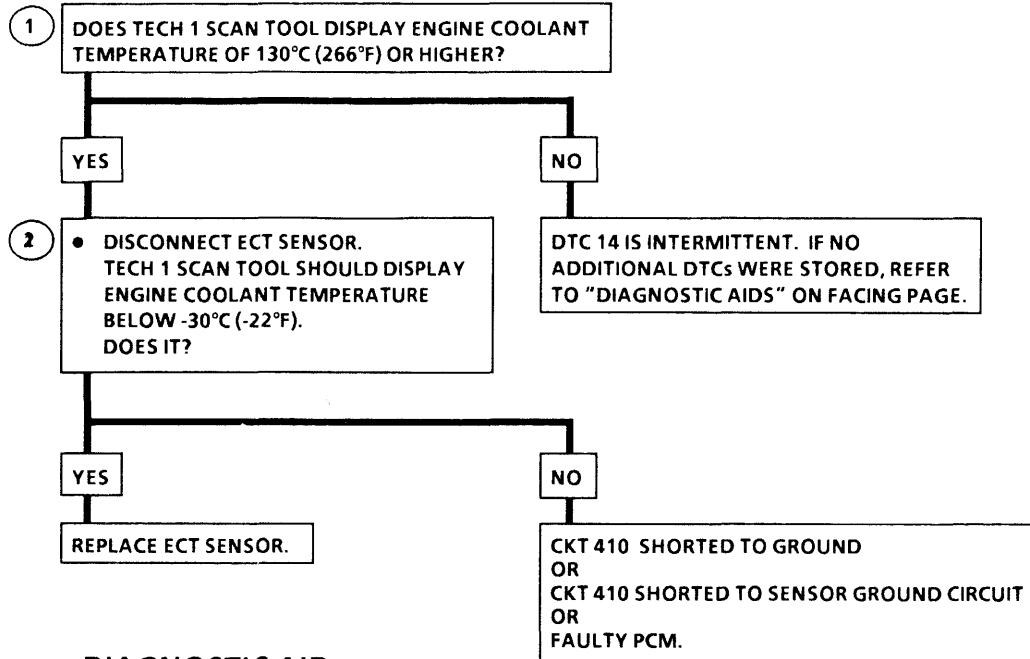
**Diagnostic Aids:** Check harness routing for a potential short to ground.

After engine is started, the coolant temperature should rise steadily to about 85°C (185°F).

The PCM default value will flash on the data screen intermittently.

## DTC 14

### ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT LOW (HIGH TEMPERATURE INDICATED)



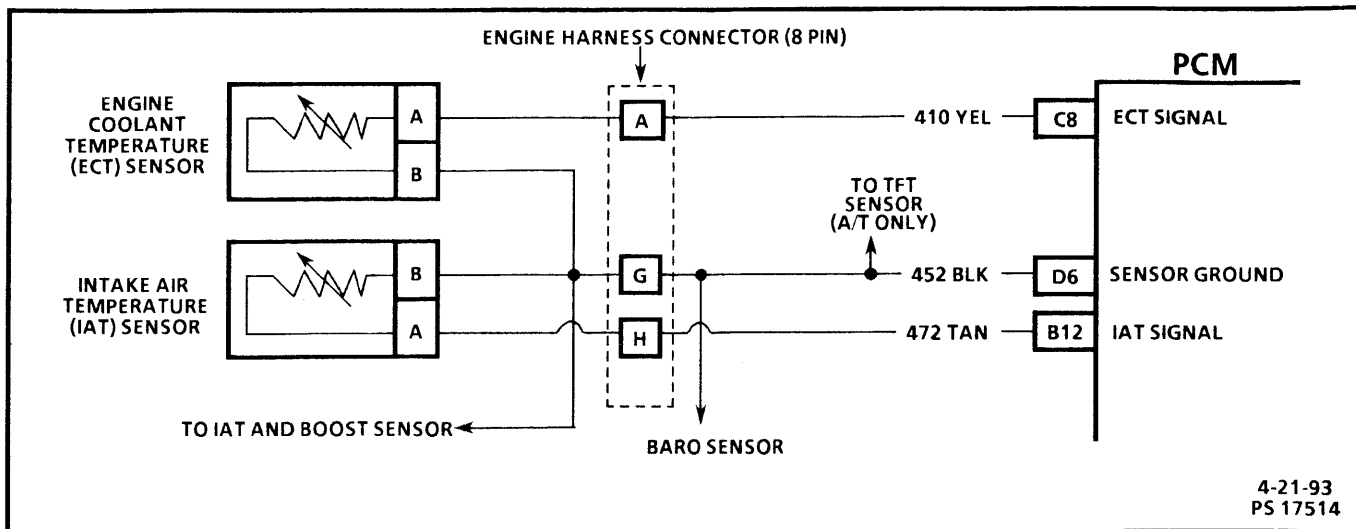
#### DIAGNOSTIC AID

| ENGINE COOLANT TEMPERATURE SENSOR                  |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-17-93  
NS 14048



## DTC 15

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The Engine Coolant Temperature (ECT) sensor is a thermistor that controls signal voltage to the PCM. When the engine is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As the engine warms, the sensor resistance becomes less and the voltage drops.

#### DTC 15 Will Set When:

- Engine coolant temperature less than  $-36^{\circ}\text{C}$  ( $-33^{\circ}\text{F}$ ).
- Engine running for at least 8 minutes.

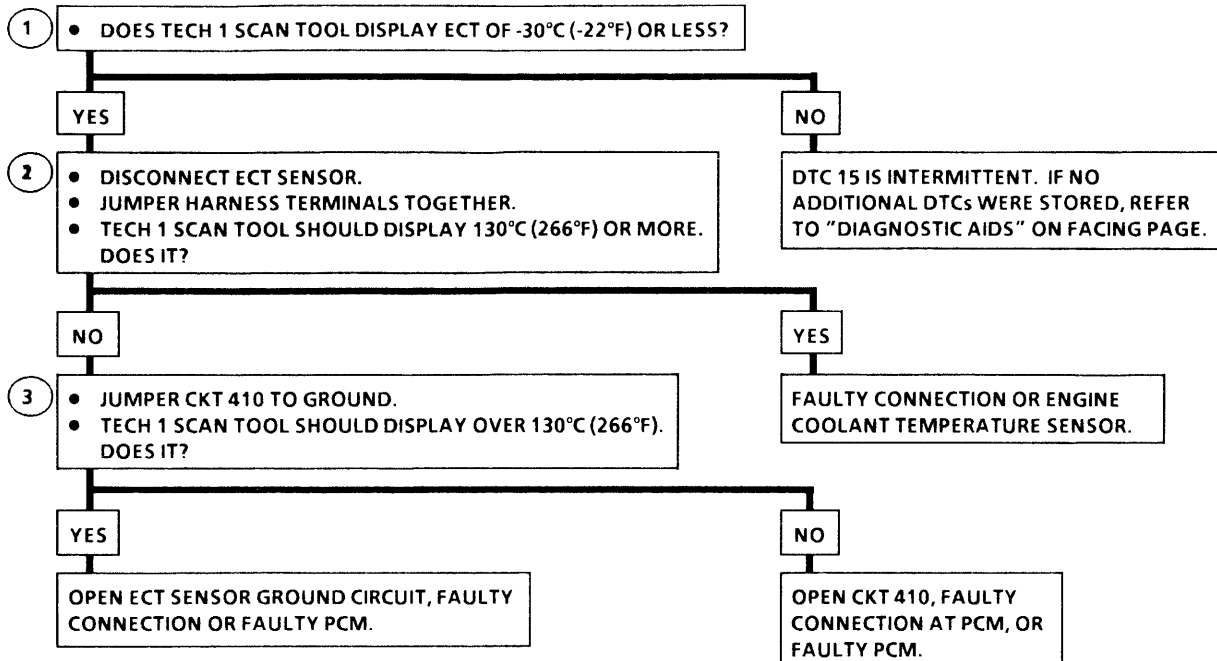
**Action Taken (PCM will default to):** The PCM will default to  $77^{\circ}\text{C}$  ( $171^{\circ}\text{F}$ ) and fast idle.

**DTC 15 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test determines if DTC 15 is a hard failure or an intermittent condition.
2. This test will determine if CKT 410 is shorted to ground.
3. This test will determine if CKT 410 is open, or a faulty PCM.

**Diagnostic Aids:** Check harness routing for a potential short to ground. After engine is started, the ECT temperature should rise steady to about  $85^{\circ}\text{C}$  ( $185^{\circ}\text{F}$ ). The default value will flash intermittently on the data screen.

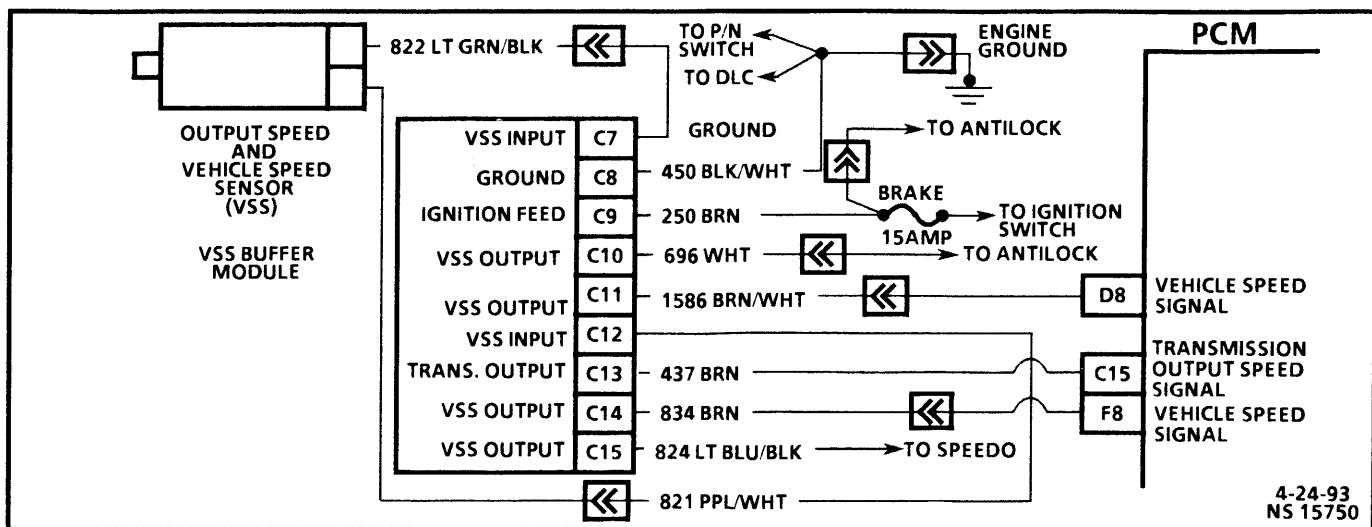
**DTC 15****ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| ENGINE COOLANT TEMPERATURE SENSOR                  |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-17-93  
NS 14046



## DTC 16

## VEHICLE SPEED SIGNAL BUFFER FAULT

### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a vehicle speed sensor buffer module and wiring. Gear teeth pressed on the output shaft induce an alternating current in the sensor. This signal is transmitted to the buffer. The buffer compensates for various axle ratios and converts the signal into a square wave for use by the speedometer, cruise control, antilock brake and PCM. The buffer sends two different signals to the PCM. The CKT 437 circuit relays the transmission output speed which is used to control shift points, line pressure, TCC, DTC 24 and DTC 72. The CKT 817 circuit relays the vehicle speed which is used to control engine operating functions and DTC 16. When DTC 24 or 72 is set, second gear only at maximum line pressure will occur.

### DTC 16 Will Set When:

- Greater than 20 mph.
- 1000 to 4400 RPM.
- CKT 817 open or grounded.
- All conditions must be met for 2 seconds.

**Action Taken (PCM will default to):** No cruise control or fuel cutoff.

**DTC 16 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

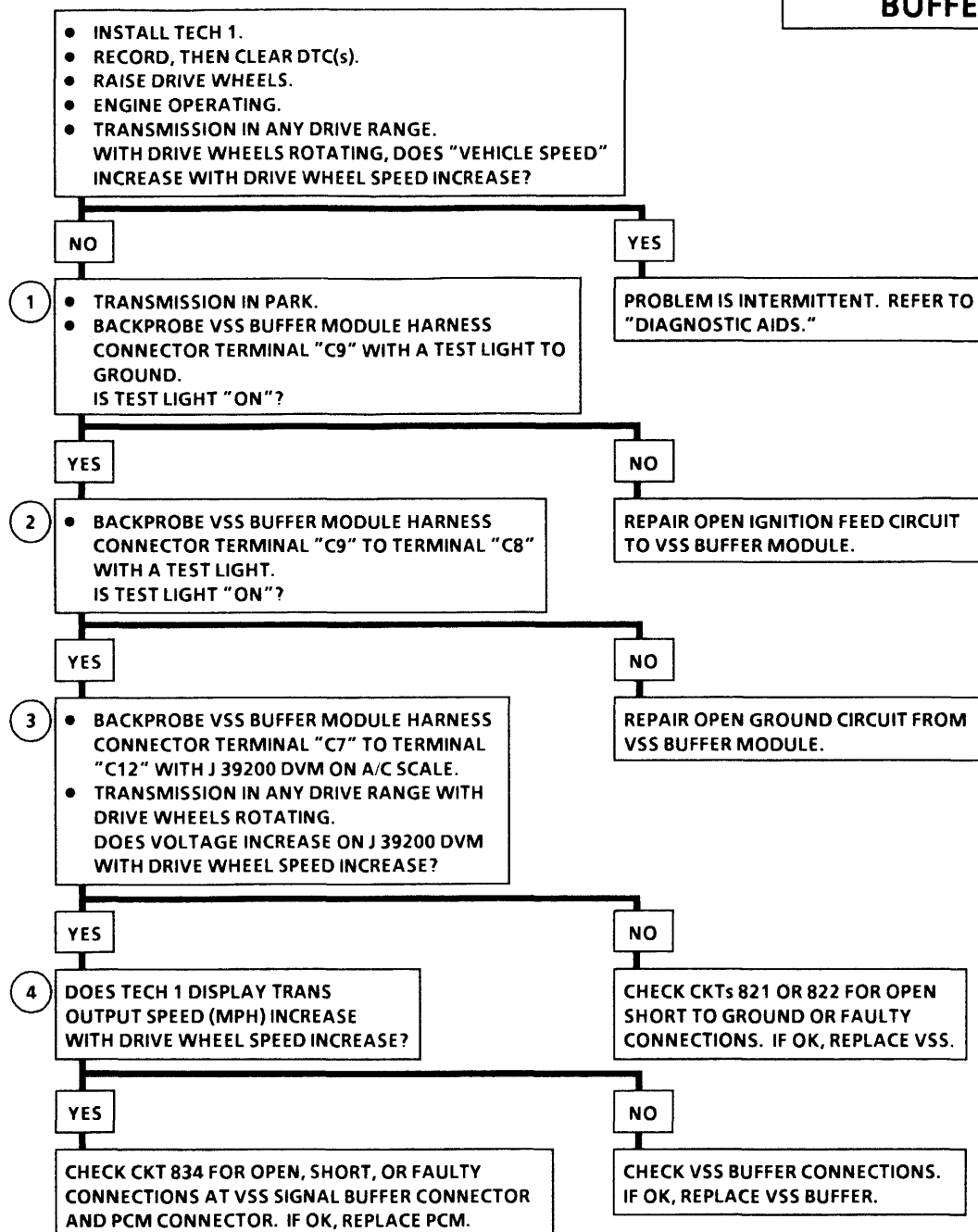
1. This tests for B+ at VSS buffer.
2. This tests for proper ground path for vehicle speed sensor signal buffer.
3. This tests for vehicle speed sensor signal buffer signal to PCM.

4. This tests for a signal from VSS buffer to the PCM.

**Diagnostic Aids:** Check connections at VSS buffer and PCM. Refer to "4L80E or 4L60E Diagnostic Trouble Codes," Section "10" if DTC 24 or DTC 72 is also set.

## DTC 16

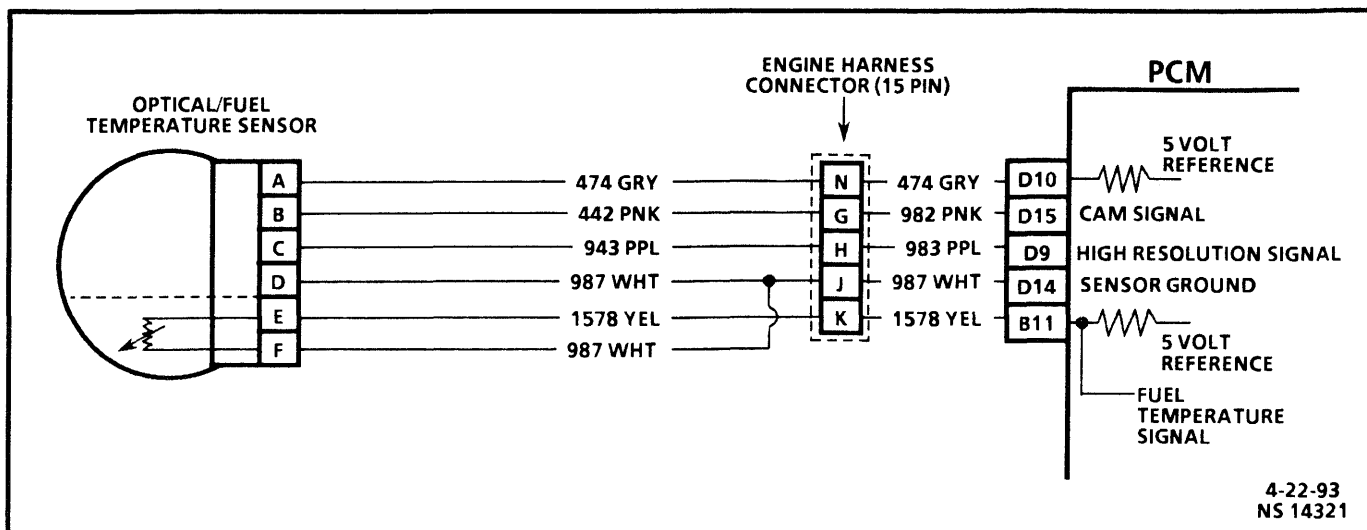
### VEHICLE SPEED SIGNAL BUFFER FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-29-93  
PS 17736



## DTC 17

### HIGH RESOLUTION CIRCUIT FAULT

#### Circuit Description:

The high resolution sensor provides a signal to the PCM by counting pulses on the sensor disk located in the injection pump. The high resolution is one of the most important inputs by the PCM for fuel control and timing.

**DTC 17 Will Set When:** 8 cam reference pulses without and increase in high resolution counts (internal to PCM).

**Action Taken (PCM will default to):** Backup fuel.

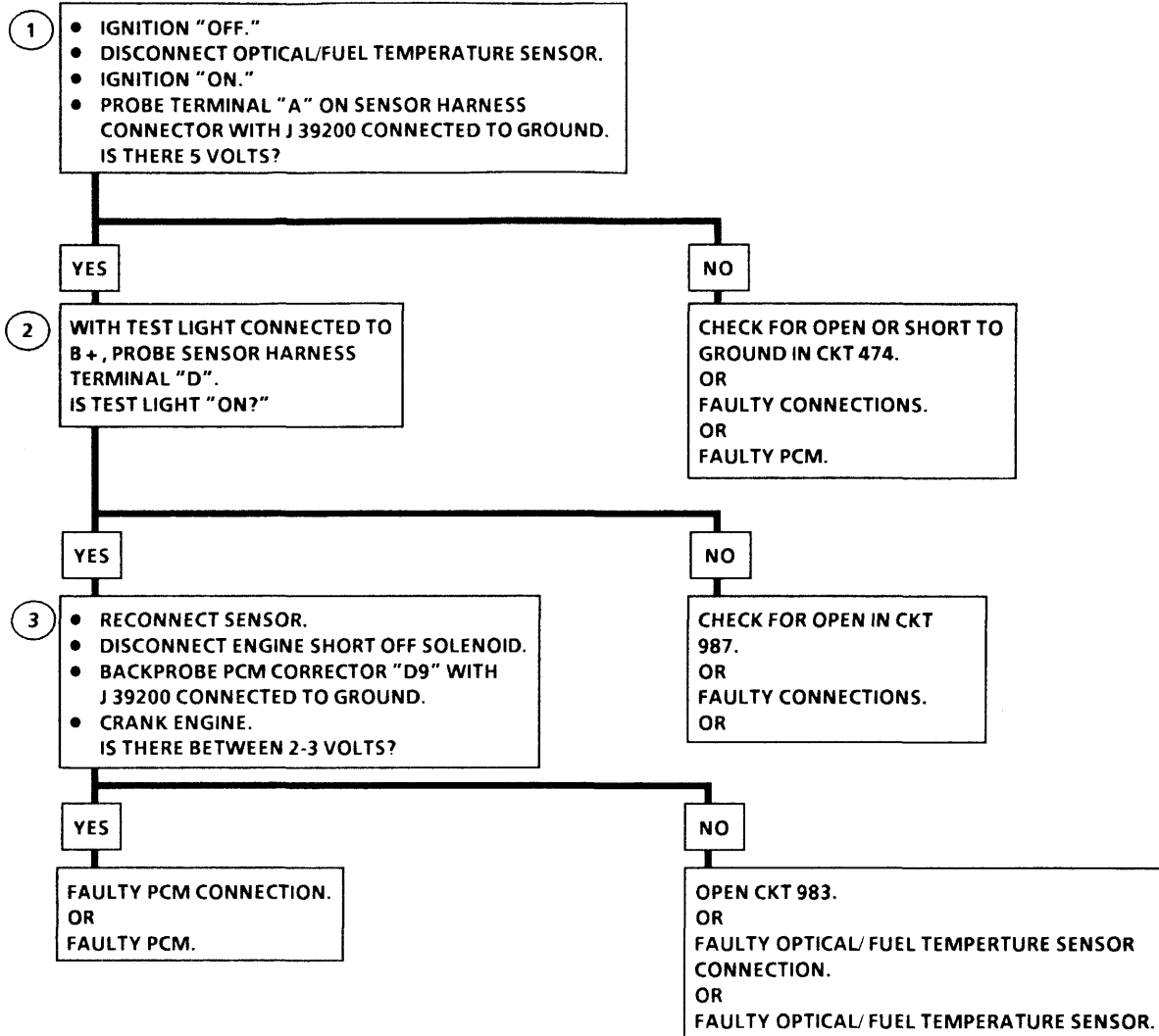
**DTC 17 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if there is a 5 volt reference.
2. This step checks the ground circuit.
3. This step will check to see if the sensor is sending a signal back to the PCM.

**Diagnostic Aids:** When PCM is in backup fuel, fast idle and poor performance problems will exist. If DTC 18 is also stored, there is a possible problem with CKTs 474 or 987. It is possible DTC 17 may set if there is air in the fuel system, refer to SECTION 4.

## DTC 17 HIGH RESOLUTION CIRCUIT FAULT

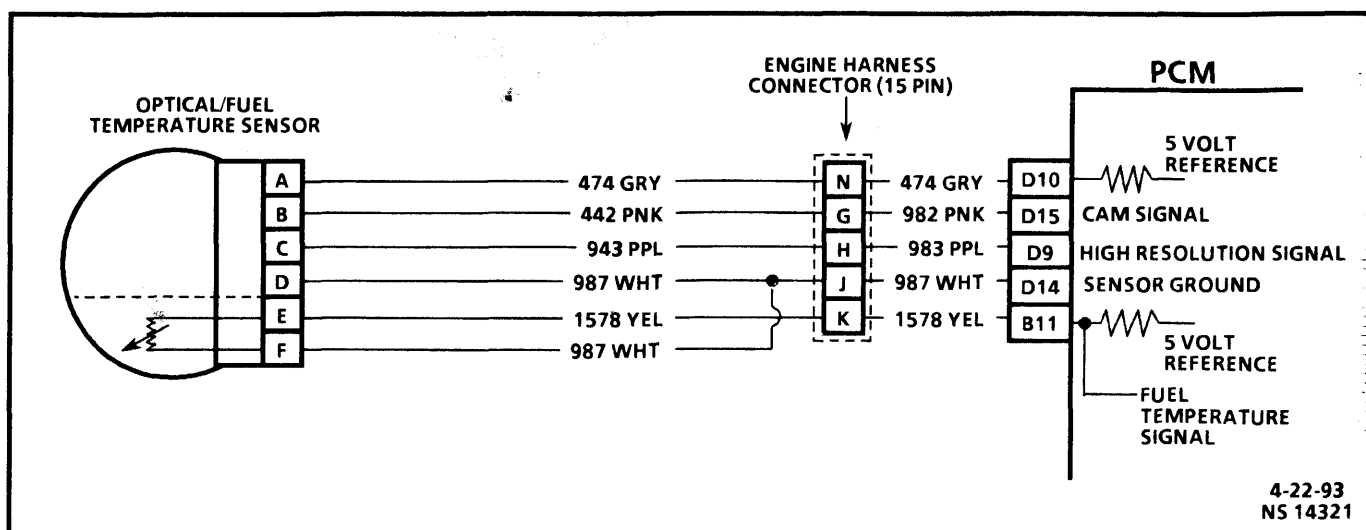


IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-22-93  
PS 16762





## DTC 18

### PUMP CAM REFERENCE PULSE ERROR

#### Circuit Description:

The high resolution sensor also provides a Pump Cam signal to the PCM by counting pulses on the sensor disk located in the injection pump. The Pump Cam reference pulse is one of the most important inputs by the PCM for timing and start of injection.

**DTC 18 Will Set When:** 8 cam reference pulses missed for every crankshaft position pulse.

**Action Taken (PCM will default to):** Backup fuel.

**DTC 18 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

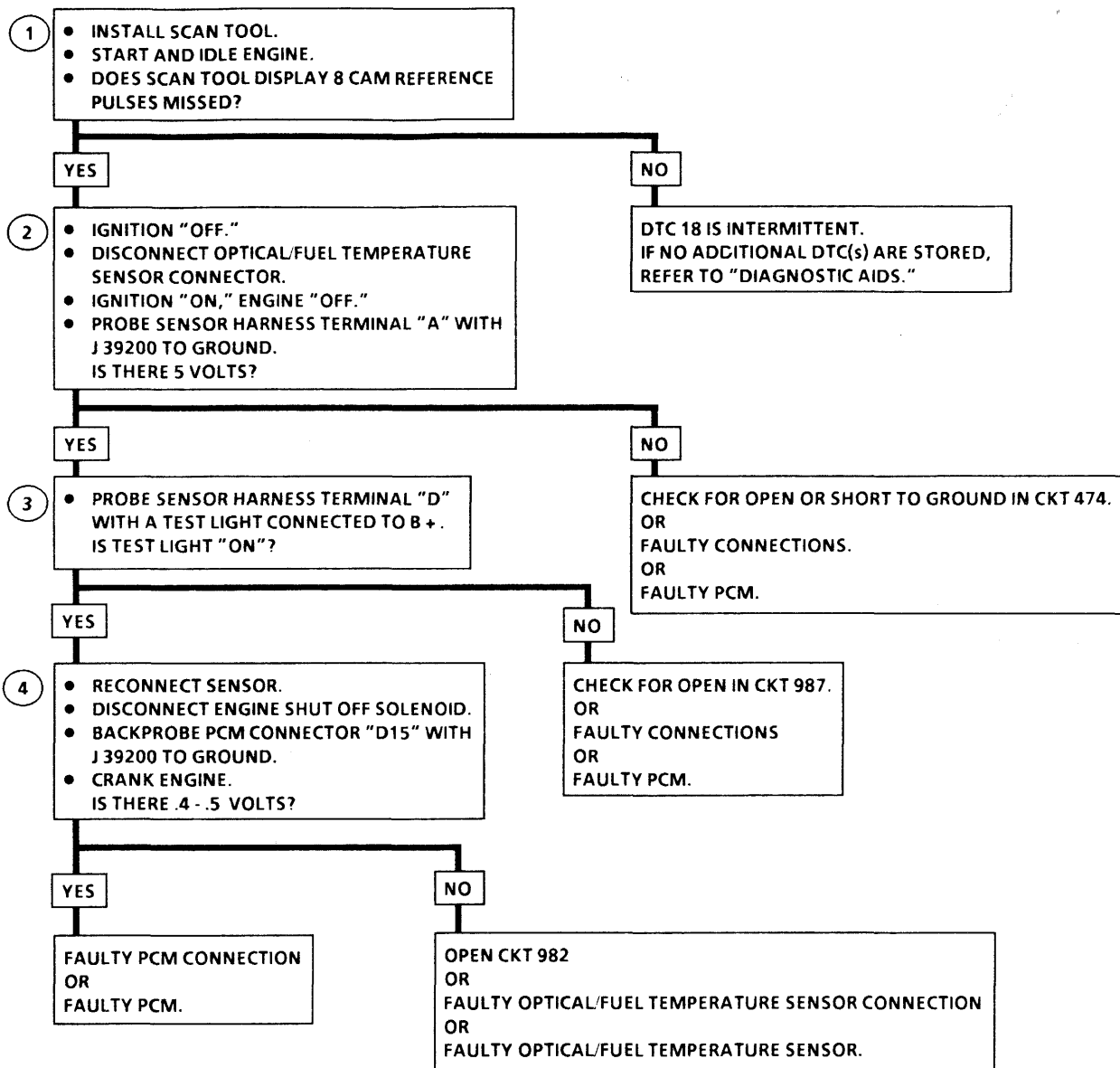
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if it is the result of a hard failure or intermittent.
2. This step checks 5 volt reference circuits.
3. This step checks ground circuit.
4. This step checks to see if the optical/fuel temperature sensor is sending a signal to the PCM and to check CKT 982 for an open.

**Diagnostic Aids:** When the PCM is in backup fuel, rough idle and poor performance problems will exist. If DTC 17 is stored, there is a possible problem with CKTs 474 or 987.

## DTC 18

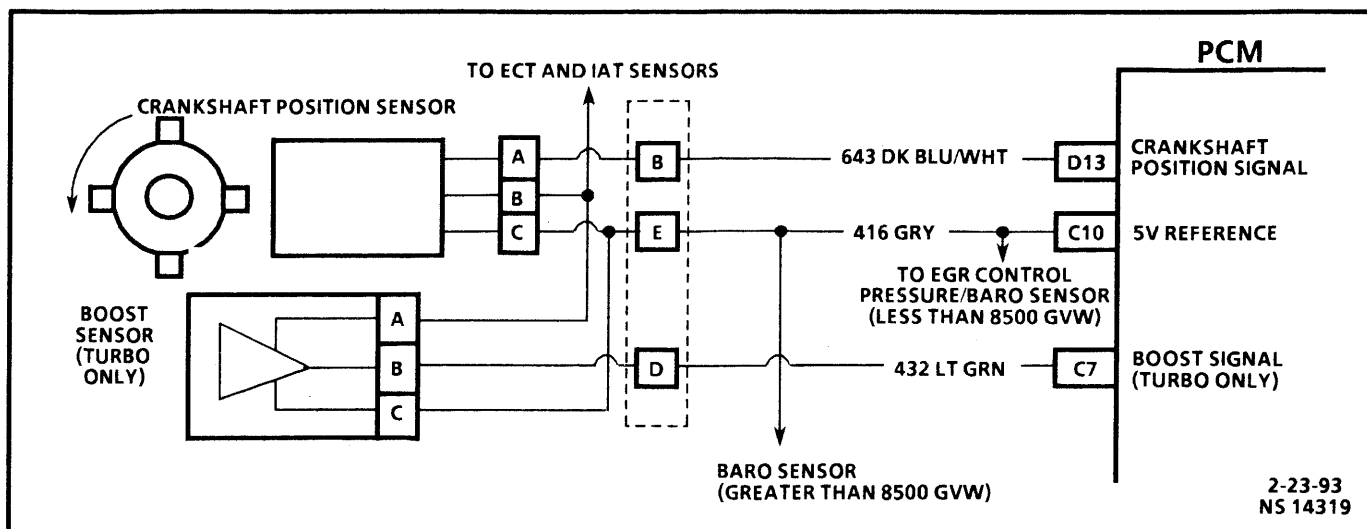
### PUMP CAM REFERENCE PULSE ERROR



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 16982



## DTC 19

### CRANKSHAFT POSITION REFERENCE ERROR

#### Circuit Description:

The crankshaft position sensor is a magnetic induction type sensor that monitors crankshaft position and speed. There are four teeth 90° apart on the front of the crankshaft sprocket that induce an alternating current in the sensor which is transmitted to the PCM.

**DTC 19 Will Set When:** 8 crankshaft position pulses missed for every cam reference pulse.

**Action Taken (PCM will default to):** Backup fuel.

**DTC 19 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

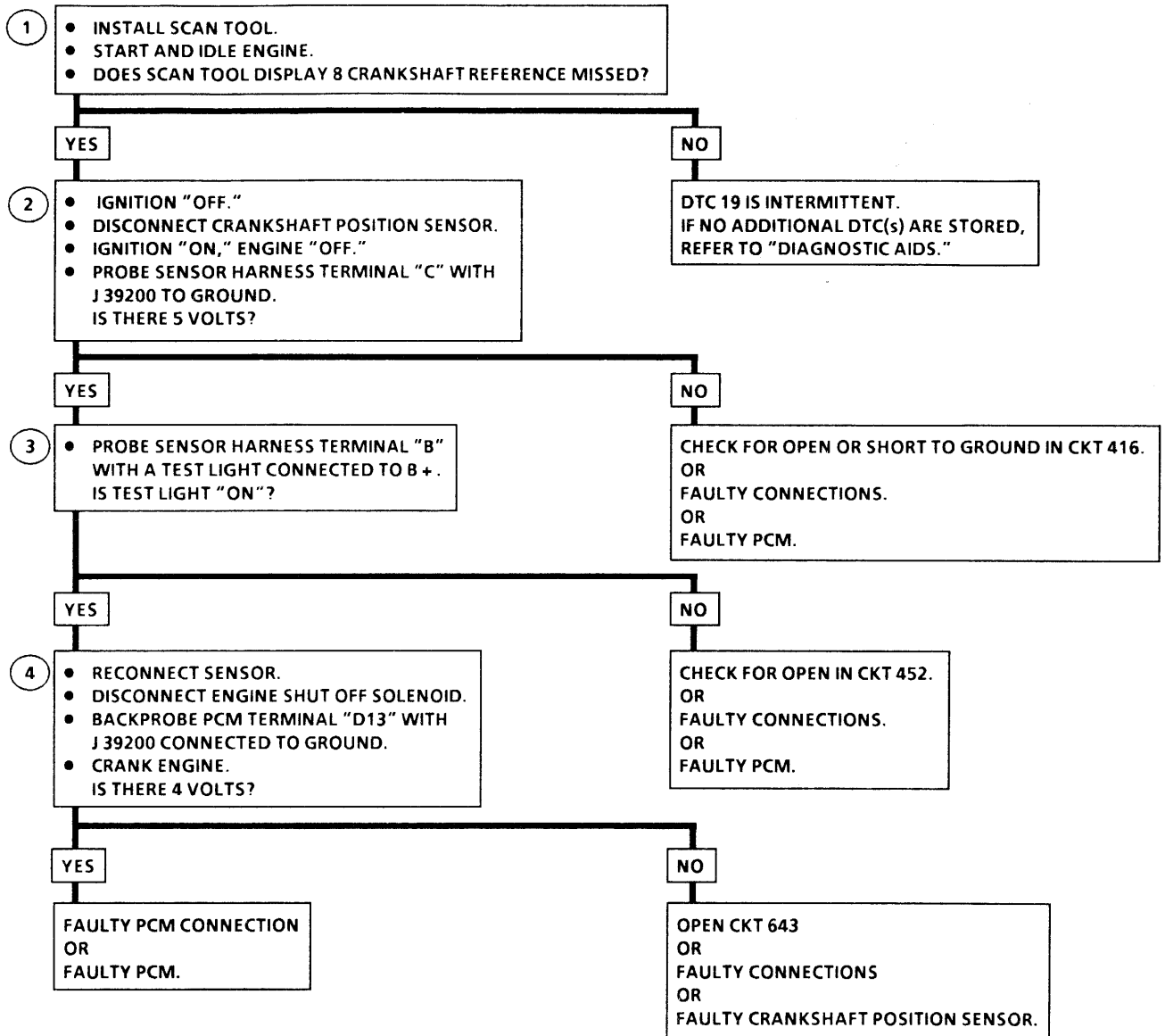
1. This step will determine if DTC 19 is the result of a hard failure or an intermittent condition.
2. This step checks the 5 volt reference.
3. This step checks the ground circuit.
4. This step checks the sensor and harness wiring.

**Diagnostic Aids:** When PCM is in backup fuel, fast idle and poor performance will exist.

Check for good connection at crankshaft position sensor and at PCM.

## DTC 19

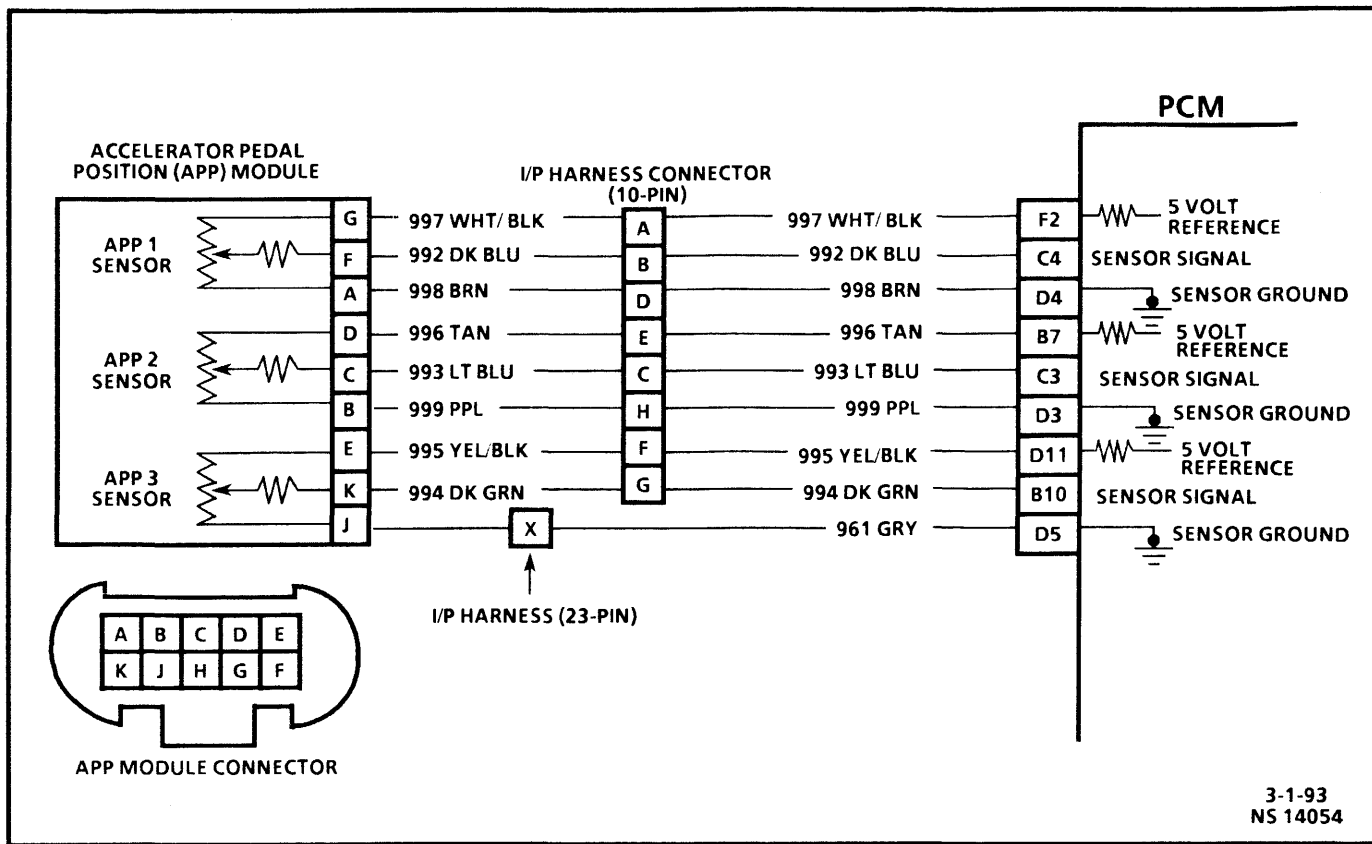
### CRANKSHAFT POSITION REFERENCE ERROR



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15524



## DTC 21

### ACCELERATOR PEDAL POSITION (APP) 1 CIRCUIT HIGH

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 21 Will Set When:** Voltage is greater than 4.75 volts for 2 seconds on APP 1 sensor.

**Action Taken (PCM will default to):** The input from APP 1 sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one sensor malfunctioning. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC 21 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 21 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This will check for an open in ground CKT 998.

**Diagnostic Aids:** A scan tool reads APP 1 position in volts. Should read about .45 to .95 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also, 90% pedal travel is acceptable for correct APP operation.

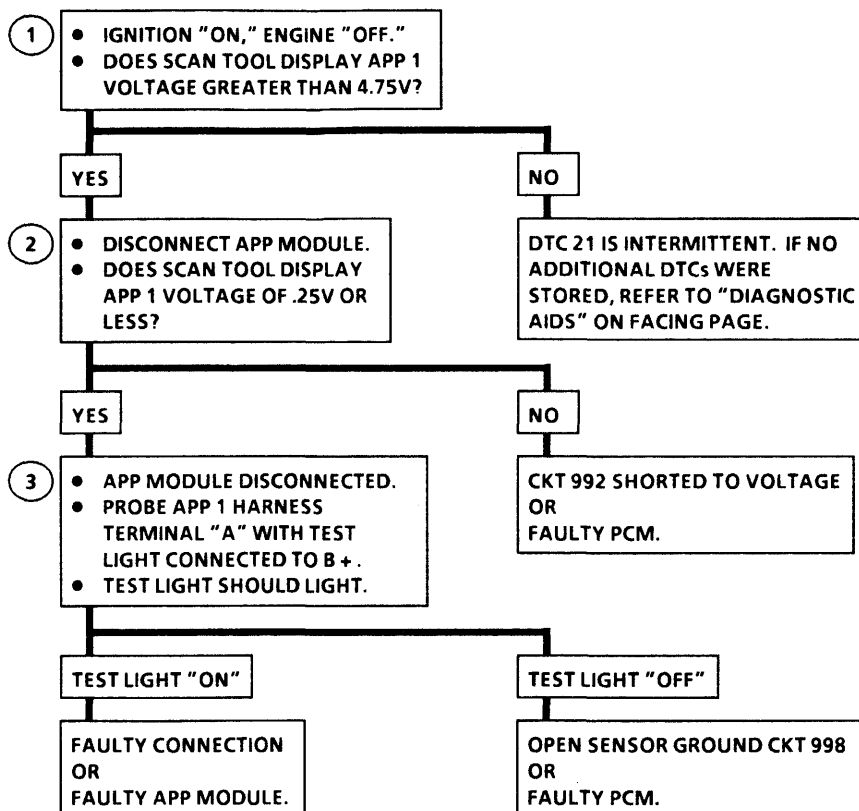
Scan APP 1 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about .74 volt when throttle was closed to about 3.7 volt when throttle is held at Wide Open Throttle (WOT) position.

A DTC 21 will result if CKT 998 is open or CKT 992 is shorted to voltage.

Refer to "Intermittent" in SECTION 2.

## DTC 21

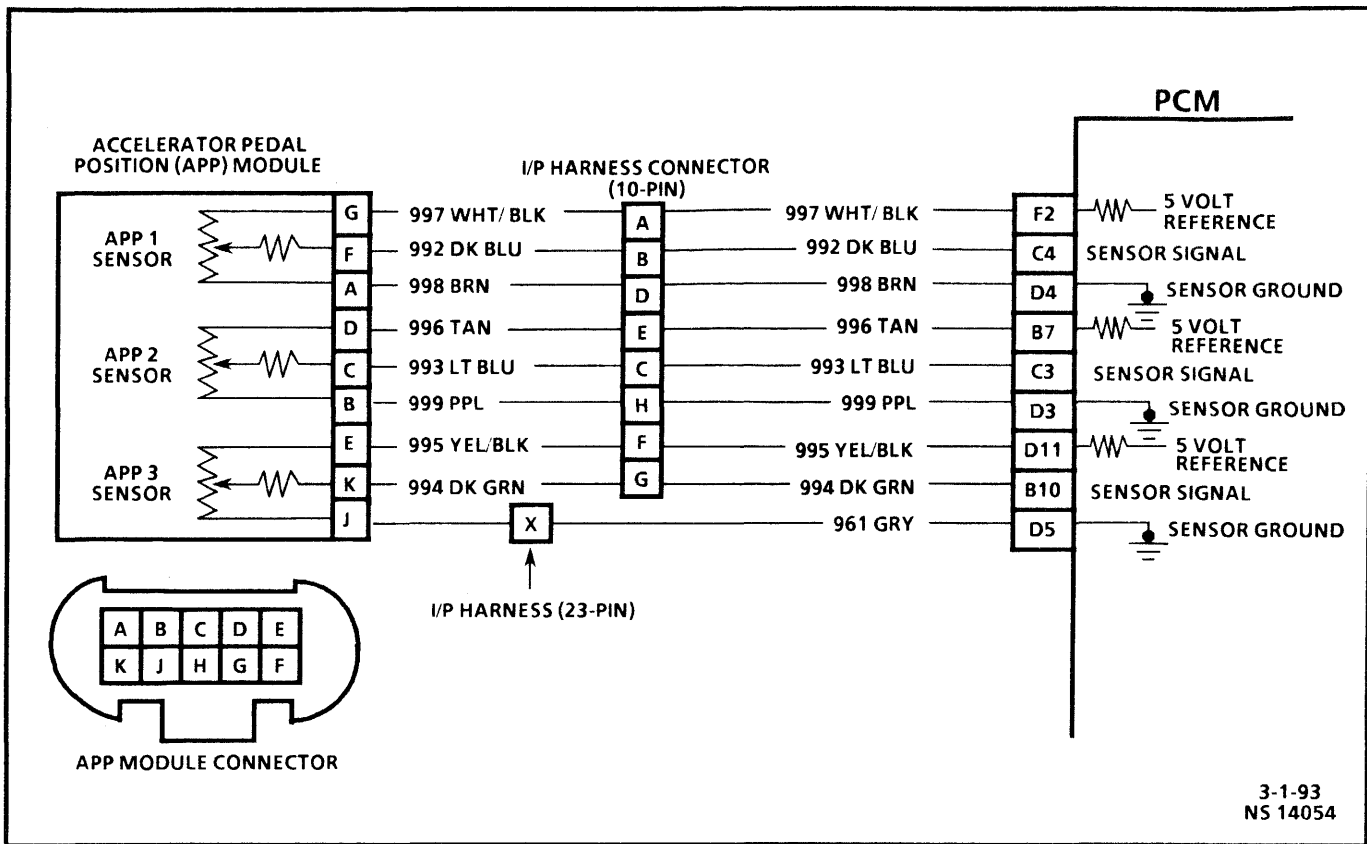
### ACCELERATOR PEDAL POSITION (APP) 1 CIRCUIT HIGH



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15525



## DTC 22

### ACCELERATOR PEDAL POSITION (APP) 1 CIRCUIT LOW

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 22 Will Set When:** Voltage is less than .25 volt for 2 seconds on APP 1 sensor.

**Action Taken (PCM will default to):** The input from APP 1 sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one sensor malfunctioning. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC 22 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 22 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This step will determine if there is a faulty connection or sensor.
4. This step will check the ground circuit.

**Diagnostic Aids:** A scan tool reads APP 1 position in volts. Should read about .45 to .95 volt with throttle

closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

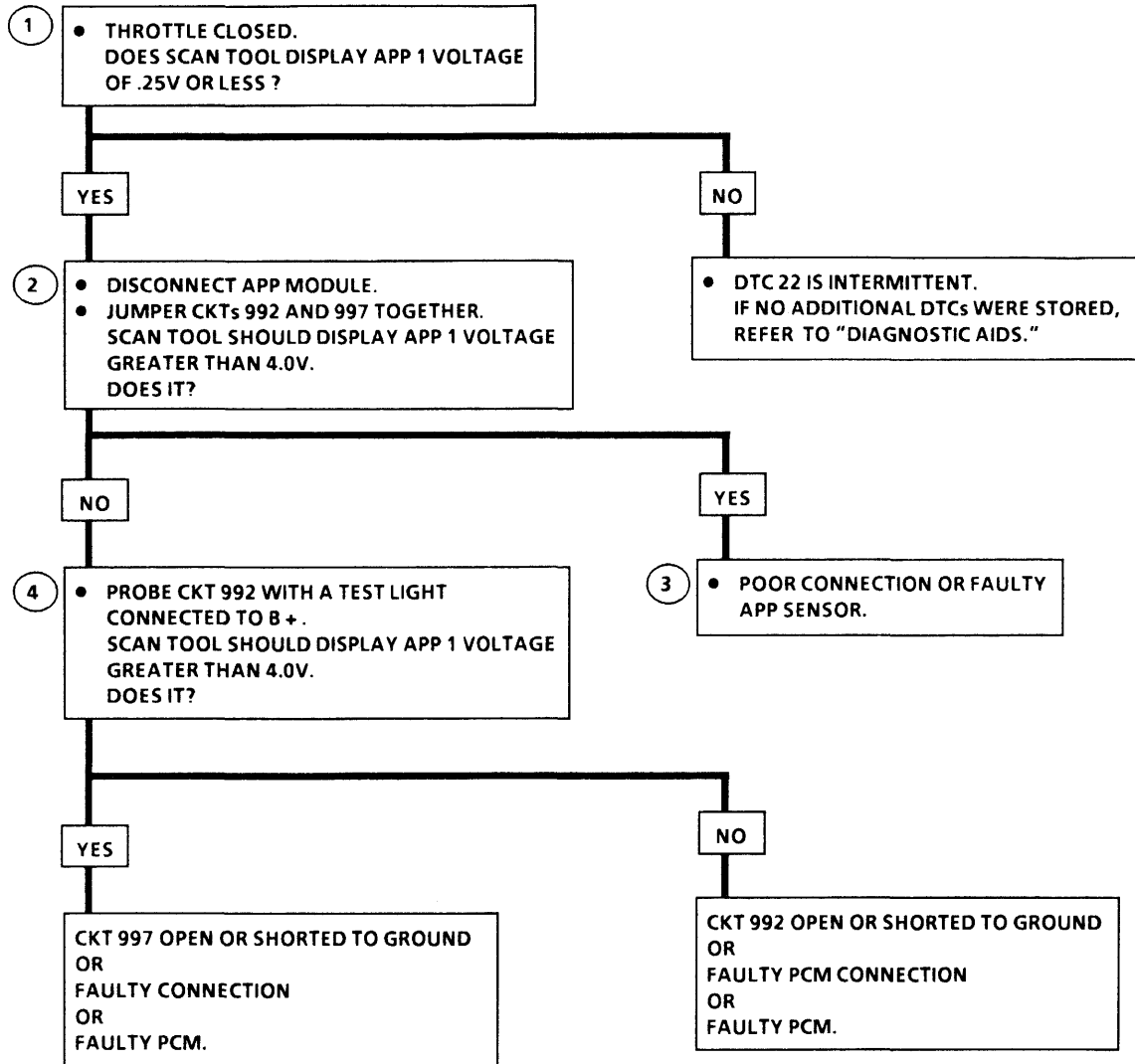
Also, 90% pedal travel is acceptable for correct APP operation.

Scan TP sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about .74 volt when throttle is closed to about 3.7 volts when throttle is held at Wide Open Throttle (WOT) position.

A DTC 22 will result if circuit is open.

## DTC 22

### ACCELERATOR PEDAL POSITION (APP) 1 CIRCUIT LOW

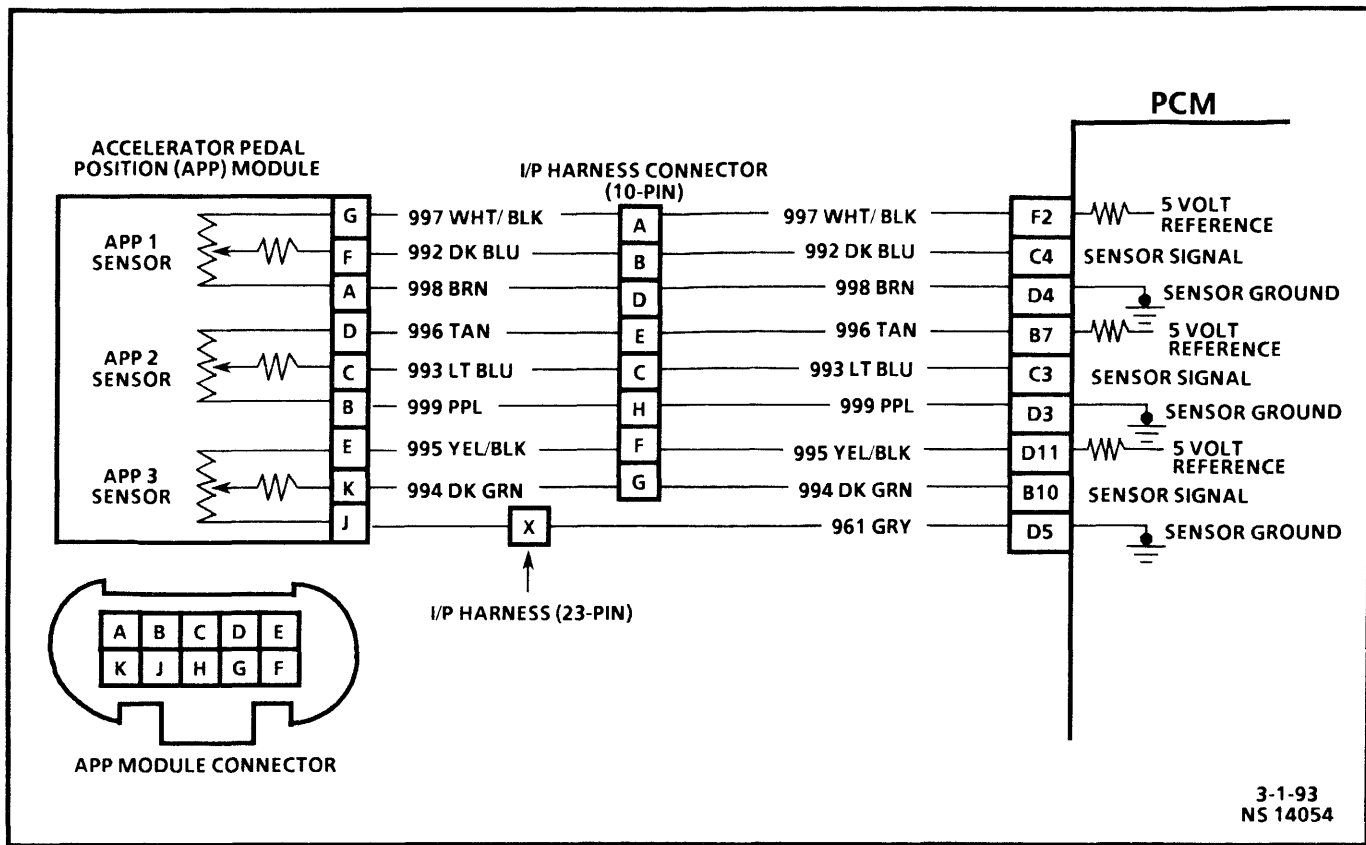


IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
PS 16760





## DTC 23

### ACCELERATOR PEDAL POSITION (APP) 1 CIRCUIT RANGE FAULT

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator pedal position. There are three sensors located within the APP module that are scaled differently.

**DTC 23 Will Set When:** PCM has recognized a "skewed" (mis-scaled) sensor. The PCM compares all three sensors to each other and determines if there is a 6% difference between APP 1 and APP 2 and a 10% difference to APP 3.

**Action Taken (PCM will default to):** The input from APP 1 sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. Throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present, the "Service Throttle Soon" lamp will be "ON" and only allow the engine to operate at idle.

**DTC 23 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

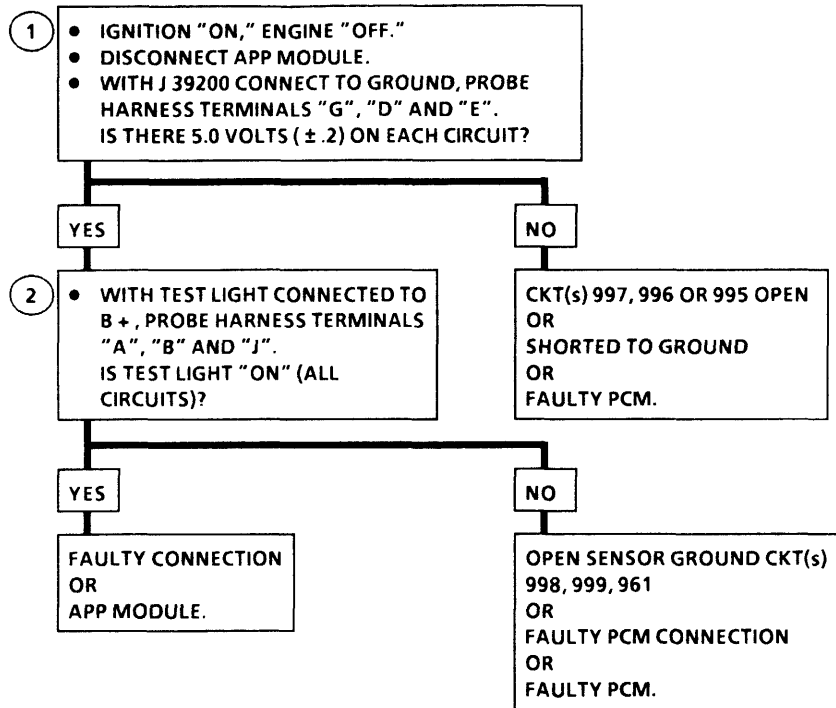
1. This step determines if there is a good 5 volt reference.
2. This step will check for an open in the ground circuit.

**Diagnostic Aids:** A scan tool reads APP 1 position in volts. Should read about .45 to .95 volt with throttle

closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also, 90% pedal travel is acceptable for correct APP operation.

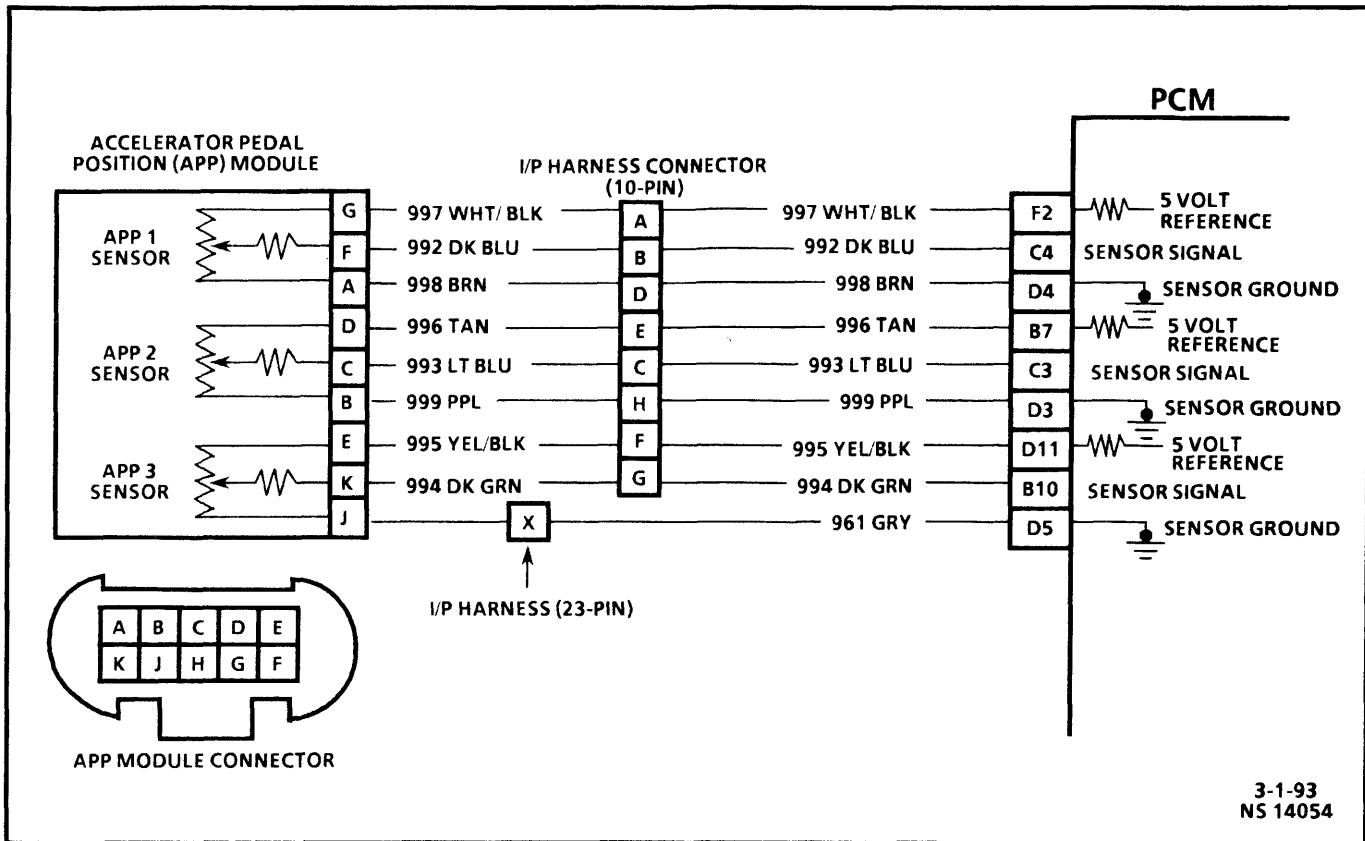
Scan APP 1 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about .74 volt when throttle was closed to over about 3.7 volts when throttle is held at Wide Open Throttle (WOT) position.

**DTC 23****ACCELERATOR PEDAL POSITION (APP) 1  
CIRCUIT RANGE FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15527



## DTC 25

### ACCELERATOR PEDAL POSITION (APP) 2 CIRCUIT HIGH

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 25 Will Set When:** Voltage is greater than 4.75 volts for 2 seconds on APP 2 sensor.

**Action Taken (PCM will default to):** The input from APP 2 sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 25 is a hard failure or an intermittent condition.
2. This will check for an open in ground CKT 999.
3. This step checks the PCM and wiring.

**Diagnostic Aids:** A Tech 1 scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward WOT.

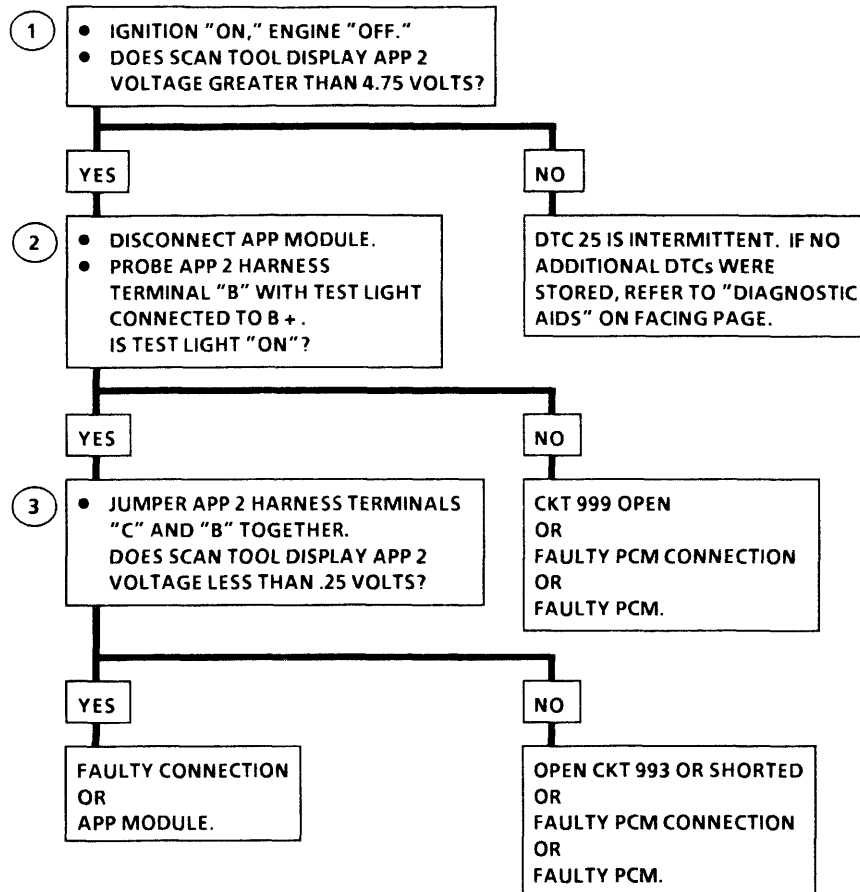
Also, 90% pedal travel is acceptable for correct APP operation.

Refer to SECTION 2 for "Intermittents."

Scan APP 2 signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

## DTC 25

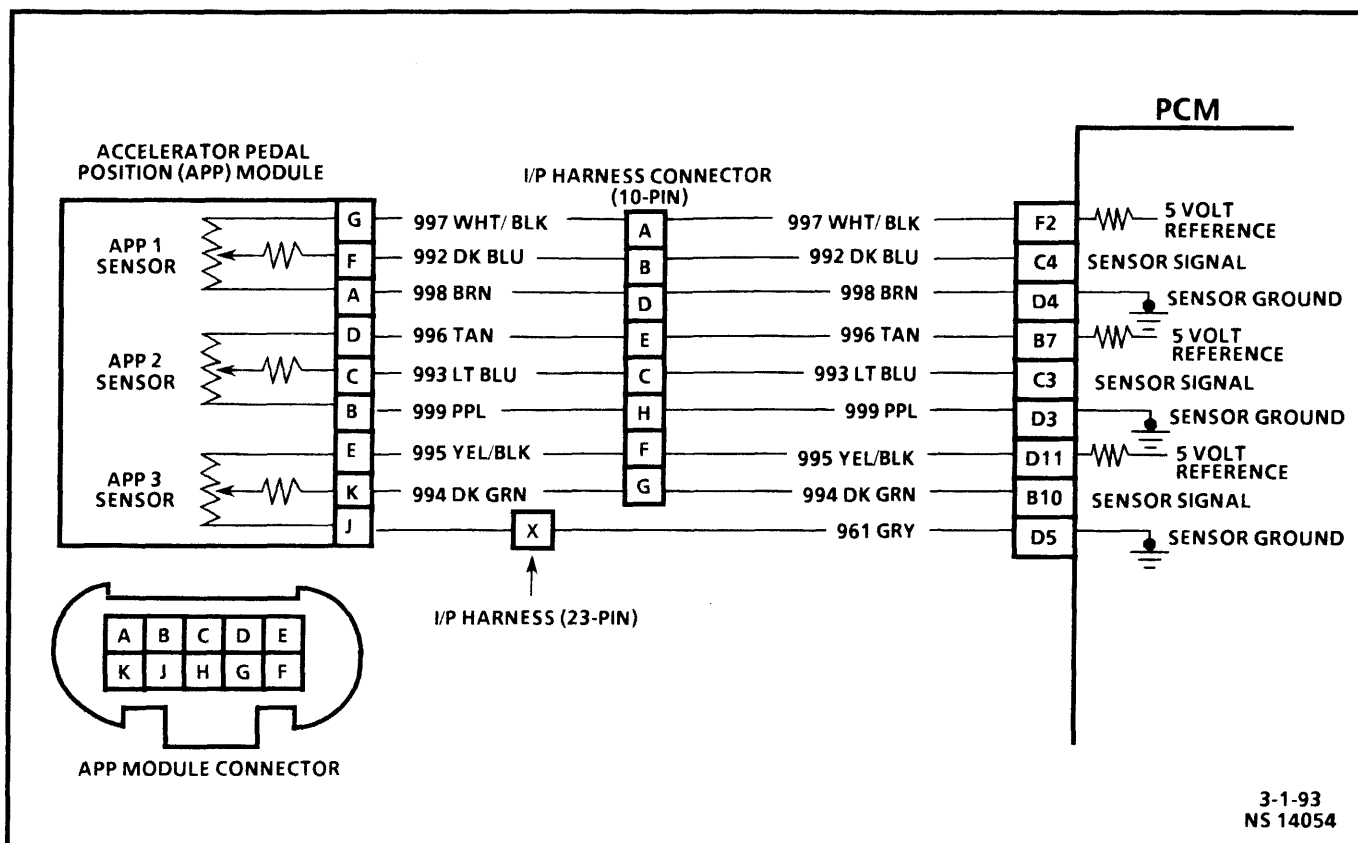
### ACCELERATOR PEDAL POSITION (APP) 2 CIRCUIT HIGH



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
NS 15528



## DTC 26

### ACCELERATOR PEDAL POSITION (APP) 2 CIRCUIT LOW

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 26 Will Set When:** Voltage is less than .25 volt for 2 seconds on APP 1 sensor.

**Action Taken (PCM will default to):** The input from the sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC 26 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 26 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This will check the PCM and CKT 993.

**Diagnostic Aids:** A Tech 1 scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward WOT.

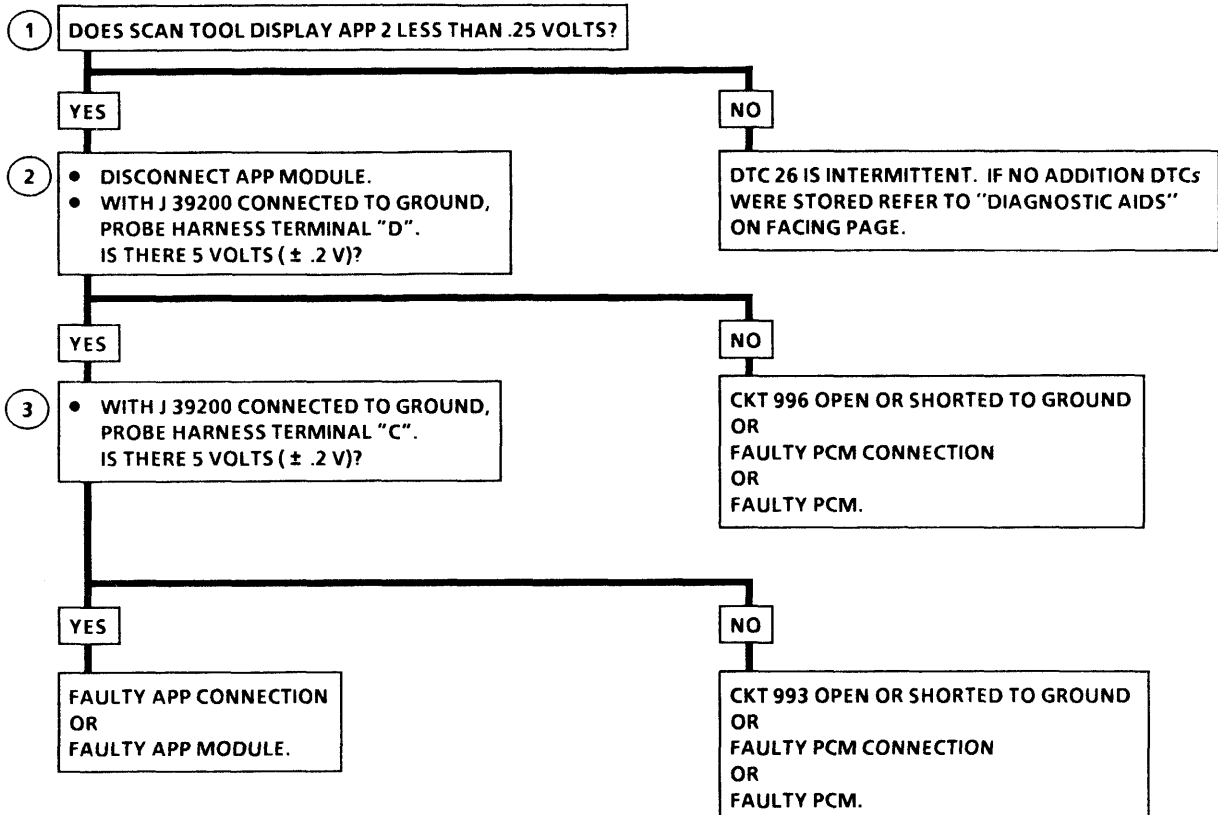
An open or short to ground in CKT 996 or 993 will result in a DTC 26.

Refer to SECTION 2 for "Intermittents."

Scan APP 2 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

## DTC 26

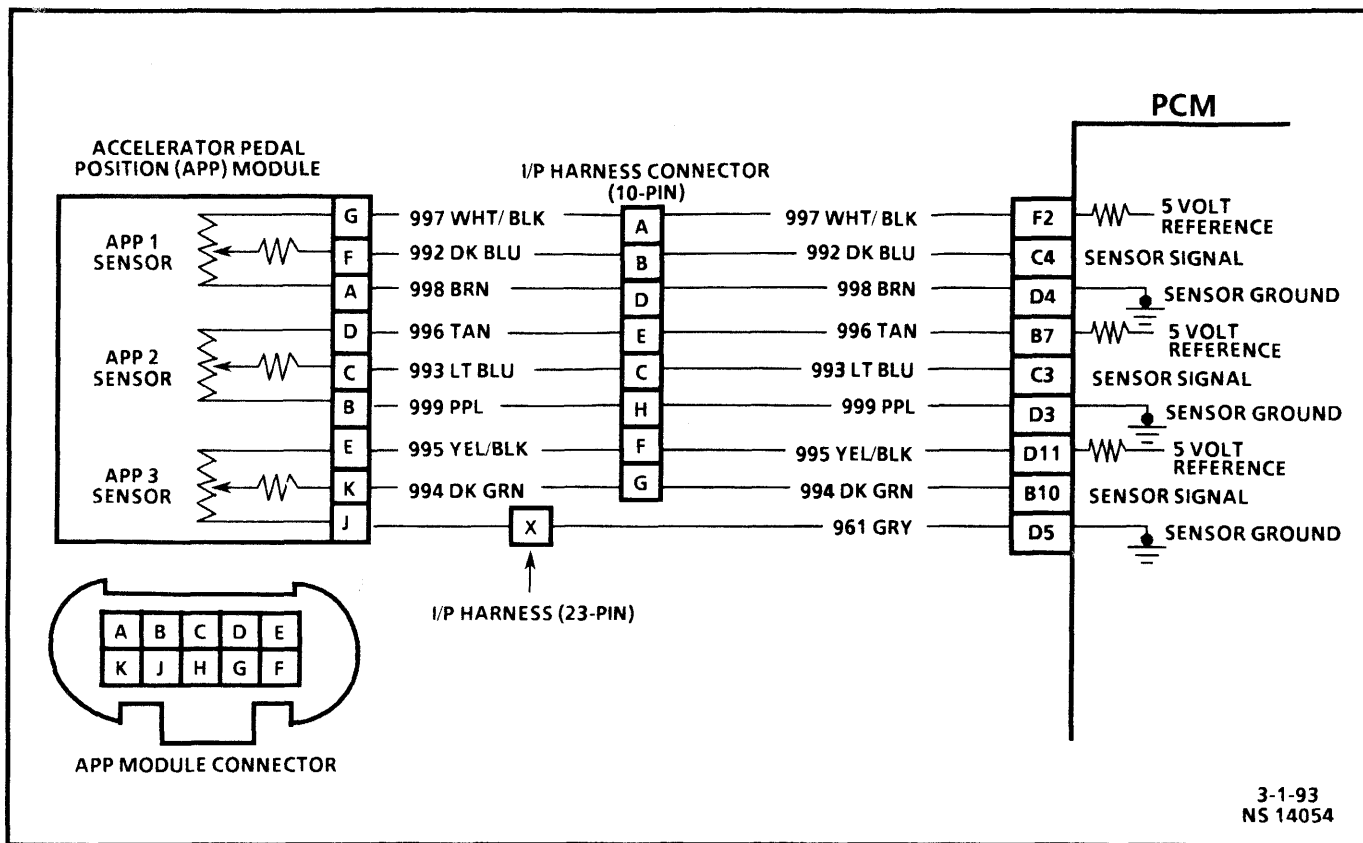
### ACCELERATOR PEDAL POSITION (APP) 2 CIRCUIT LOW



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15529



## DTC 27

### ACCELERATOR PEDAL POSITION (APP) 2 CIRCUIT RANGE FAULT

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 27 Will Set When:** PCM has recognized a "skewed" (mis-scaled) sensor. The PCM compares all three sensors to each other (percentage to voltage chart) and determines if there is a 6% difference between APP 1 and APP 2 and a 10% difference to APP 3.

**Action Taken (PCM will default to):** The input from APP 2 sensor is ignored. A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. Throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will then turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present, the "Service Throttle Soon" lamp will be "ON" and will only allow the engine to operate at idle.

**DTC 27 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if there is a good 5 volt reference.
2. This step will check for an open in the ground circuits.

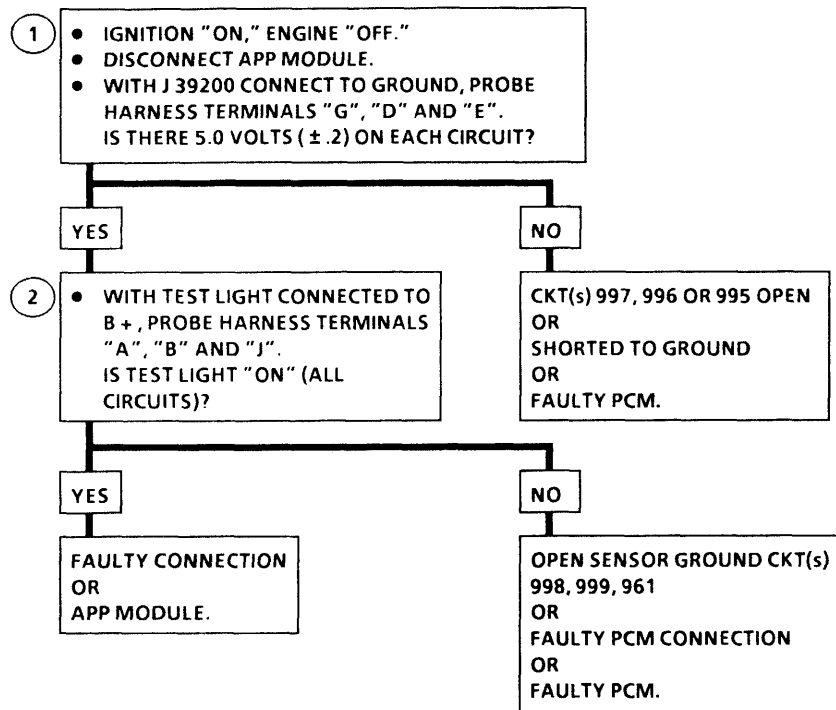
**Diagnostic Aids:** A Tech 1 scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage

should decrease at a steady rate as throttle is moved toward WOT.

Also, 90% pedal travel is acceptable for correct APP operation.

Refer to SECTION 2 for "Intermittents."

Scan APP 2 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

**DTC 27****ACCELERATOR PEDAL POSITION (APP) 2  
CIRCUIT RANGE FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15527



## DTC 29

## GLOW PLUG RELAY CIRCUIT FAULT

### Circuit Description:

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures. The glow plugs are heated before and during cranking, as well as initial engine operation. The PCM controls the glow plugs by sending a B+ signal.

### DTC 29 Will Set When:

- Glow plugs commanded "ON" and "glow plug volts" is less than .8 volt.  
**OR**
- Glow plugs "OFF" and "glow plug volts" is greater than .8 volt.  
**OR**
- "System voltage" exceeds "glow plug volts" by 2 volts.

**Action Taken (PCM will default to):** Hard start.

**DTC 29 Will Clear When:** The fault condition(s) no longer exist.

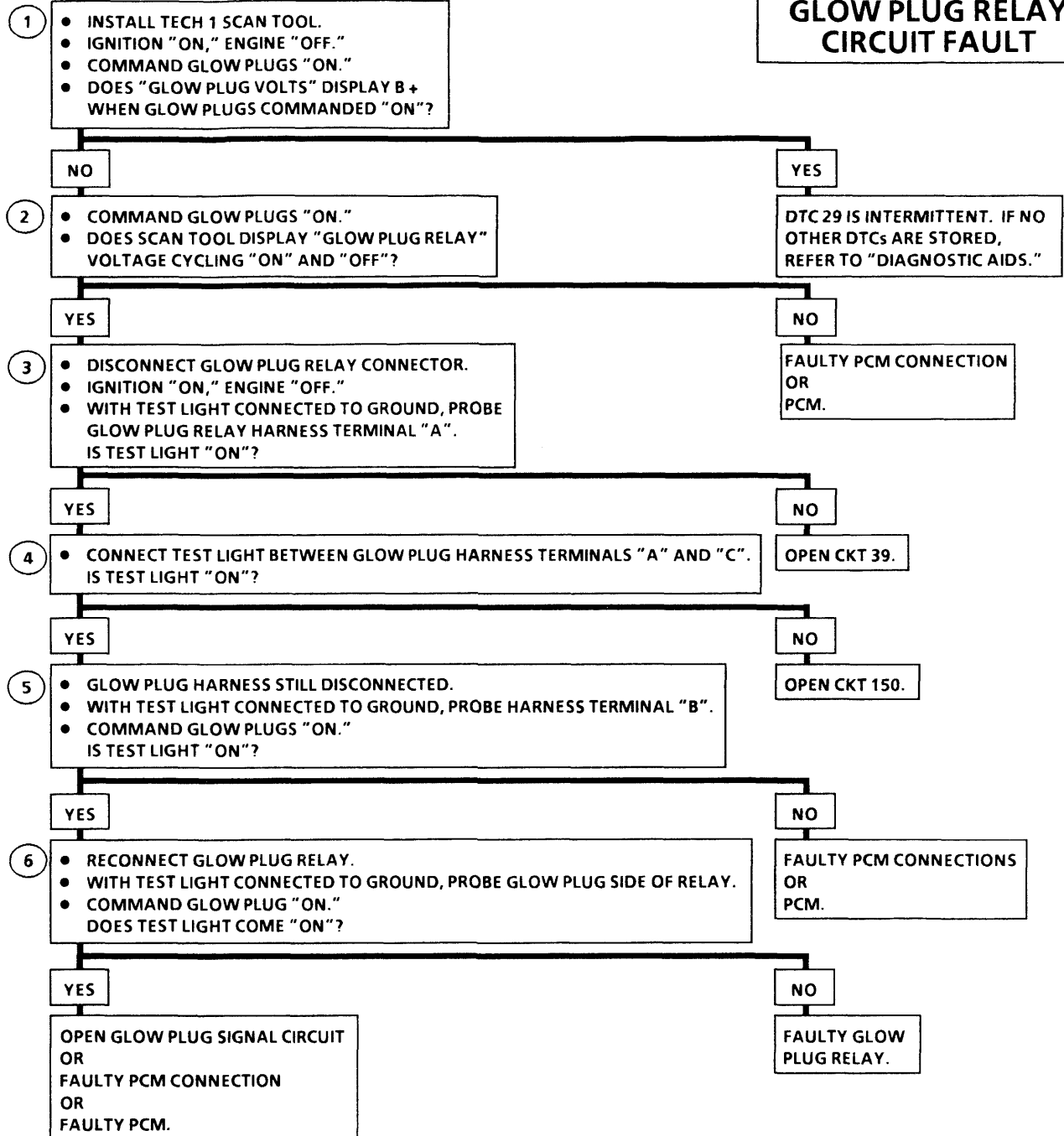
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 29 is a hard failure.
2. The Tech 1 scan tool may not display system voltage. The important thing is that the PCM is cycling voltage "ON" and "OFF" indicating that the PCM is OK.
3. This step will check relay feed circuit.
4. This step will check relay ground.

5. This step will determine if CKT 505 is open.
6. This step will check relay and wiring.

**Diagnostic Aids:** If glow plug relay was stuck in the "ON" position, check for proper operation of glow plugs, refer to SECTION 7. When glow plugs are commanded "ON" by the Tech 1, an internal PCM timer protects the glow plugs from damage by cycling them "ON" for 3 seconds and the "OFF" for 12 seconds.

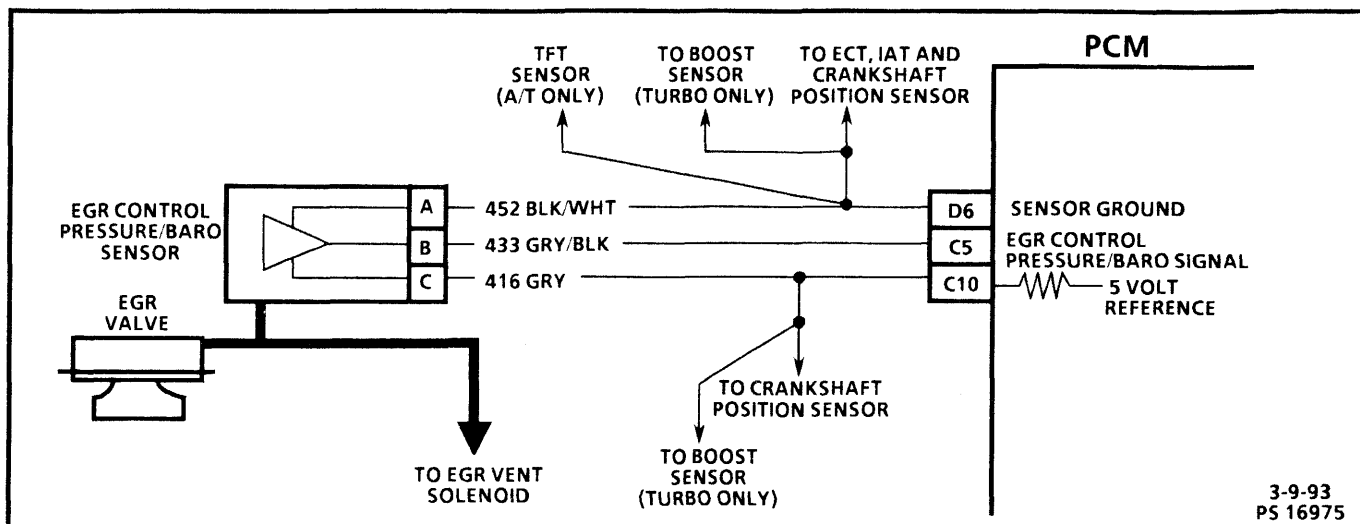
## DTC 29 GLOW PLUG RELAY CIRCUIT FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 17109



## DTC 31

### EGR CONTROL PRESSURE/BARO SENSOR CIRCUIT LOW (HIGH VACUUM)

#### Circuit Description:

A MAP sensor is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. The signal is compared to the EGR duty cycle calculated by the PCM.

**DTC 31 Will Set When:** Actual EGR pressure is less than 15 kPa for 2 seconds.

**Action Taken (PCM will default to):** The PCM will shut down the EGR system.

**DTC 31 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" the "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

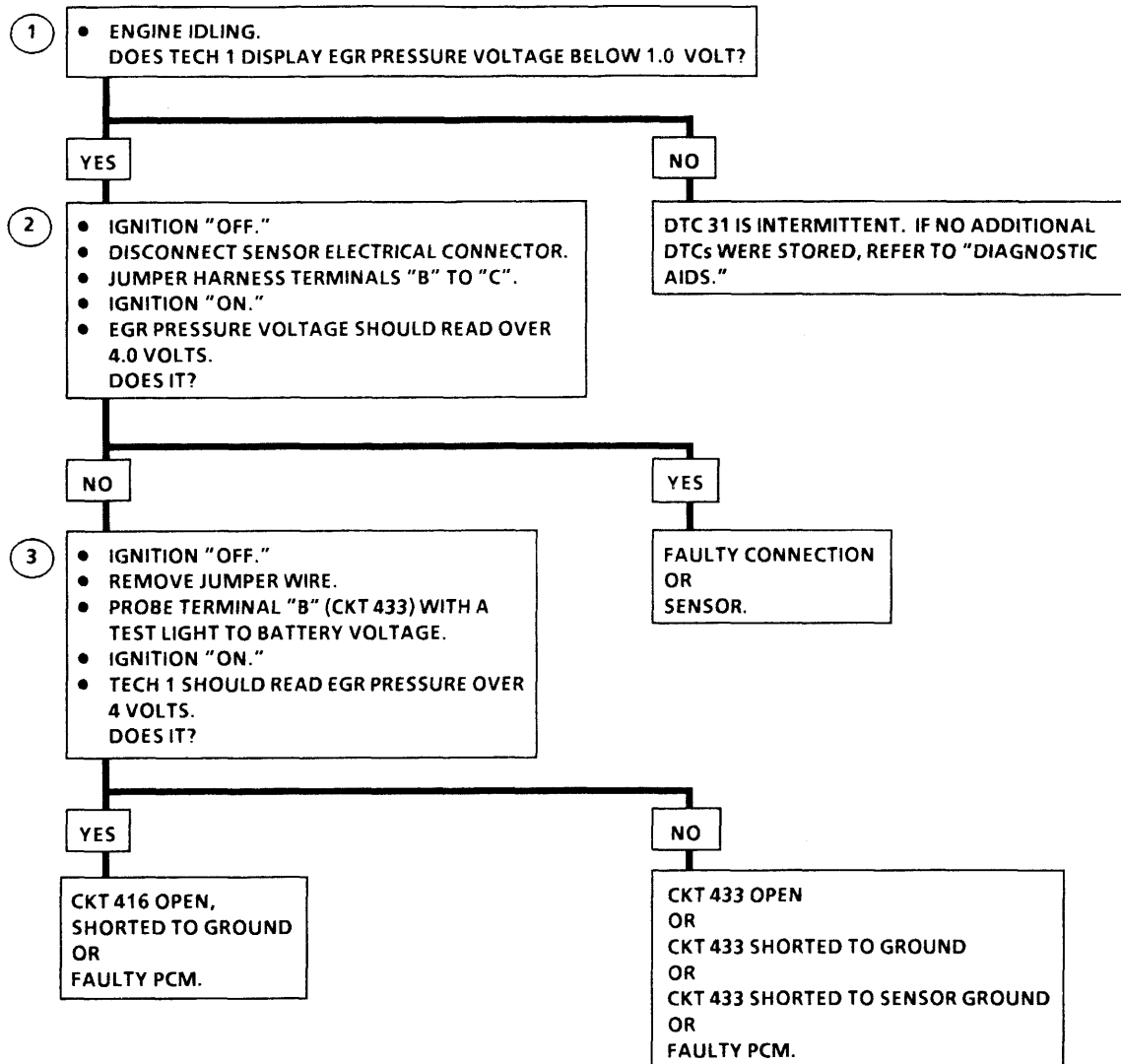
1. This step determines if DTC 31 is a hard failure or an intermittent condition.
2. Jumpering harness terminals "B" to "C" (5 volts to signal circuit) will determine if the sensor is at fault, or if there is a problem with the PCM or wiring.
3. The Tech 1 scan tool may not display 5 volts. The important thing is that the PCM recognized the voltage as more than 4 volts, indicating that the PCM and CKT 433 are OK.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, the EGR pressure is equal to atmospheric pressure with the signal voltage being high. The information is used by the PCM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

An intermittent open in CKT 433 or CKT 416 will result in a DTC 31.

## DTC 31

### EGR CONTROL PRESSURE/BARO SENSOR CIRCUIT LOW (HIGH VACUUM)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
NS 15531

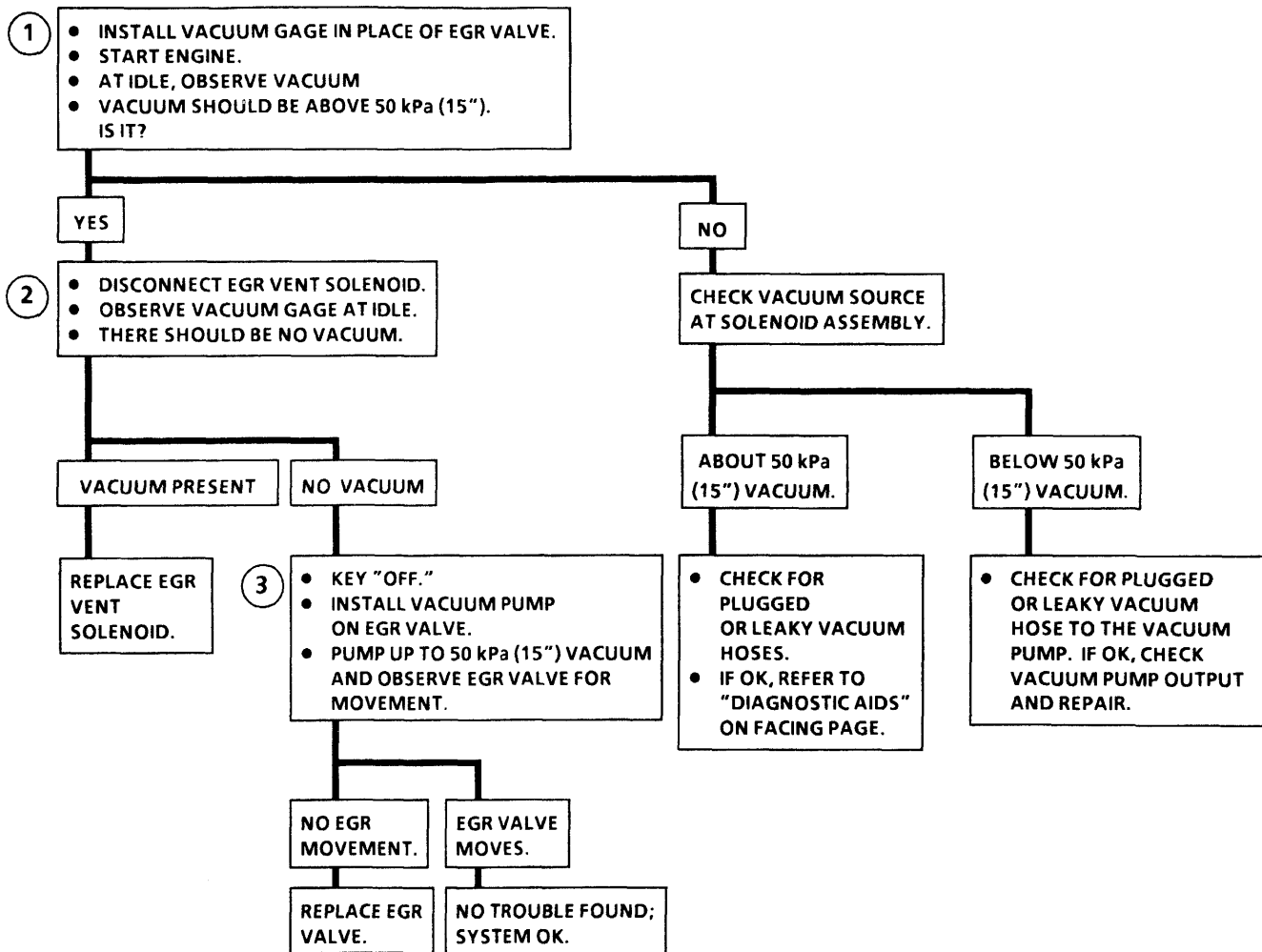
**Diagnostic Aids:** A vacuum leak or a pinched vacuum line may cause a DTC 32. Check all vacuum lines and components connected to the hoses for leaks or sharp bends. Check vacuum source to EGR solenoid.

## DTC 32

### EGR CIRCUIT ERROR

**IMPORTANT:**

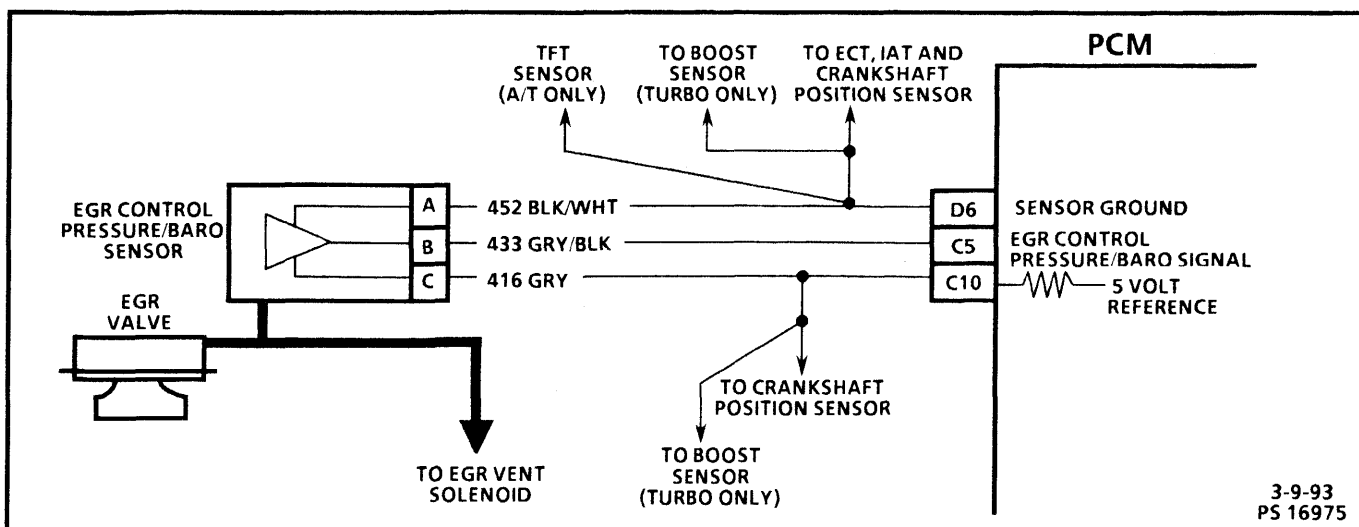
THE PCM WILL SHUT DOWN THE EGR SYSTEM IN 15 SECONDS. TO PROPERLY DIAGNOSIS EGR SYSTEM, IGNITION SHOULD BE CYCLED "ON" AND "OFF" BEFORE EACH PROCEDURE.



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-6-93  
NS 14047



## DTC 33

### EGR CONTROL PRESSURE/BARO SENSOR CIRCUIT HIGH (LOW VACUUM)

#### Circuit Description:

A EGR control pressure/BARO sensor is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. The signal is compared to the EGR duty cycle calculated by the PCM.

#### DTC 33 Will Set When:

- EGR vent "OFF."
- Desired EGR is less than 60 kPa from EGR pressure.

**Action Taken (PCM will default to):** PCM will shut off EGR system.

**DTC 33 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 33 is a hard failure or an intermittent condition.
2. This step simulates conditions for a DTC 31. If the PCM recognizes the change, the PCM and CKT 433 and CKT 416 are OK.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure with the signal voltage being high. This information is used by the PCM as an indicator of vehicle altitude.

Comparison of the reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm$  .4 volt.

A DTC 33 will result if CKT 452 is open or if CKT 433 is shorted to voltage or to CKT 416.

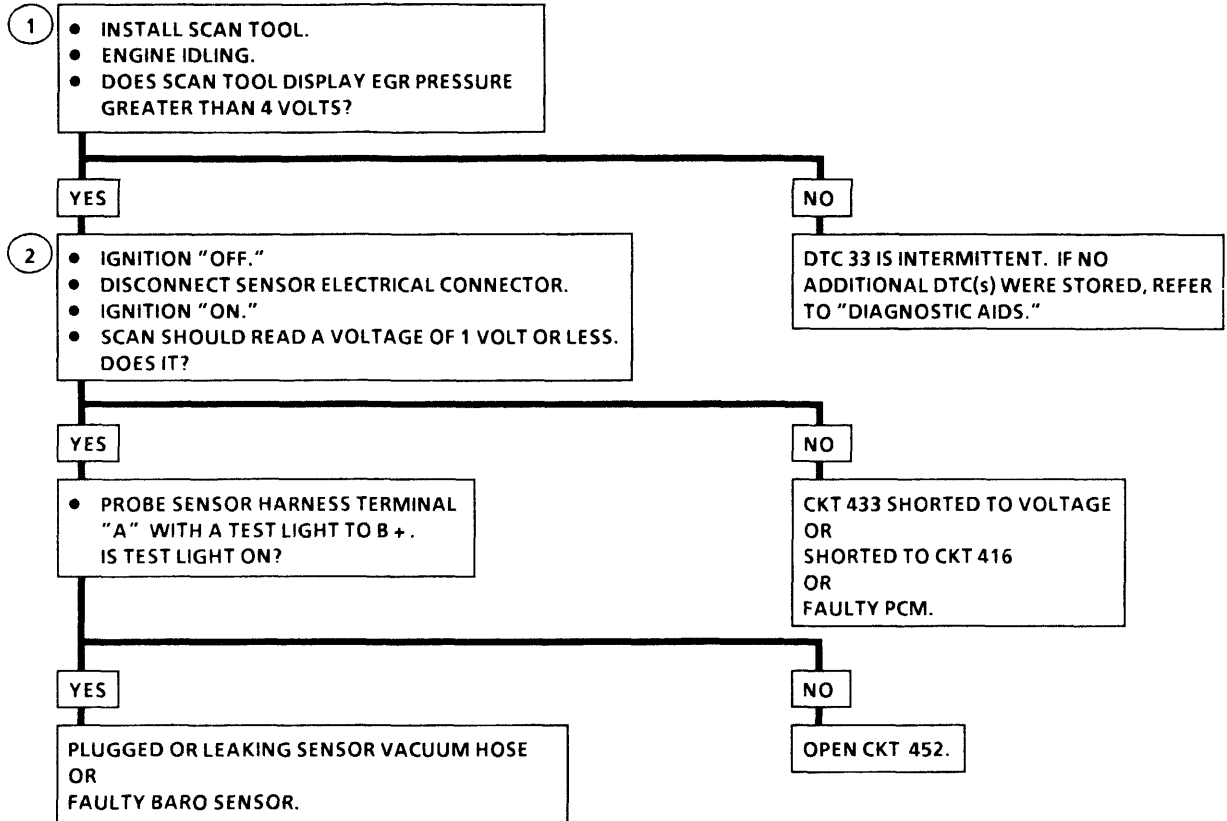
If DTC 33 is intermittent, refer to SECTION 2.

**NOTICE:** Make sure electrical connector remains securely fastened.

- Refer to "EGR Control Pressure/BARO Sensor Output Check" for further diagnosis.

## DTC 33

### EGR CONTROL PRESSURE/BARO SENSOR CIRCUIT HIGH (LOW VACUUM)

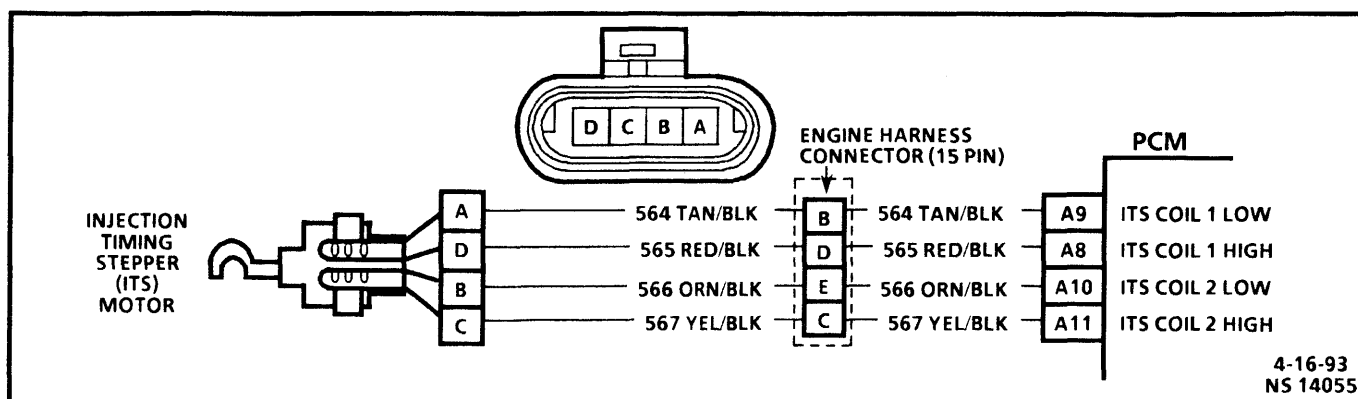


IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-21-93  
PS 17141





## DTC 34

### INJECTION TIMING STEPPER (ITS) MOTOR CIRCUIT FAULT

#### Circuit Description:

The PCM controls injection timing with the injection timing stepper motor. To increase injection timing the PCM extends the stepper motor. To retard injection timing the PCM retracts the stepper motor.

#### DTC 34 Will Set When:

- Engine operating at steady RPM.
- A 5° difference between measured and desired injection timing for 20.8 seconds.

**Action Taken (PCM will default to):** None.

**DTC 34 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

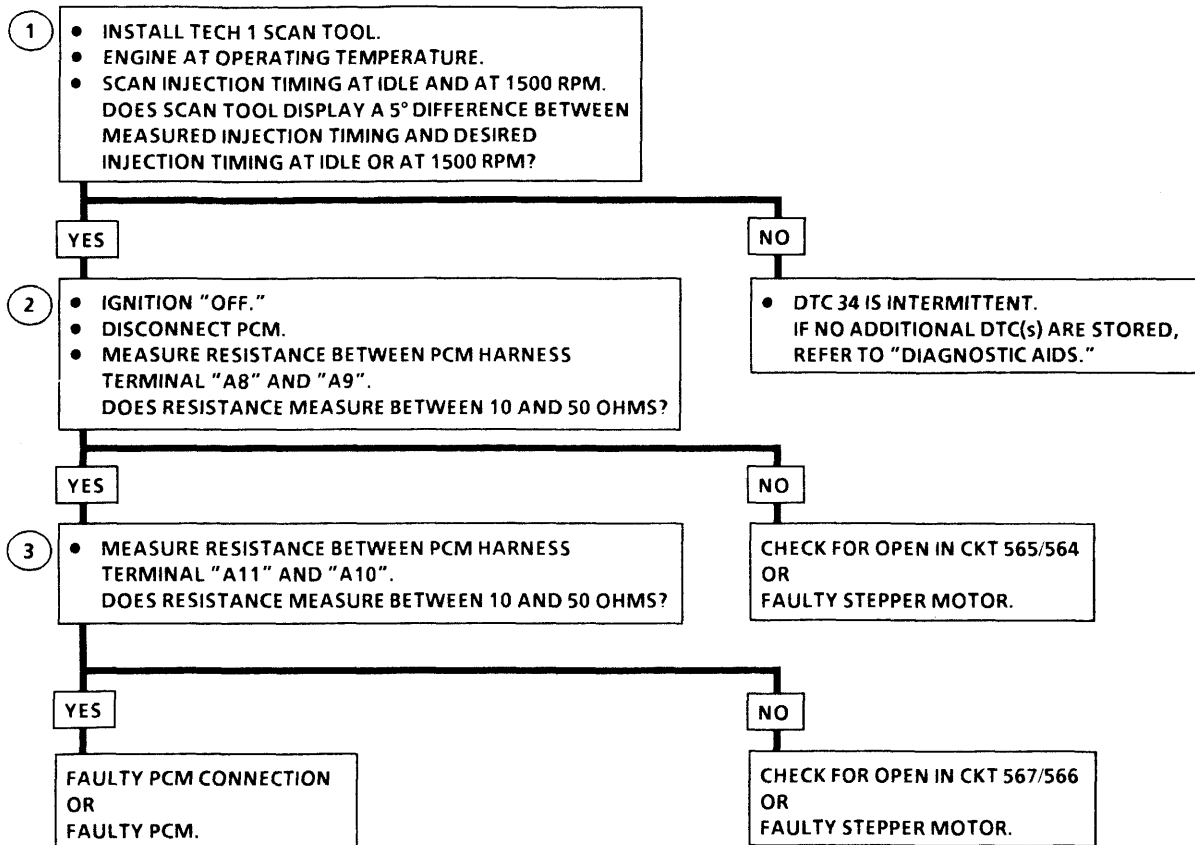
1. This step determines if DTC 34 is a hard failure or an intermittent.
2. This step checks for an open or short in CKTs 564 and 565.
3. This step checks for an open or short in CKTs 566 and 567.

**Diagnostic Aids:** A hard start and possible poor performance condition might exist.

Measured injection timing will freeze at the point of the fault.

## DTC 34

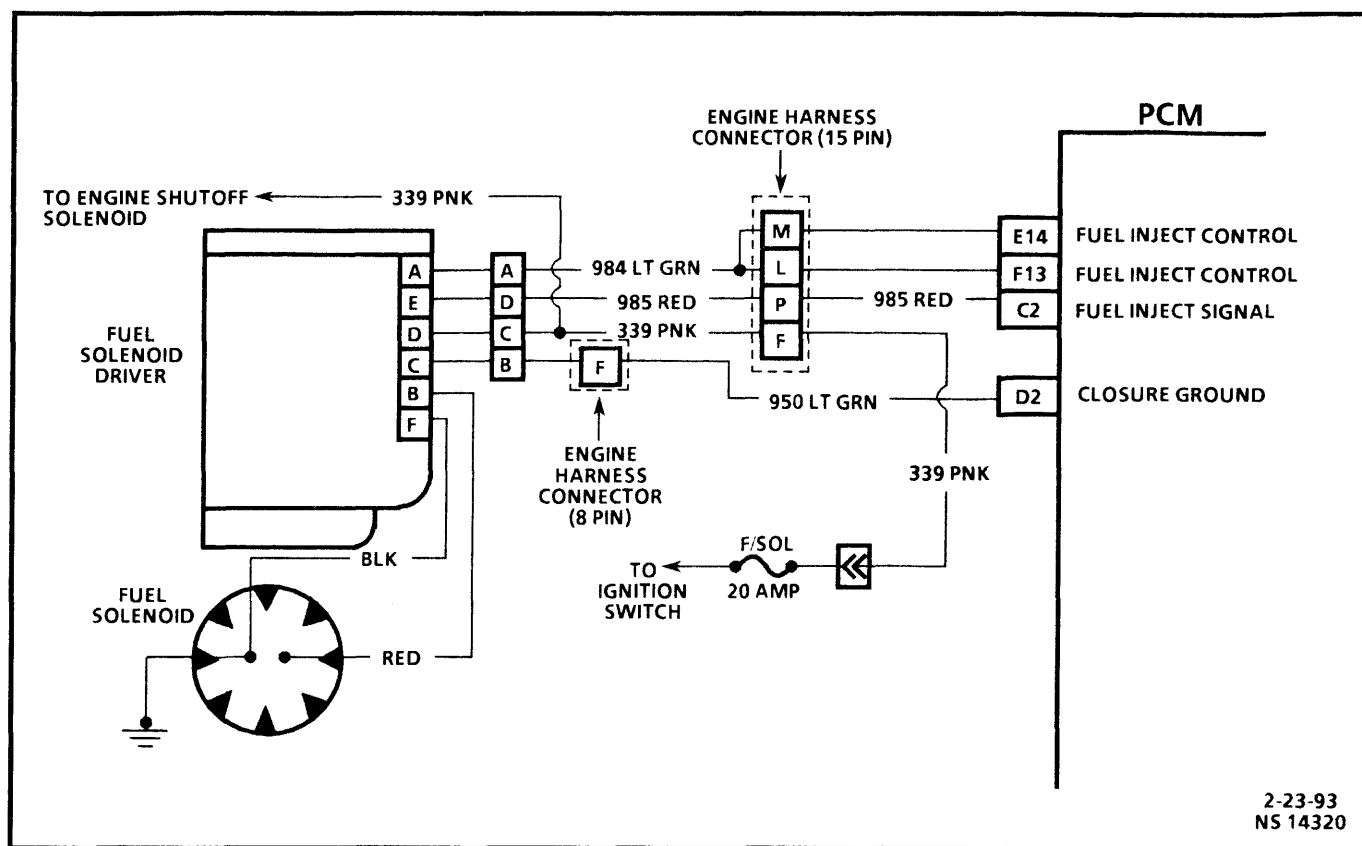
### INJECTION TIMING STEPPER (ITS) MOTOR CIRCUIT FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 16983



## DTC 35

### INJECTION PULSE WIDTH ERROR (RESPONSE TIME SHORT)

#### Circuit Description:

The fuel injector driver receives an inject command signal from the PCM and provides a current regulated output to the fuel solenoid that controls injection. It also returns an injection pulse width signal back to the PCM to inform it when the fuel solenoid has actually seated. This injection pulse width signal is measured in micro seconds.

#### DTC 35 Will Set When:

- Battery voltage greater than 10 volts.
- Engine coolant temperature greater than 20°C (68°F).
- Injection pulse width less than 1.5 milliseconds.

**Action Taken (PCM will default to):** Fixed injection pulse width valve.

**DTC 35 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

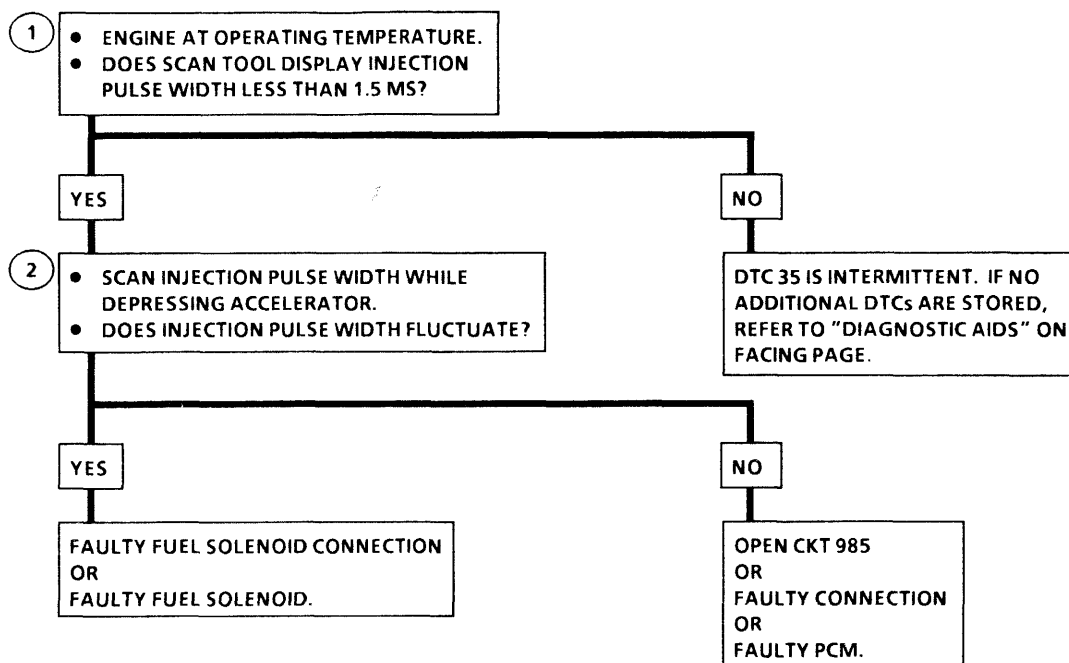
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 35 is the result of a hard failure or an intermittent.
2. This will check CKT 985 for an open.

**Diagnostic Aids:** The injection pulse width will fluctuate slightly when throttle is depressed.

## DTC 35

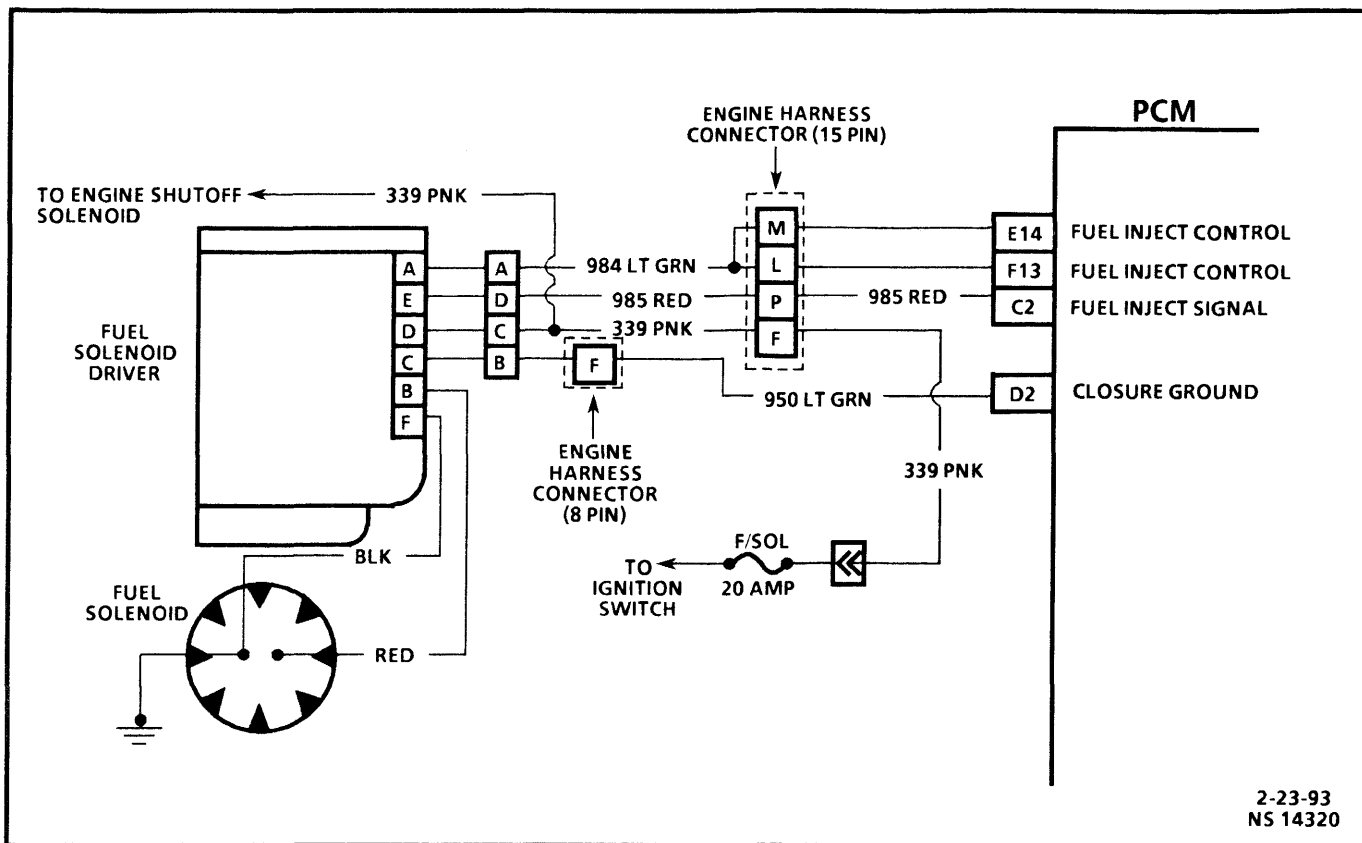
### INJECTION PULSE WIDTH ERROR (RESPONSE TIME SHORT)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-7-93  
NS 15532



## DTC 36

### INJECTION PULSE WIDTH ERROR (RESPONSE TIME LONG)

#### Circuit Description:

The fuel injection driver receives an inject command signal from the PCM and provides a current regulated output to the fuel solenoid that controls injection. It also returns an injection pulse width signal back to the PCM to inform it when the fuel solenoid has actually seated. This injection pulse width signal is measured in micro seconds.

#### DTC 36 Will Set When:

- Battery voltage greater than 10 volts.
- Coolant temperature greater than 20°C (68°F).
- Injection pulse width greater than 2.5 milliseconds.

**Action Taken (PCM will default to):** Fixed injection pulse width.

**DTC 36 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

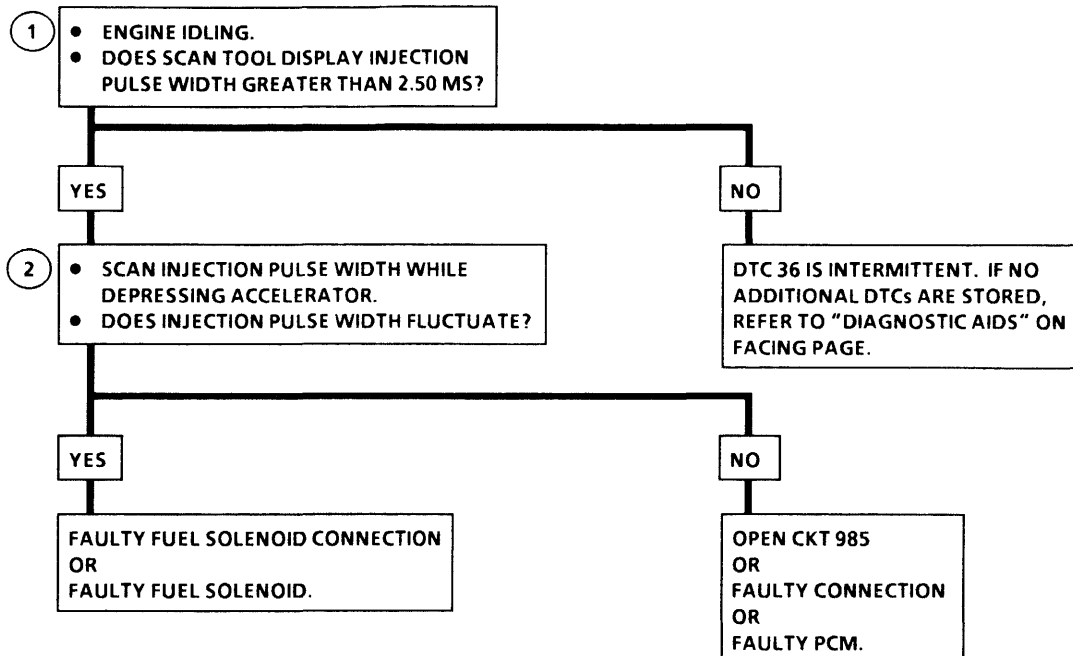
1. This step determines if DTC 36 is a hard failure or an intermittent.
2. This step will determine if the solenoid is at fault, or if there is a problem with the PCM or wiring.

**Diagnostic Aids:** The injection pulse width will fluctuate when throttle is depressed.

A weak (mechanical failure) fuel solenoid will result in a DTC 36.

## DTC 36

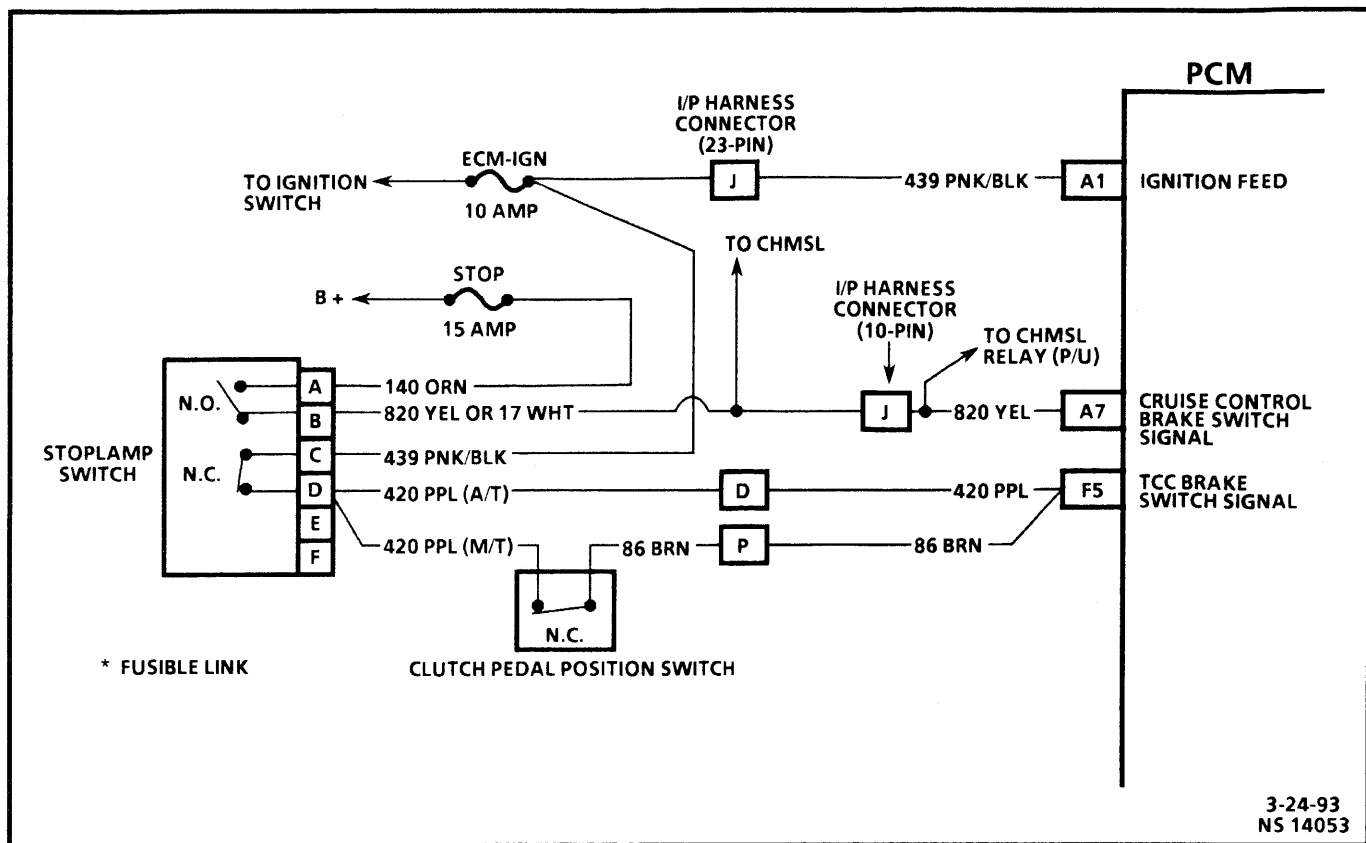
### INJECTION PULSE WIDTH ERROR (RESPONSE TIME LONG)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 16758



## DTC 41

### BRAKE SWITCH CIRCUIT FAULT

#### Circuit Description:

The TCC normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The circuit is opened when the brakes are applied.

The stop lamp/cruise control normally open brake switch supplies a B+ signal on CKT 820 to the PCM when the brake is applied.

#### DTC 41 Will Set When:

- Vehicle on decel.
- TCC and cruise control brake switches are not toggling "open" and "closed," during 6 brake applications on same ignition cycle.

**Action Taken (PCM will default to):** An incorrect brake signal can affect TCC, fourth gear operation, in hot mode and cruise control.

**DTC 41 Will Clear When:** The fault condition(s) no longer exist.

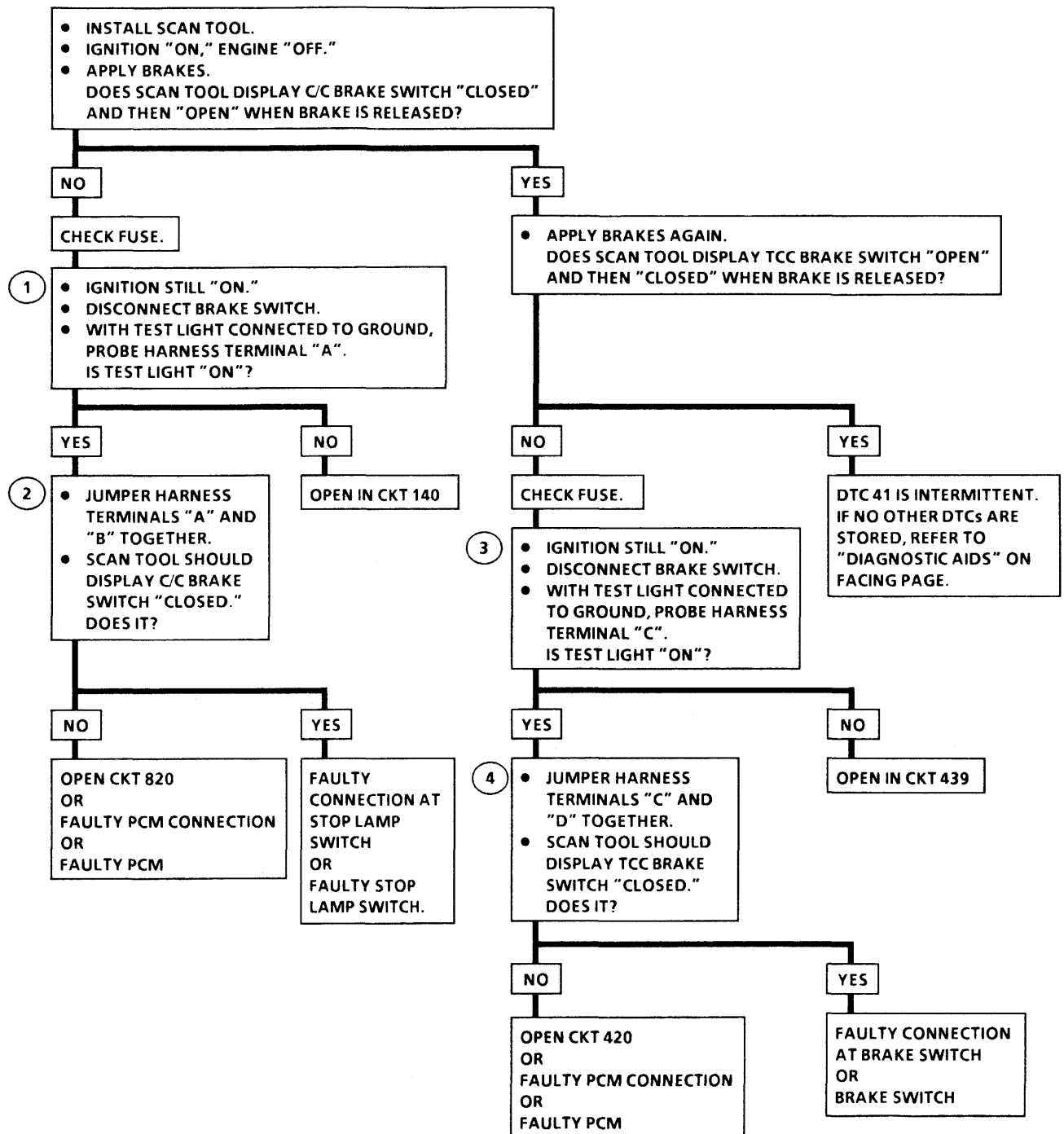
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- This test checks for voltage at brake switch.
- This test simulates brake switch closed or brakes "OFF."
- This test checks for ignition feed to TCC brake switch.
- This test checks CKT 420 and simulates brakes being applied.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

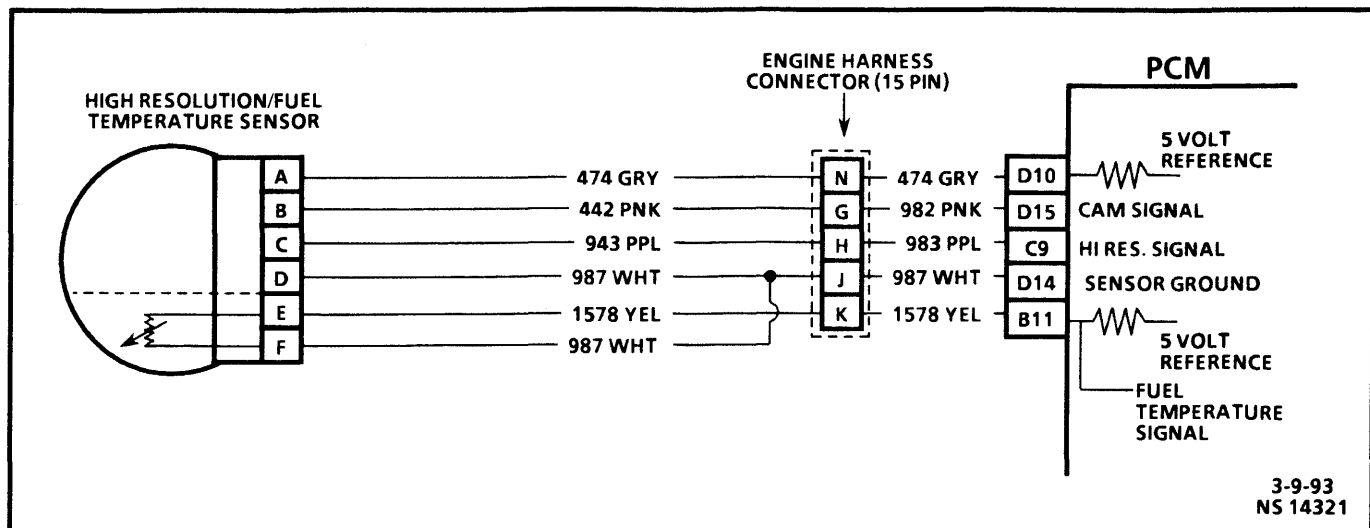
## DTC 41 BRAKE SWITCH CIRCUIT FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.





## DTC 42

### FUEL TEMPERATURE CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The fuel temperature sensor is a thermistor that controls signal voltage to the PCM. When the fuel is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As fuel warms, sensor resistance becomes less and voltage drops. The fuel temperature sensor is integrated with the optical sensor.

**DTC 42 Will Set When:** Fuel temperature greater than 102°C (215°F) for 2 seconds.

**Action Taken (PCM will default to):** Poor idle quality during hot conditions.

**DTC 42 Will Clear When:** The fault condition(s) no longer exist.

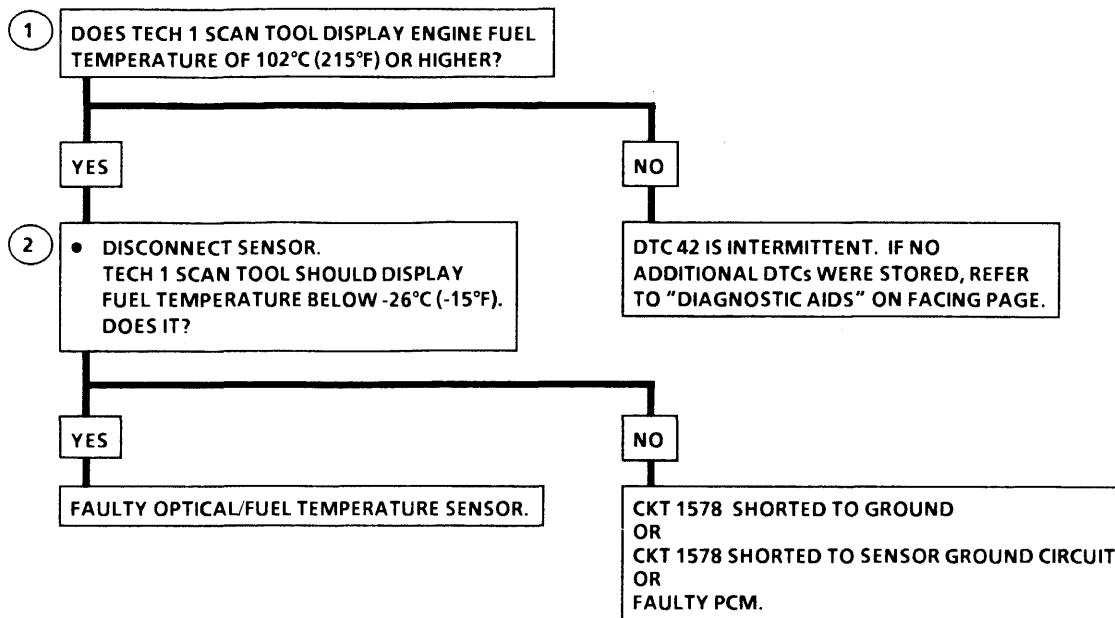
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 42 is a hard failure or an intermittent condition.
2. This test will determine if CKT 1578 is shorted to ground.

**Diagnostic Aids:** A scan tool reads fuel temperature in degrees centigrade. After engine is started, the fuel temperature should rise steadily.

A faulty connection, or an open in CKTs 1578 or 987 will result in a DTC 43.

The "Temperature To Resistance Value" scale at the right may be used to test the fuel sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor.

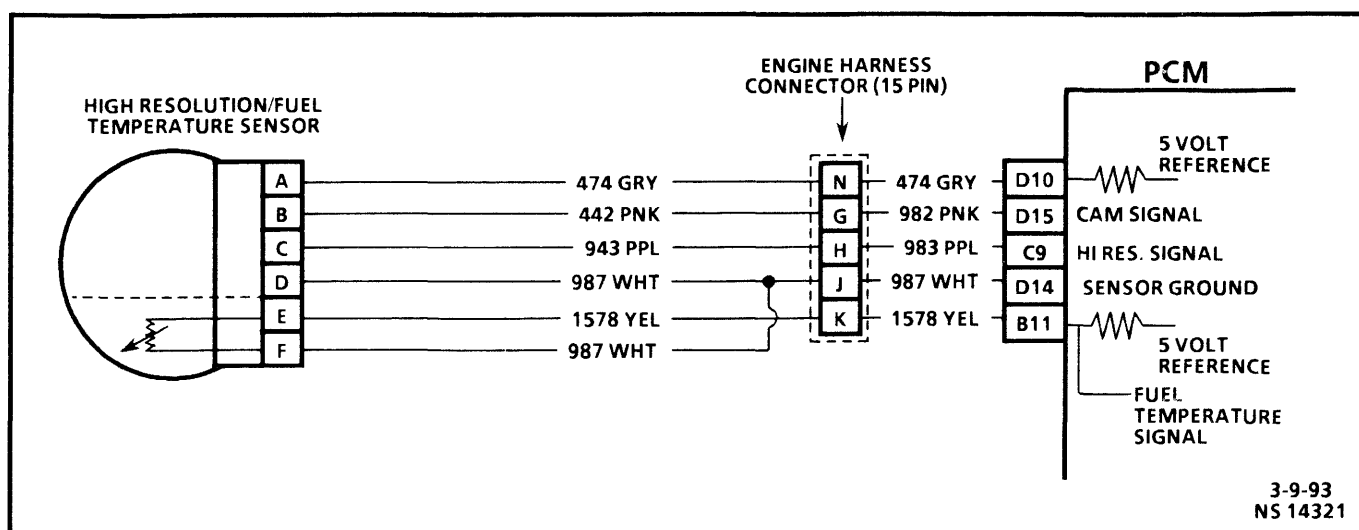
**DTC 42****FUEL TEMPERATURE CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| FUEL TEMPERATURE SENSOR                            |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15533



## DTC 43

### FUEL TEMPERATURE CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The fuel temperature sensor is a thermistor that controls signal voltage to the PCM. When the fuel is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As fuel warms, sensor resistance becomes less and voltage drops. The fuel temperature sensor is integrated with the optical sensor.

#### DTC 43 Will Set When:

- Fuel temperature less than -14°C (6°F).
- Engine running for at least 2 minutes.

**Action Taken (PCM will default to):** Poor idle quality during hot conditions.

**DTC 43 Will Clear When:** The fault condition(s) no longer exist.

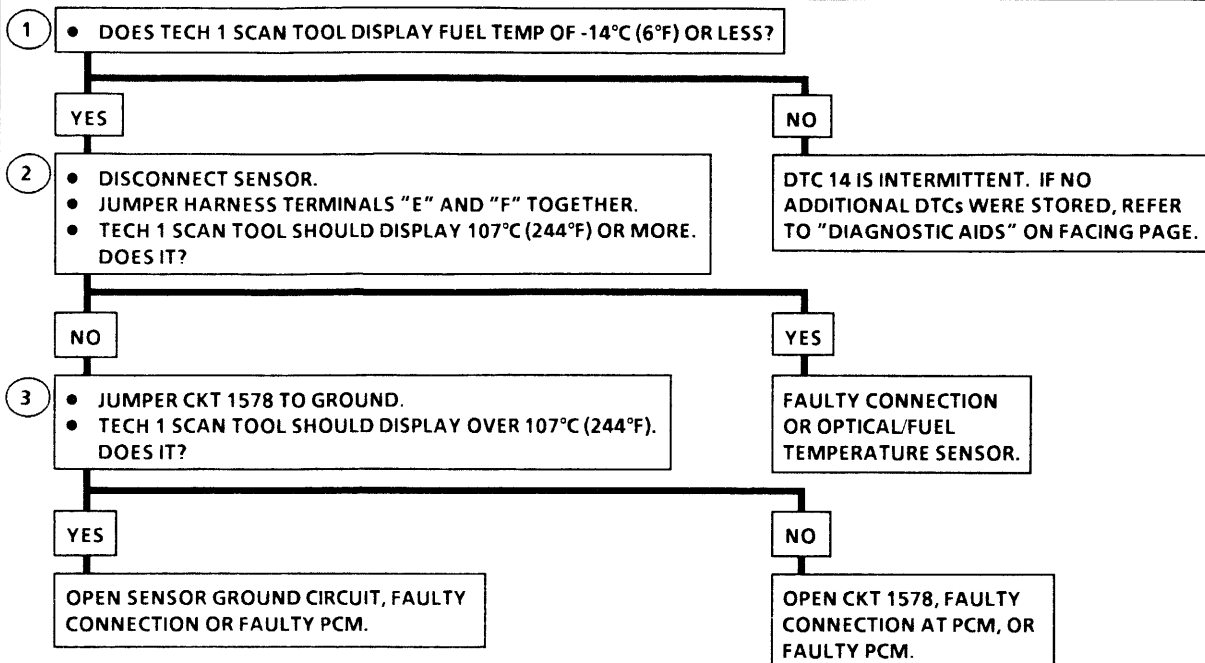
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 43 is a hard failure or an intermittent condition.
2. This test simulates a DTC 42. If the PCM recognizes the low signal voltage (high temp) the PCM and wiring are OK.
3. This test will determine if CKT 1578 is open. There should be 5 volts at sensor connector if measured with J 39200-DVM. This will determine if there is a wiring problem or a faulty PCM.

**Diagnostic Aids:** A scan tool reads fuel temperature in degrees centigrade. After engine is started, the temperature should rise steadily.

A faulty connection, or an open in CKTs 1578 or 987 will result in a DTC 43.

The "Temperature To Resistance Value" scale at the right may be used to test the fuel sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor.

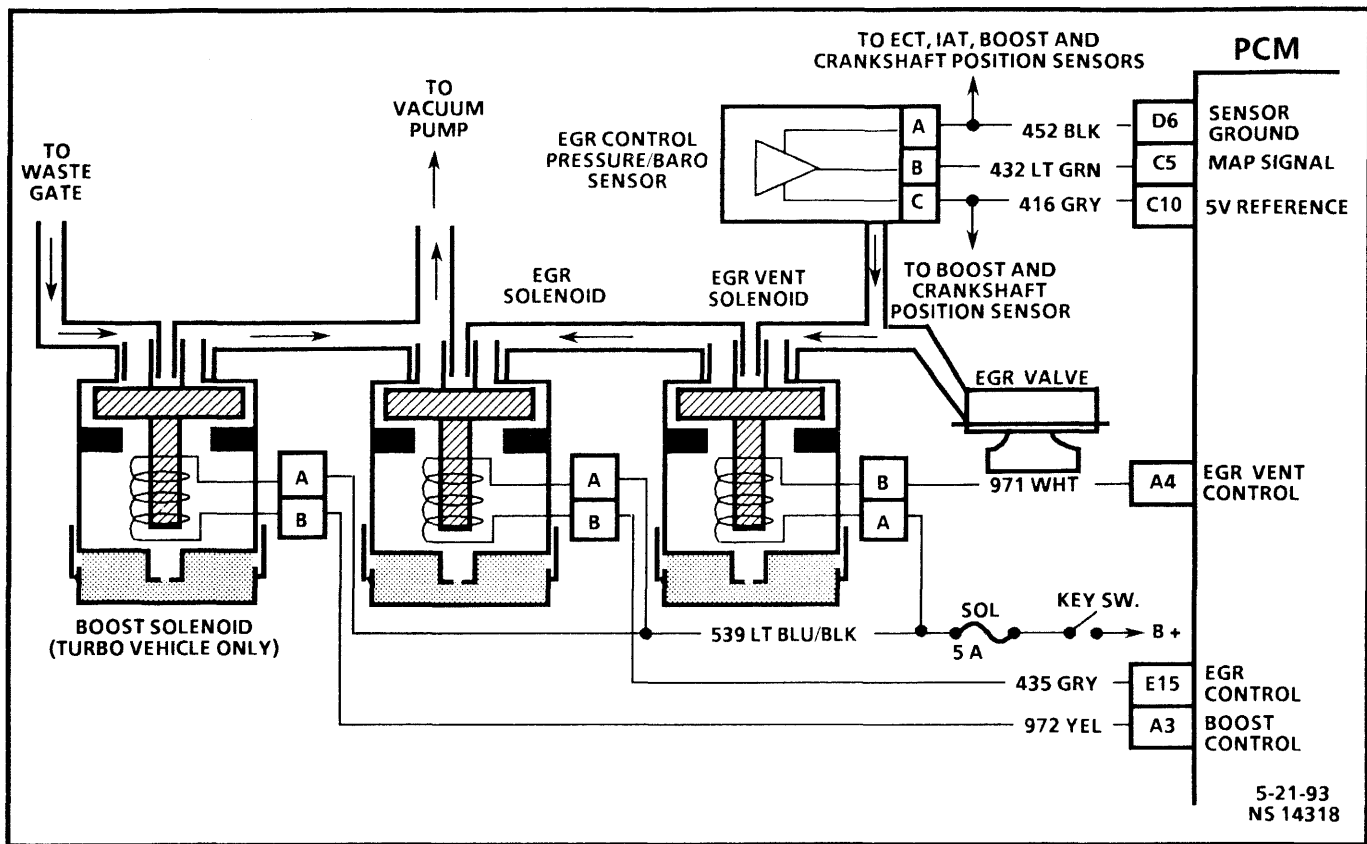
**DTC 43****FUEL TEMPERATURE CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| FUEL TEMPERATURE SENSOR                            |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-7-93  
NS 15534



## DTC 44

### EGR PULSE WIDTH ERROR

#### Circuit Description:

The PCM operates a solenoid to control the EGR valve. This solenoid is normally open. By providing a ground path the PCM energizes the solenoid which then allows vacuum to pass to the EGR.

During normal operation, the PCM compares its EGR duty cycle signal with the EGR control pressure/BARO signal and makes corrections in the duty cycle accordingly. If there is a difference in the PCM command and what is at the EGR valve sensed by the EGR control pressure/BARO, the PCM makes minor adjustments to correct.

**DTC 44 Will Set When:** No ignition voltage on Terminal "E15" when EGR solenoid is commanded "ON."

**Action Taken (PCM will default to):** The PCM will shut down the EGR.

**DTC 44 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

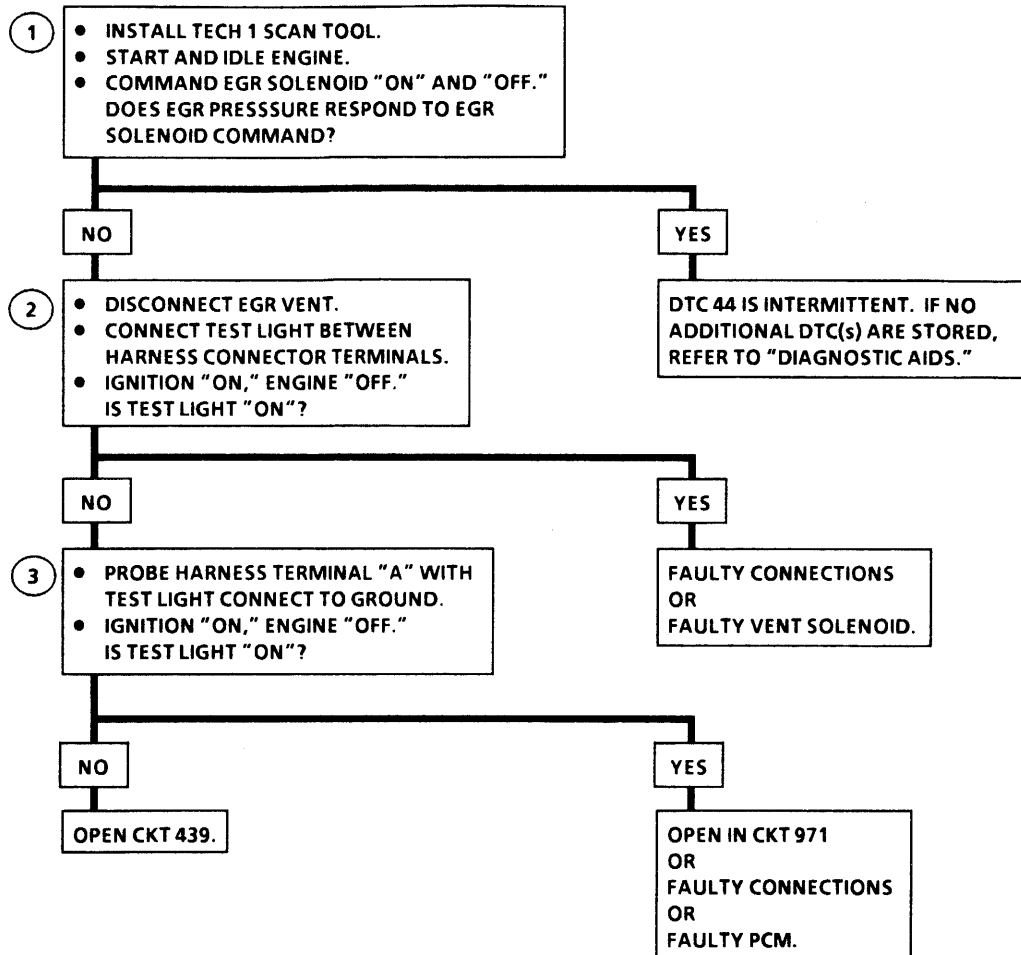
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 44 is a hard failure or an intermittent.
2. This step checks to see if PCM and wiring are OK.
3. This step checks the EGR solenoid.

**Diagnostic Aids:** An open in CKT 439 or 435 will set a DTC 44.

## DTC 44

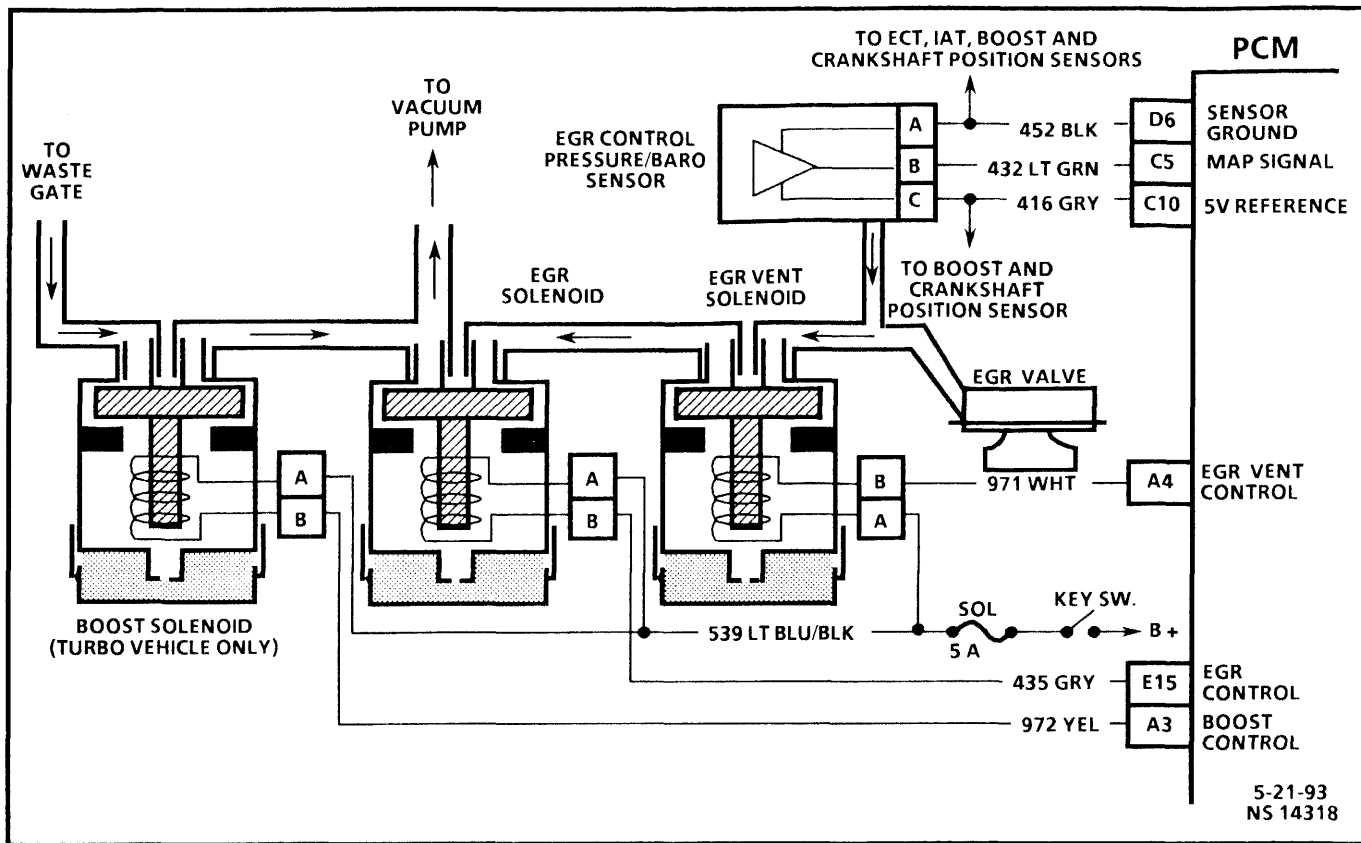
### EGR PULSE WIDTH ERROR



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-22-93  
PS 16753



## DTC 45

### EGR VENT ERROR

#### Circuit Description:

When the PCM recognizes the operating range for no EGR, the PCM energizes the EGR vent solenoid which allows rapid venting of EGR vacuum. This solenoid is normally open.

**DTC 45 Will Set When:** No ignition voltage on Terminal "A4" when EGR vent commanded "ON."

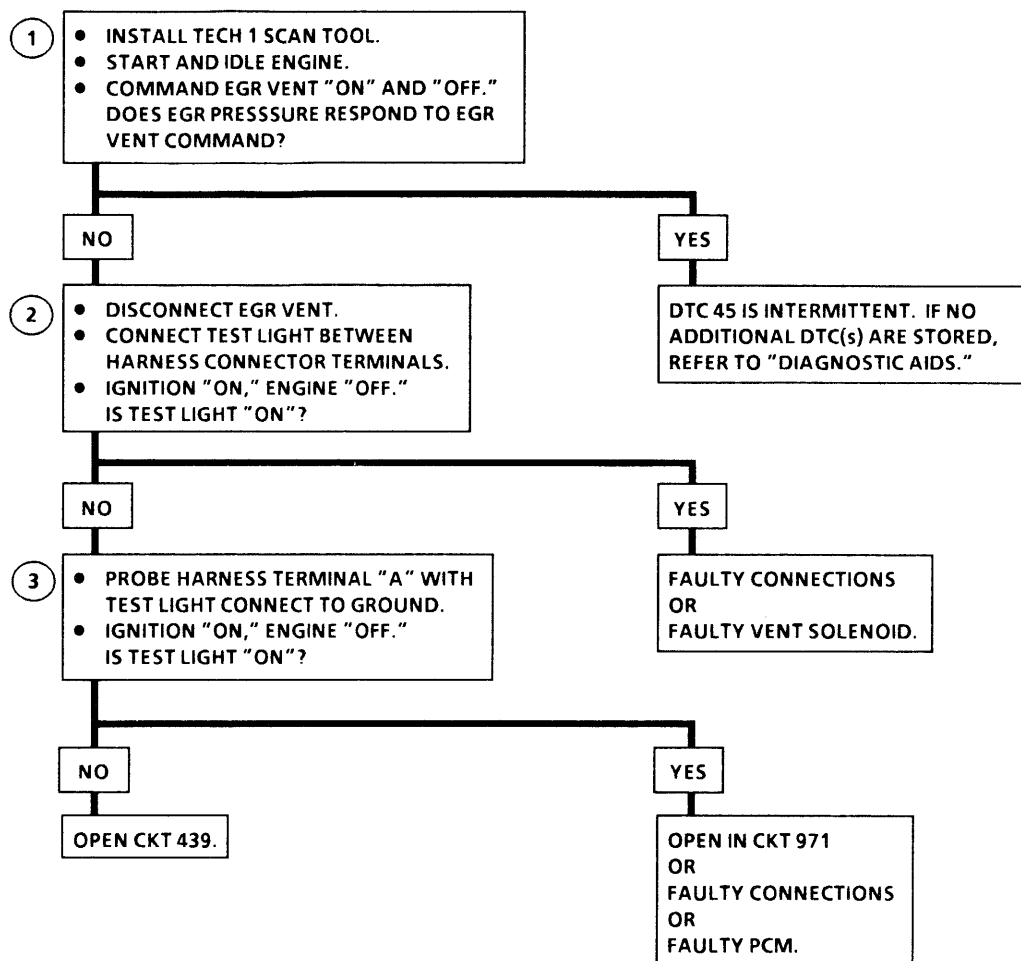
**Action Taken (PCM will default to):** The PCM will shut "OFF" EGR system.

**DTC 45 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 45 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This step checks power and control circuit.

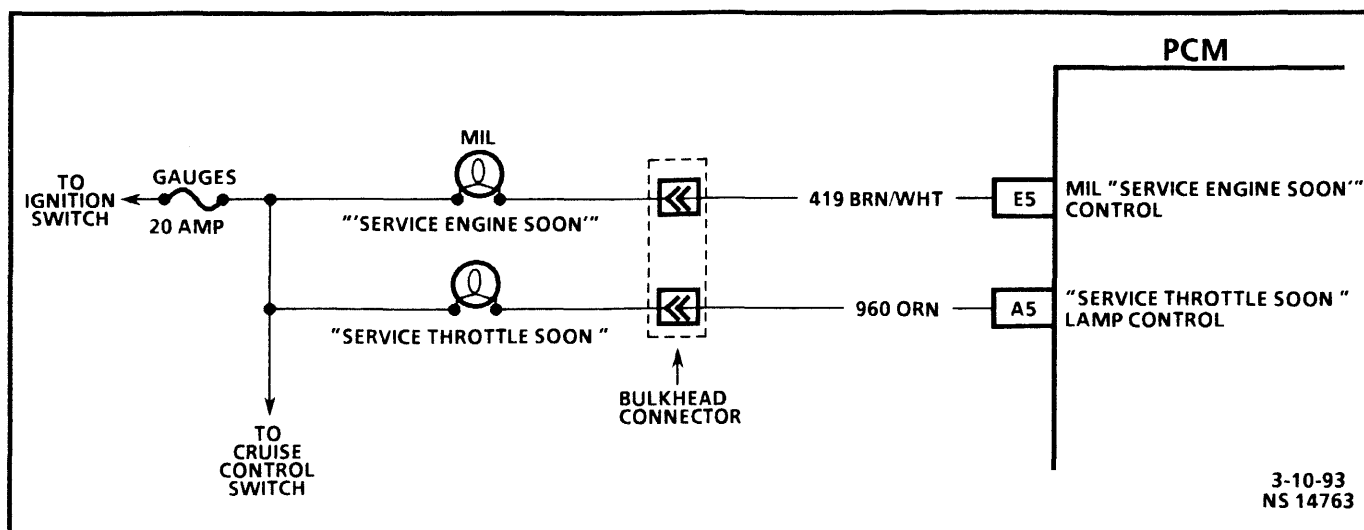
**Diagnostic Aids:** DTC 45 will set if CKT 971 or 439 is open.

**DTC 45**  
**EGR VENT ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-22-93  
PS 16761





## DTC 46

### MIL "SERVICE ENGINE SOON" CIRCUIT FAULT

#### Circuit Description:

There should always be a MIL "Service Engine Soon" when the ignition is "ON" and the engine stopped. The PCM will control the MIL and turn it "ON" by providing a ground path.

**DTC 46 Will Set When:** No ignition voltage on Terminal "E5" when PCM is requesting MIL "ON."

**Action Taken (PCM will default to):** No MIL.

**DTC 46 Will Clear When:** The fault condition(s) no longer exist.

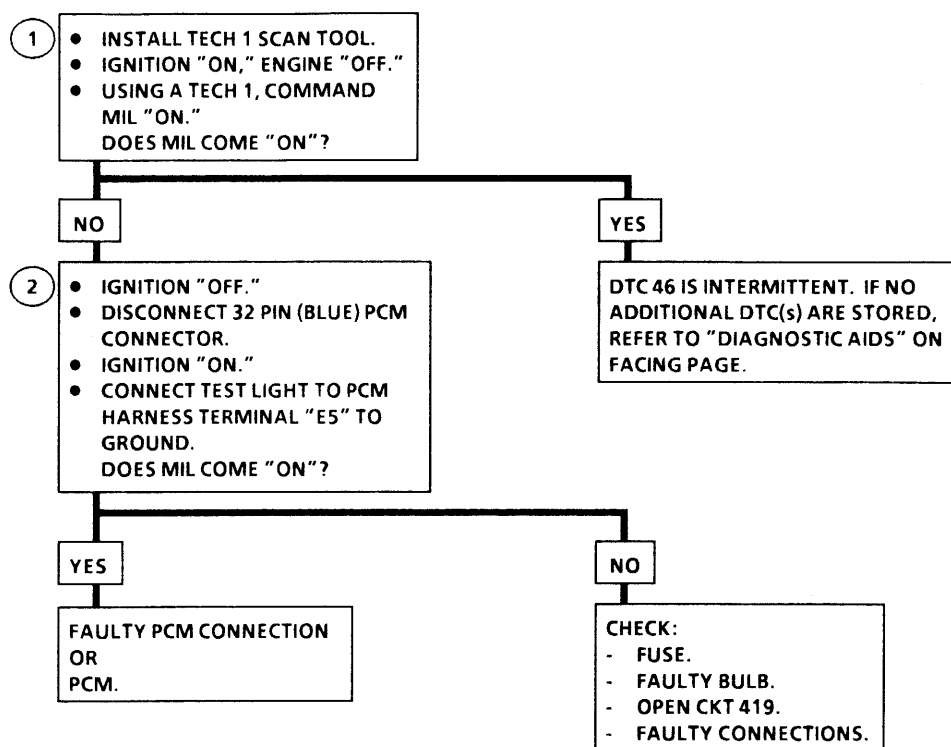
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the MIL.
2. This test will determine if there is an open in ignition feed circuit.

**Diagnostic Aids:** Check for faulty bulb or fuse. An open in CKT 419 will cause a DTC 46 to set.

## DTC 46

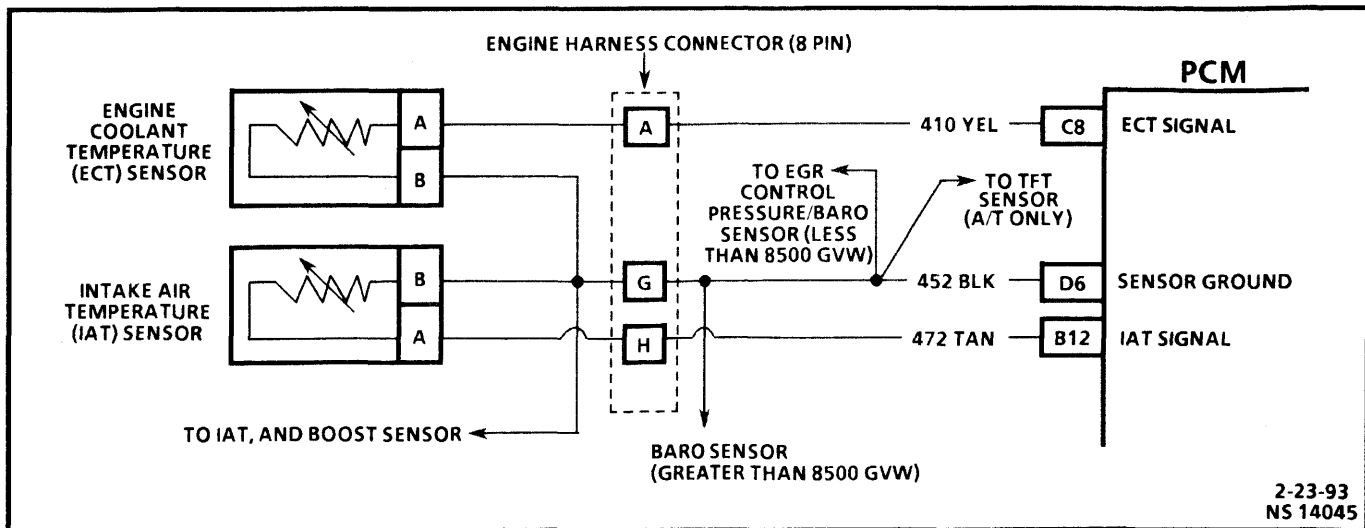
### MIL "SERVICE ENGINE SOON" CIRCUIT FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 16752



## DTC 47

### INTAKE AIR TEMPERATURE (IAT) CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The intake air temperature sensor is a thermistor that controls signal voltage to the PCM. When the air is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As air warms, sensor resistance becomes less and voltage drops.

#### DTC 47 Will Set When:

- Engine coolant temperature less than 38°C (100°F).
- Intake air temperature is greater than 96°C (205°F) for 2 seconds.

**Action Taken (PCM will default to):** Poor performance during cold operation.

**DTC 47 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

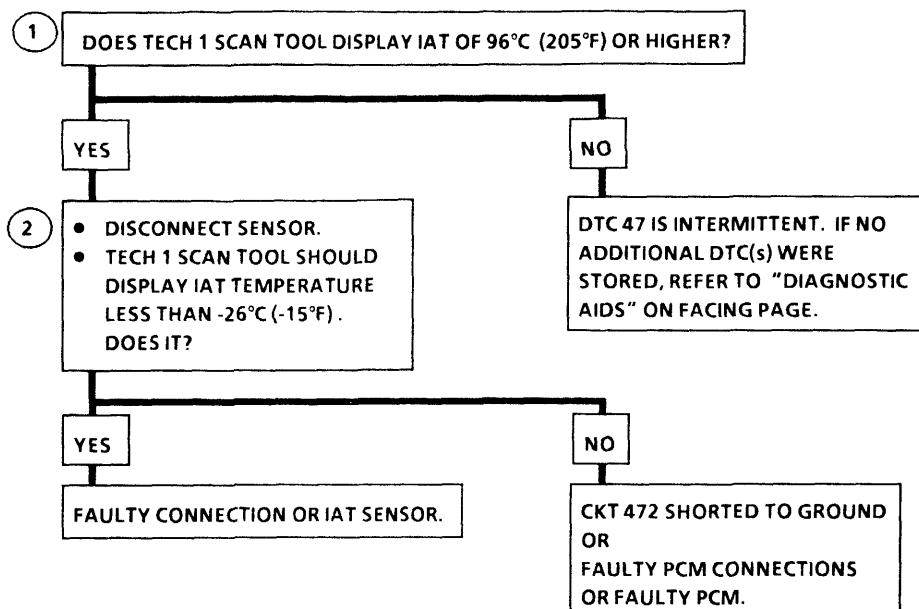
1. This step determines if DTC 47 is a hard failure or an intermittent condition.
2. This test will determine if CKT 472 is shorted to ground.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 472.

Tech 1 scan tool displays intake air temperature in degrees centigrade.

Refer to "Intermittents" in SECTION 2.

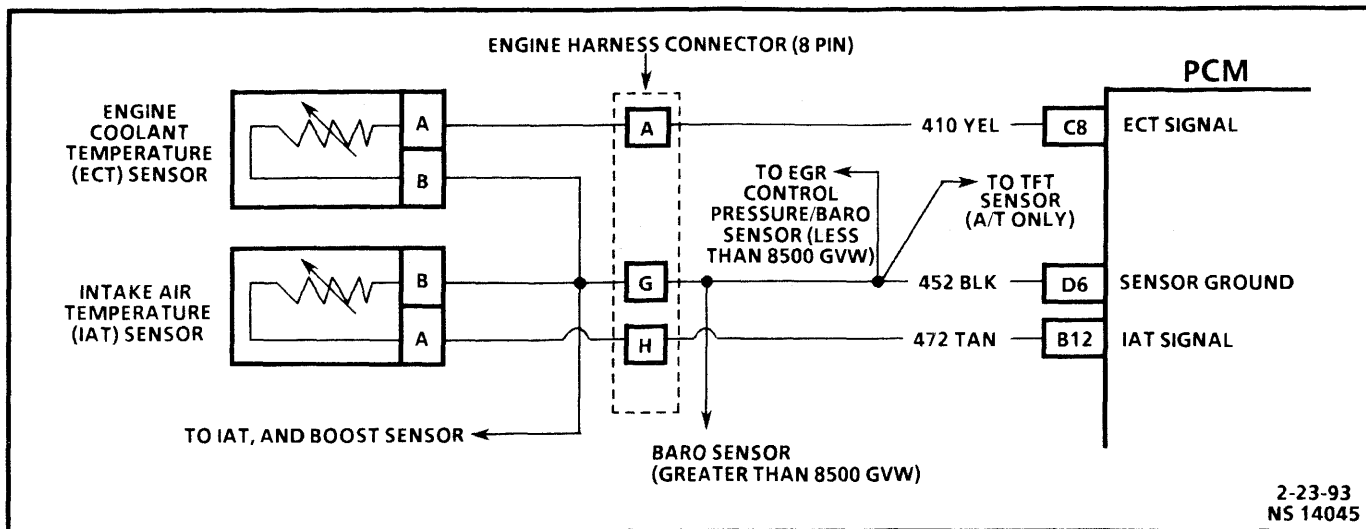
The "Temperature to Resistance Value" scale at the right may be used to test the intake air temperature sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

**DTC 47****INTAKE AIR TEMPERATURE (IAT) CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| INTAKE AIR TEMPERATURE SENSOR                      |     |        |
|----------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES<br>(APPROXIMATE) |     |        |
| °C                                                 | °F  | OHMS   |
| 100                                                | 212 | 177    |
| 90                                                 | 194 | 241    |
| 80                                                 | 176 | 332    |
| 70                                                 | 158 | 467    |
| 60                                                 | 140 | 667    |
| 50                                                 | 122 | 973    |
| 45                                                 | 113 | 1188   |
| 40                                                 | 104 | 1459   |
| 35                                                 | 95  | 1802   |
| 30                                                 | 86  | 2238   |
| 25                                                 | 77  | 2796   |
| 20                                                 | 68  | 3520   |
| 15                                                 | 59  | 4450   |
| 10                                                 | 50  | 5670   |
| 5                                                  | 41  | 7280   |
| 0                                                  | 32  | 9420   |
| -5                                                 | 23  | 12300  |
| -10                                                | 14  | 16180  |
| -15                                                | 5   | 21450  |
| -20                                                | -4  | 28680  |
| -30                                                | -22 | 52700  |
| -40                                                | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.



## DTC 48

### INTAKE AIR TEMPERATURE (IAT) CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The intake air temperature sensor is a thermistor that controls signal voltage to the PCM. When the air is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As air warms, sensor resistance becomes less and voltage drops.

**DTC 48 Will Set When:** Intake air temperature less than  $-38^{\circ}\text{C}$  ( $-39^{\circ}\text{F}$ ) for 2 minutes.

**Action Taken (PCM will default to):** Possible poor performance during cold operation.

**DTC 48 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

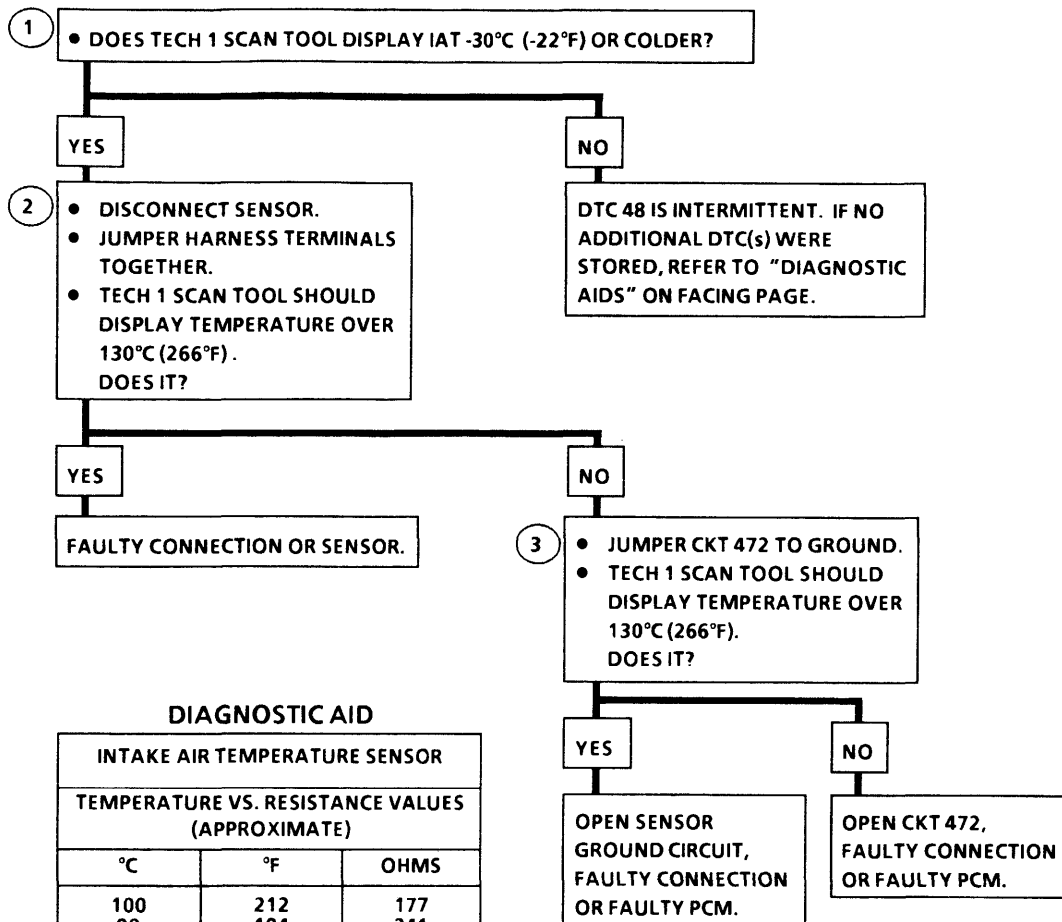
1. This step determines if DTC 48 is a hard failure or an intermittent condition.
2. This test will determine if circuit is shorted to ground.
3. This step will determine if there is a wiring problem or a faulty PCM.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 472.

Tech 1 scan tool displays intake air temperature in degrees centigrade.

Refer to "Intermittents" in SECTION 2.

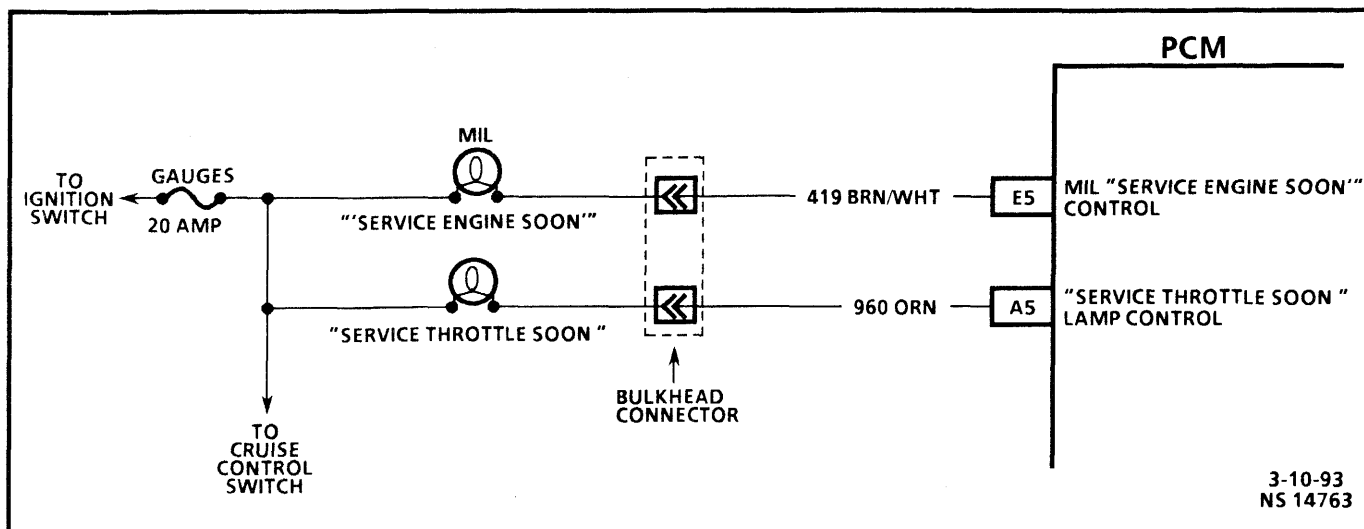
The "Temperature to Resistance Value" scaled at the right may be used to test the engine coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

**DTC 48****INTAKE AIR TEMPERATURE (IAT) CIRCUIT HIGH  
(LOW TEMPERATURE INDICATED)****DIAGNOSTIC AID**

| INTAKE AIR TEMPERATURE SENSOR                   |     |        |
|-------------------------------------------------|-----|--------|
| TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE) |     |        |
| °C                                              | °F  | OHMS   |
| 100                                             | 212 | 177    |
| 90                                              | 194 | 241    |
| 80                                              | 176 | 332    |
| 70                                              | 158 | 467    |
| 60                                              | 140 | 667    |
| 50                                              | 122 | 973    |
| 45                                              | 113 | 1188   |
| 40                                              | 104 | 1459   |
| 35                                              | 95  | 1802   |
| 30                                              | 86  | 2238   |
| 25                                              | 77  | 2796   |
| 20                                              | 68  | 3520   |
| 15                                              | 59  | 4450   |
| 10                                              | 50  | 5670   |
| 5                                               | 41  | 7280   |
| 0                                               | 32  | 9420   |
| -5                                              | 23  | 12300  |
| -10                                             | 14  | 16180  |
| -15                                             | 5   | 21450  |
| -20                                             | -4  | 28680  |
| -30                                             | -22 | 52700  |
| -40                                             | -40 | 100700 |

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.



## DTC 49

### "SERVICE THROTTLE SOON" LAMP CIRCUIT FAULT

#### Circuit Description:

There should be a "Service Throttle Soon" lamp when the ignition is "ON" and the engine "OFF" for 2 seconds. The PCM will control the "Service Throttle Soon" and turn it "ON" by providing a ground path.

**DTC 49 Will Set When:** No ignition voltage on Terminal "A5" when PCM is requesting "Service Throttle Soon" lamp "ON."

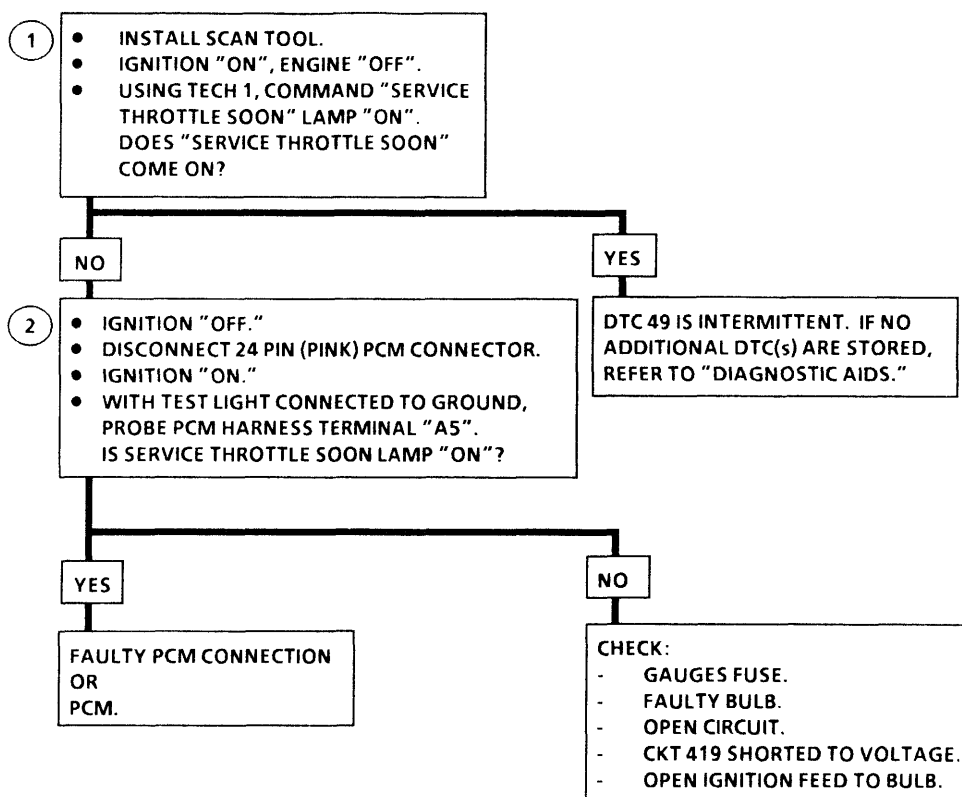
**Action Taken (PCM will default to):** DTC 49 will not turn "ON" the MIL, but will set a current and history DTC.

**DTC 49 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the STS lamp.
2. This test will determine if there is an open in ignition feed circuit.

**Diagnostic Aids:** Check for faulty bulb or fuse. An open in CKT 960 will cause a DTC 49 to set.

**DTC 49****"SERVICE THROTTLE SOON" LAMP CIRCUIT FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-22-93  
NS 14761



**BLANK**

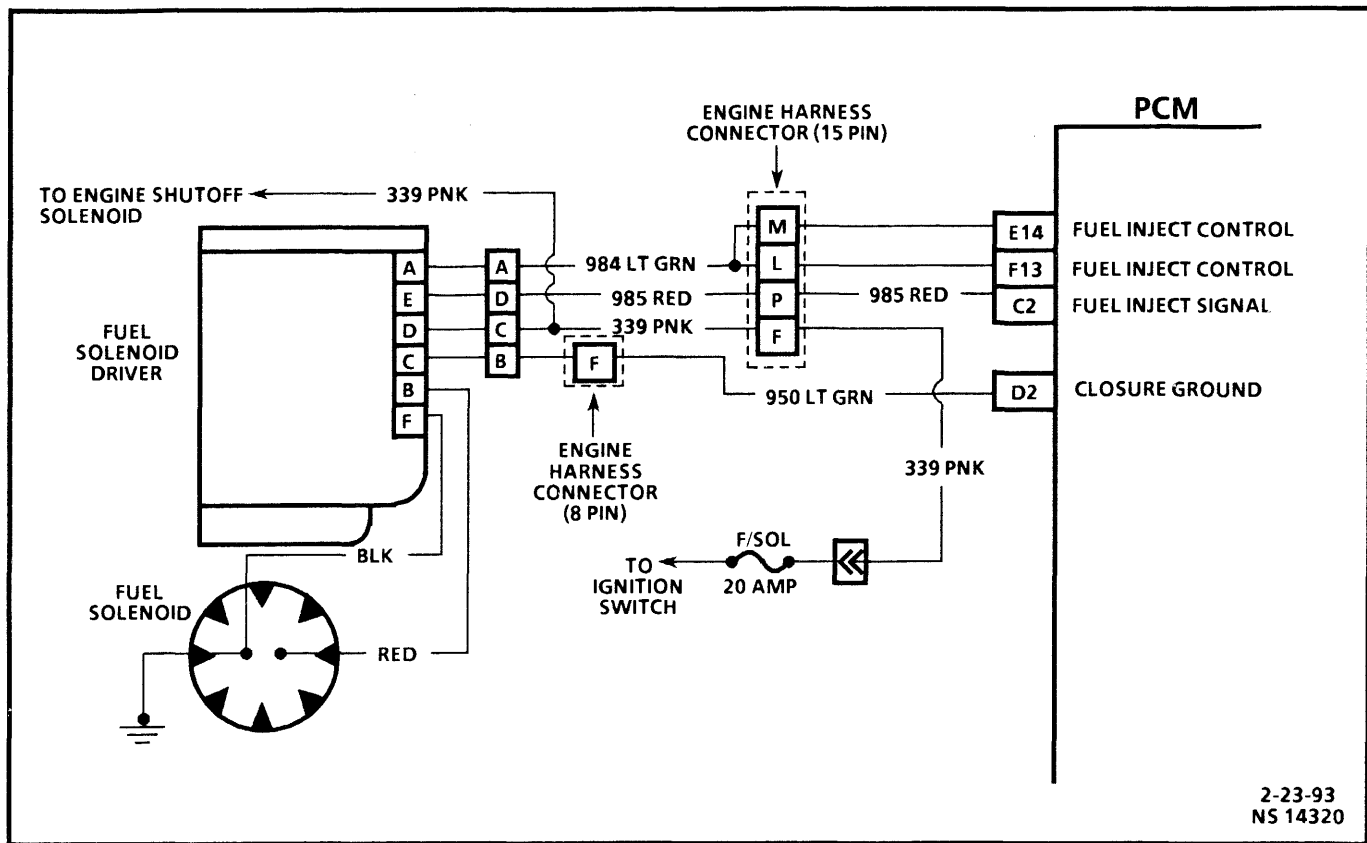
**DTC 51**  
**PROM ERROR**  
**(FAULTY OR INCORRECT PROM)**

CHECK THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET. IF OK, REPLACE PROM, CLEAR MEMORY AND RECHECK. IF DTC 51 REAPPEARS, REPLACE PCM.

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 14764



## DTC 56

### INJECTION PUMP CALIBRATION RESISTOR ERROR

#### Circuit Description:

The PCM uses a calibrated resistor mounted internally in the injection pump to determine fuel rates. The resistor value is stored in the PCM memory. If the PCM memory has been disturbed or the PCM has been replaced, the PCM will relearn the resistor value on the next ignition cycle.

**DTC 56 Will Set When:** PCM has lost its memory and is unable to read a resistor value on CKT 960 on the next ignition cycle. Possible poor performance problem.

**Action Taken (PCM will default to):** A current and history DTC will store and turn "ON" the MIL. The PCM will default to the lowest fuel table.

**DTC 56 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

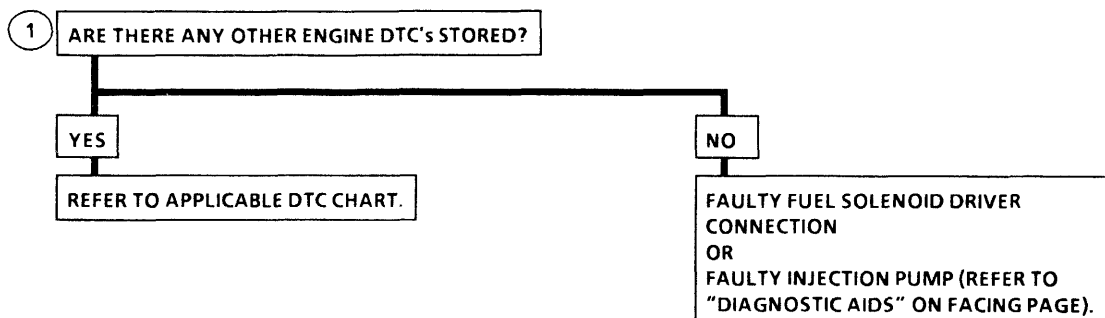
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 56 is a hard failure.

**Diagnostic Aids:** Check connection at fuel injector driver. Clear DTC, and cycle ignition. If DTC clears, treat condition as an intermittent.

## DTC 56

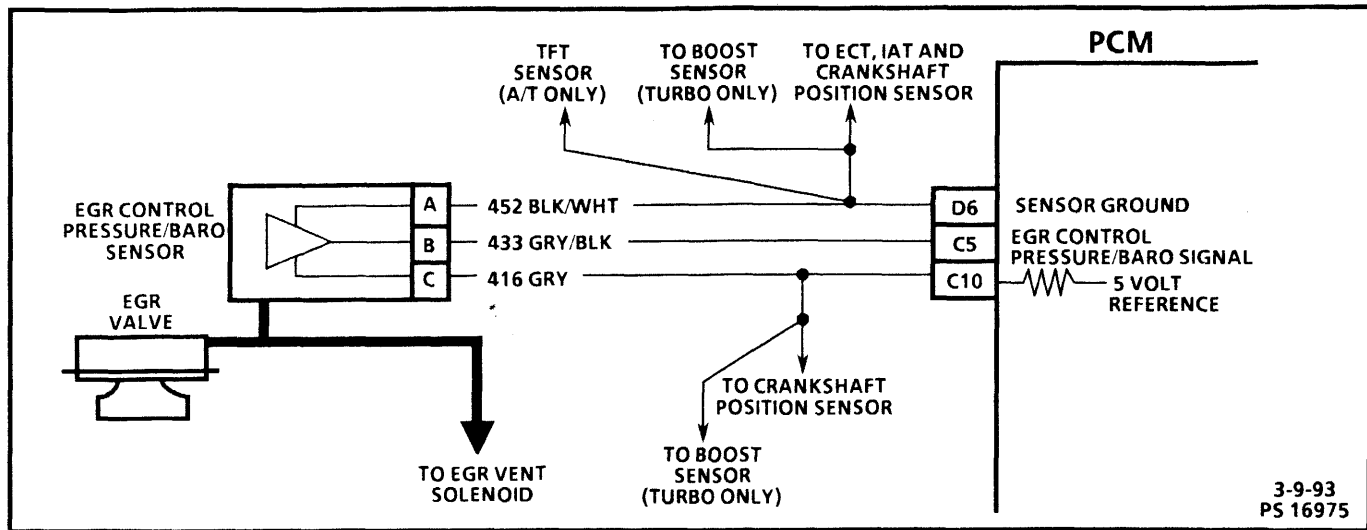
### INJECTION PUMP CALIBRATION RESISTOR ERROR



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-7-93  
PS 16756



## DTC 57

### PCM 5 VOLT SHORTED

#### Circuit Description:

The 5 volt reference is a non-varying calculated voltage.

**DTC 57 Will Set When:** 5 volt reference is less than 1 volt.

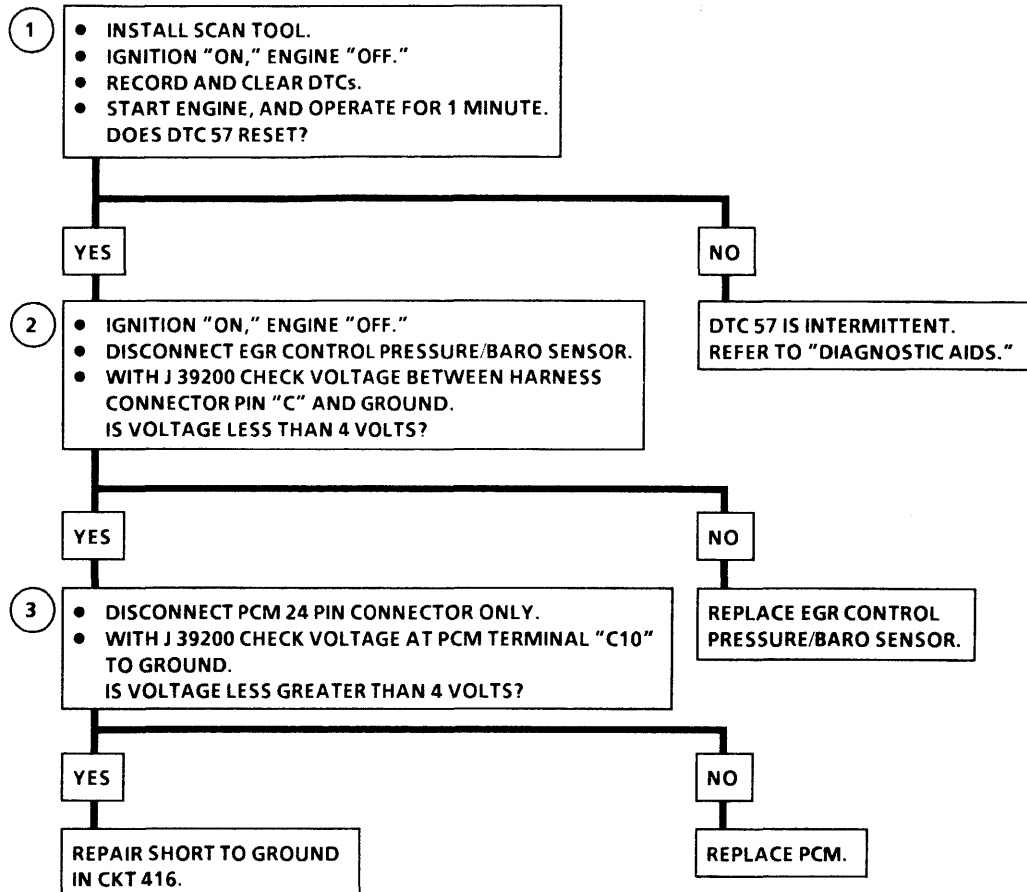
**Action Taken (PCM will default to):** Backup fuel, no EGR and no turbo boost.

**DTC 57 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to confirm that a DTC is still present.
2. Checks to determine if there is a 5 volt reference from the PCM.
3. Checks to determine if there is a short-to-ground in CKT 416, or a short-to-ground in the PCM.

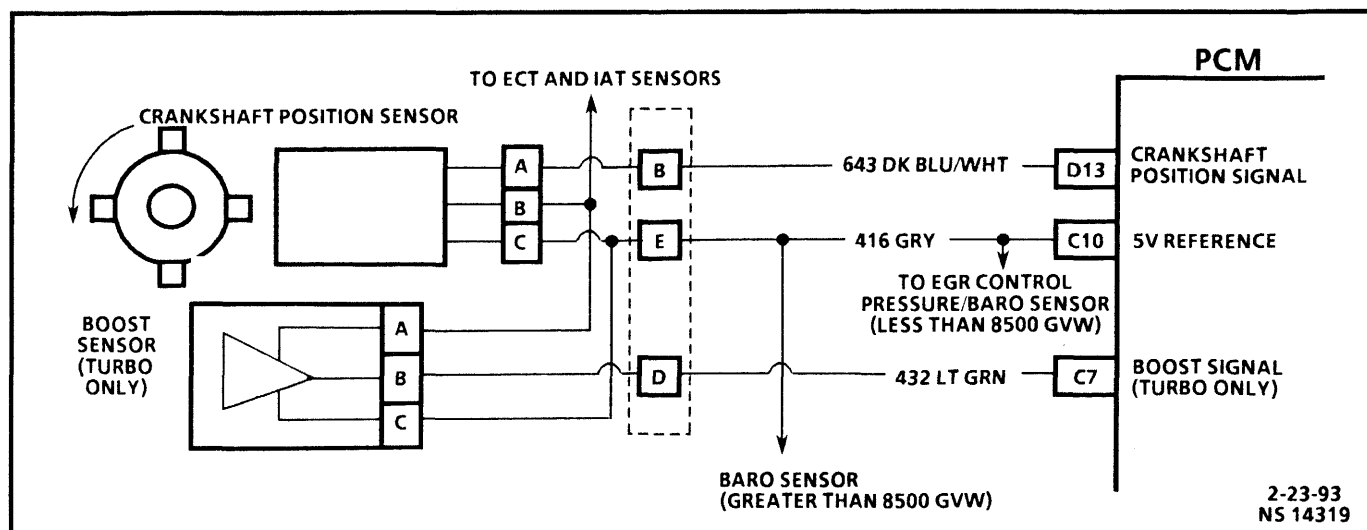
**Diagnostic Aids:** During the time the failure is present, the setting of additional DTCs may result.

**DTC 57**  
**PCM 5 VOLT SHORTED**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
NS 14545



## DTC 61

### TURBO BOOST SENSOR CIRCUIT HIGH

#### Circuit Description:

The PCM sends a 5 volt reference signal to the boost sensor. As manifold pressure changes, the electrical resistance of the boost sensor also changes. By monitoring the sensor output voltage, the PCM detects how much pressure is being produced by the turbocharger in the intake manifold. The PCM uses the boost sensor to control turbo boost and fuel at different loads.

#### DTC 61 Will Set When:

- Boost signal voltage greater than 3.9 volts.
- RPM less than 3500.

**Action Taken (PCM will default to):** No turbo boost. Poor performance.

**DTC 61 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

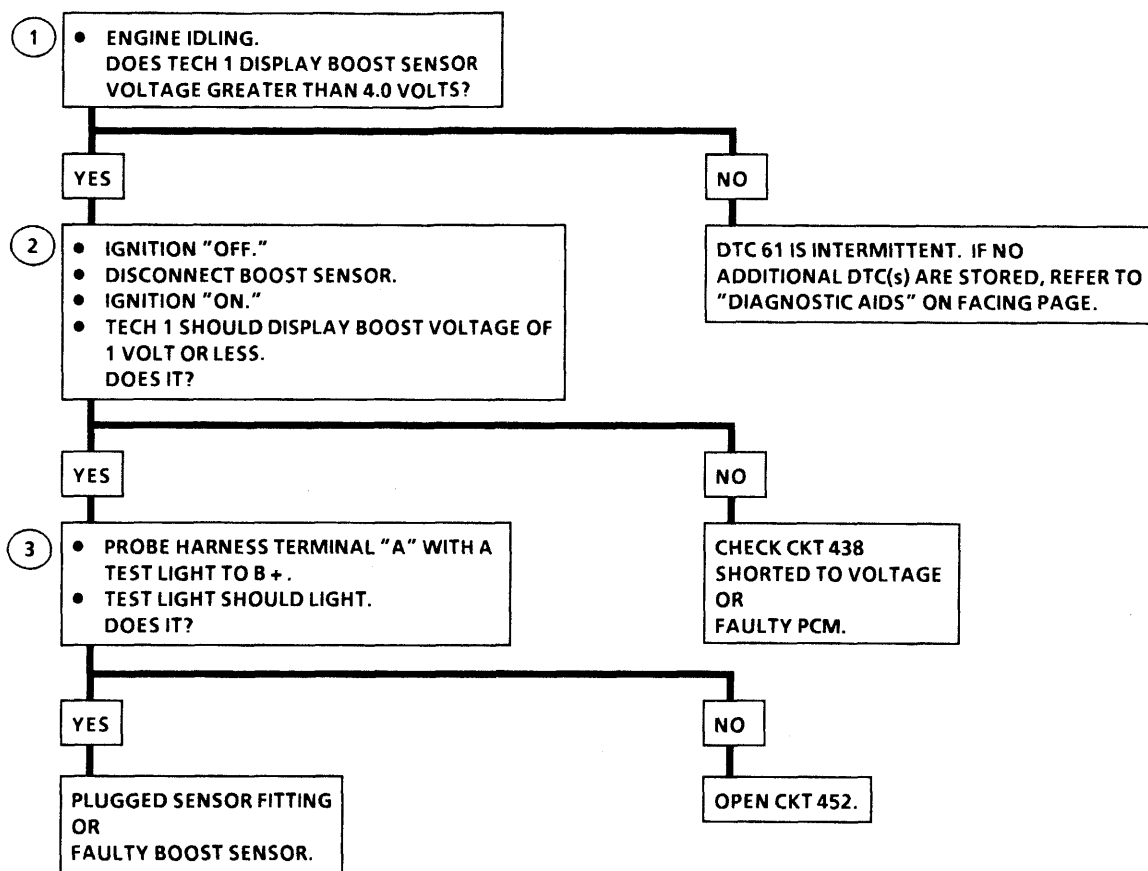
1. This step will determine if DTC 61 is the result of a hard failure or an intermittent condition.
2. This step simulates conditions for a DTC 62. If the PCM recognizes the change, the PCM and CKT 416 and CKT 432 are OK.
3. This step will check for an open in ground circuit.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, boost pressure is equal to atmospheric pressure with the signal voltage being high.

Comparison of this reading with a known good vehicle using the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

## DTC 61

### TURBO BOOST SENSOR CIRCUIT HIGH

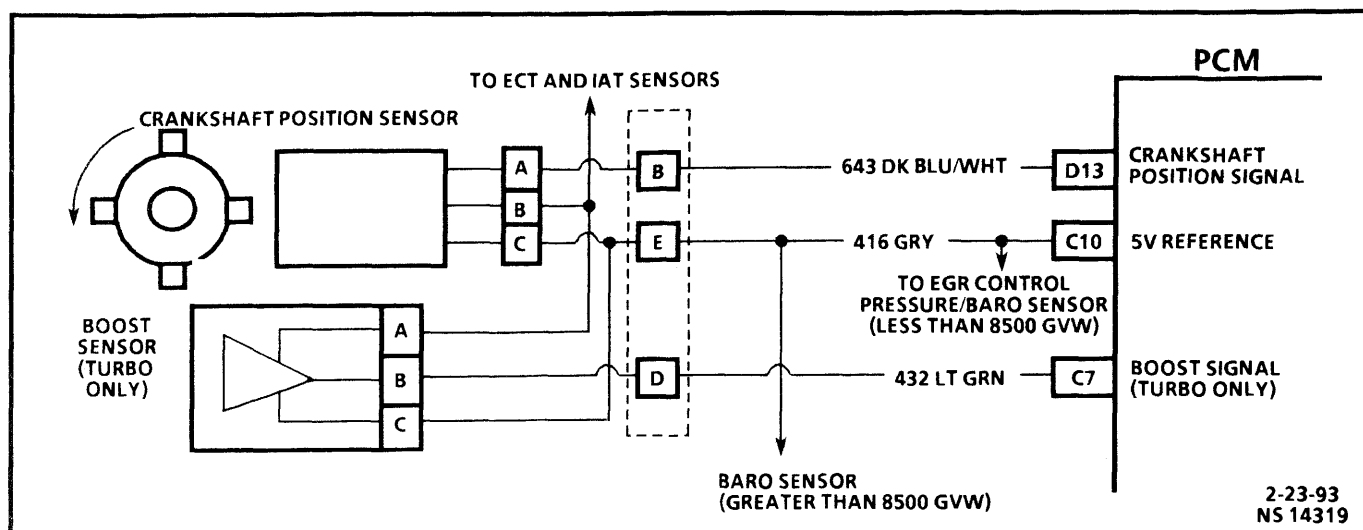


IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15535





## DTC 62

### TURBO BOOST SENSOR CIRCUIT LOW

#### Circuit Description:

The PCM sends a 5 volt reference signal to the boost sensor. As manifold pressure changes, the electrical resistance of the boost sensor also changes. By monitoring the sensor output voltage, the PCM detects how much pressure is being produced by the turbocharger in the intake manifold. The PCM uses the boost sensor to control turbo boost and fuel at different loads.

**DTC 62 Will Set When:** Boost signal voltage less than .8 volt.

**Action Taken (PCM will default to):** No turbo boost and limited fuel.

**DTC 62 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

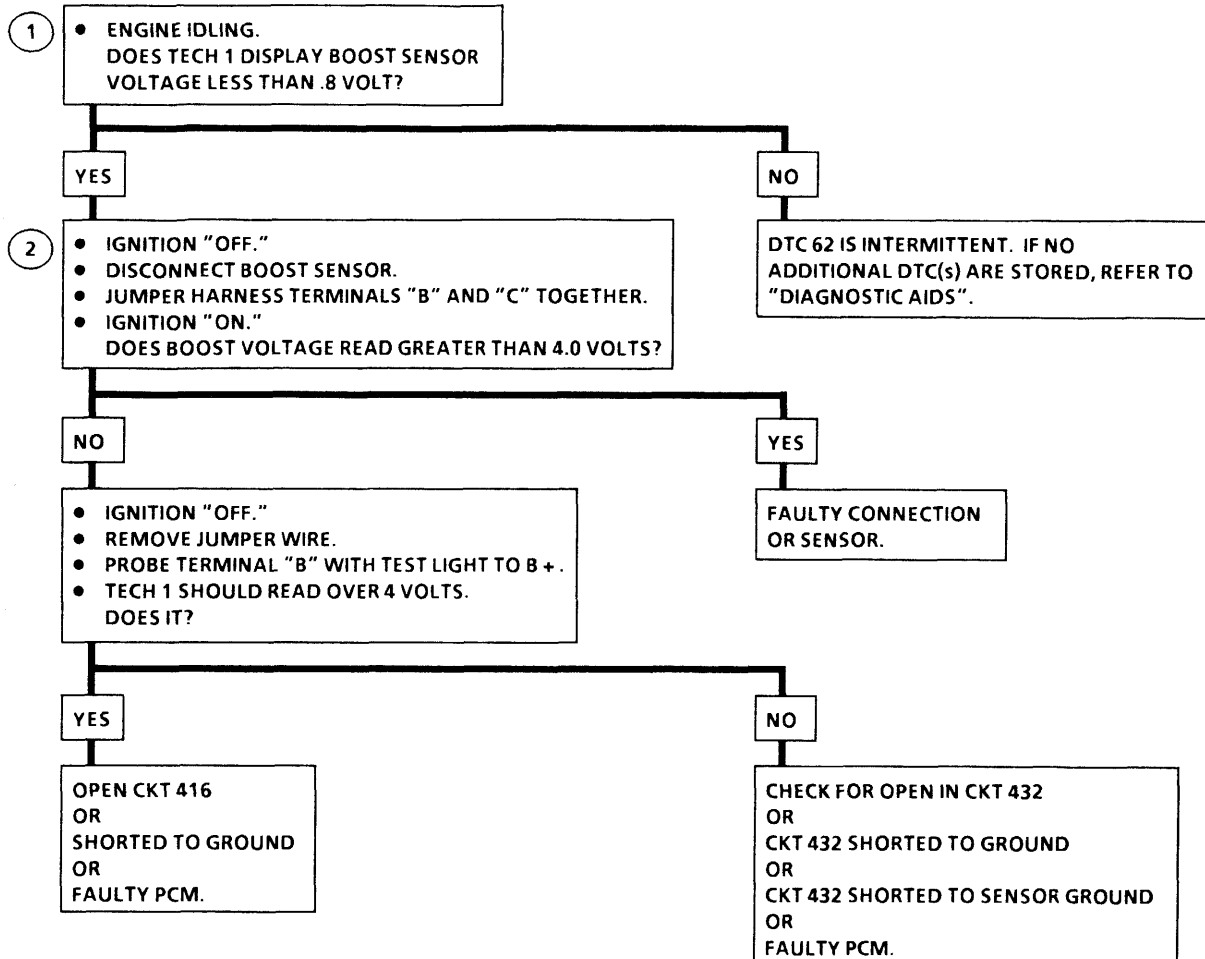
1. This step will determine if DTC 62 is the result of a hard failure or an intermittent condition.
2. This step simulates conditions for a DTC 61. If the PCM recognizes the change, the PCM and CKT 416 and CKT 432 are OK.

**Diagnostic Aids:** With the ignition "ON" and the engine stopped, boost pressure is equal to atmospheric pressure with the signal voltage being high.

Comparison of this reading with a known good vehicle using the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same  $\pm .4$  volt.

## DTC 62

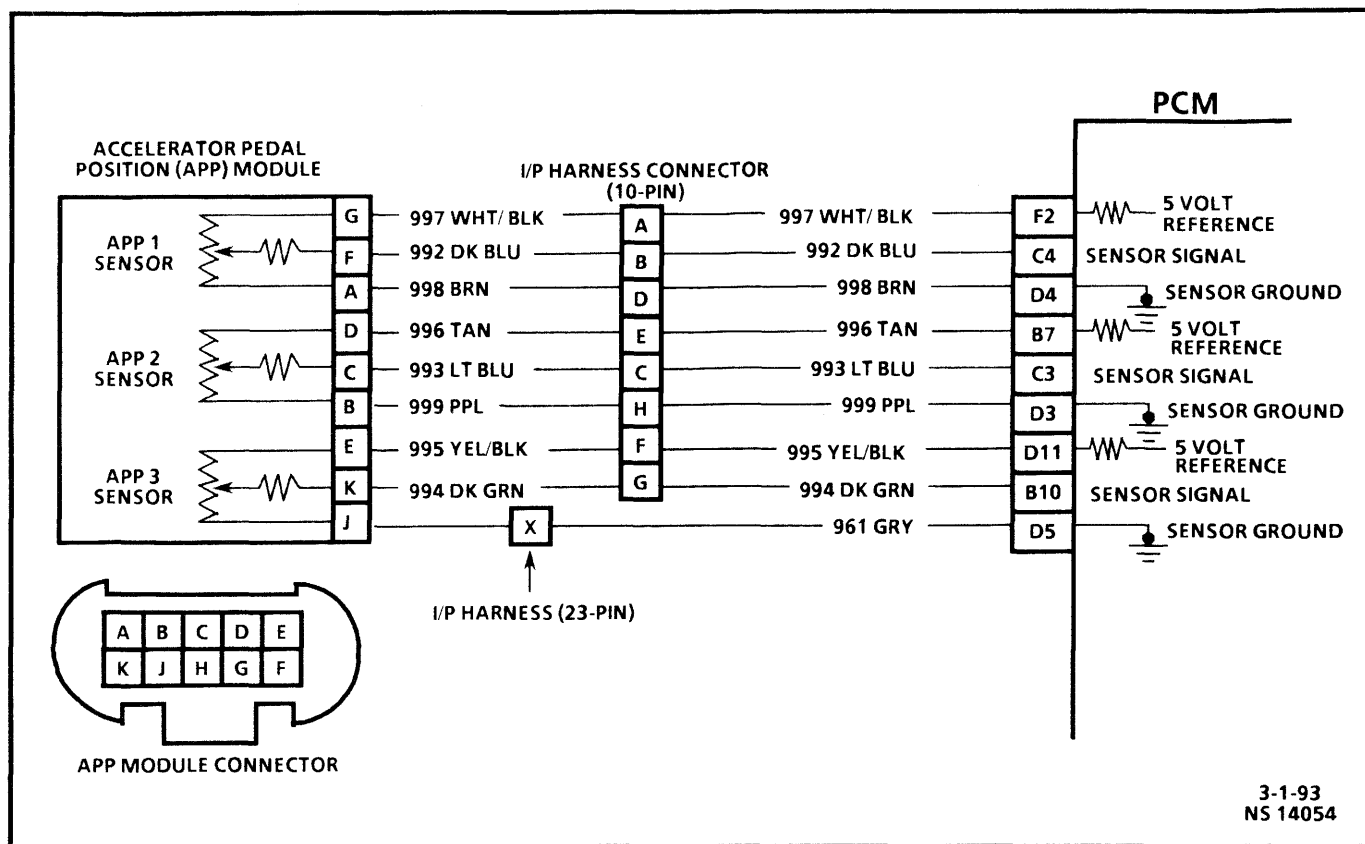
### TURBO BOOST SENSOR CIRCUIT LOW



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15536



## DTC 63

### ACCELERATOR PEDAL POSITION (APP) 3 CIRCUIT HIGH

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 63 Will Set When:** Voltage is greater than 4.75 volts for 2 seconds on APP 3 sensor.

**Action Taken (PCM will default to):** The input from APP 3 sensor is ignored. A current and history DTC will set but it will not turn "ON" the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 63 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This will check for an open in ground CKT 994 and PCM.

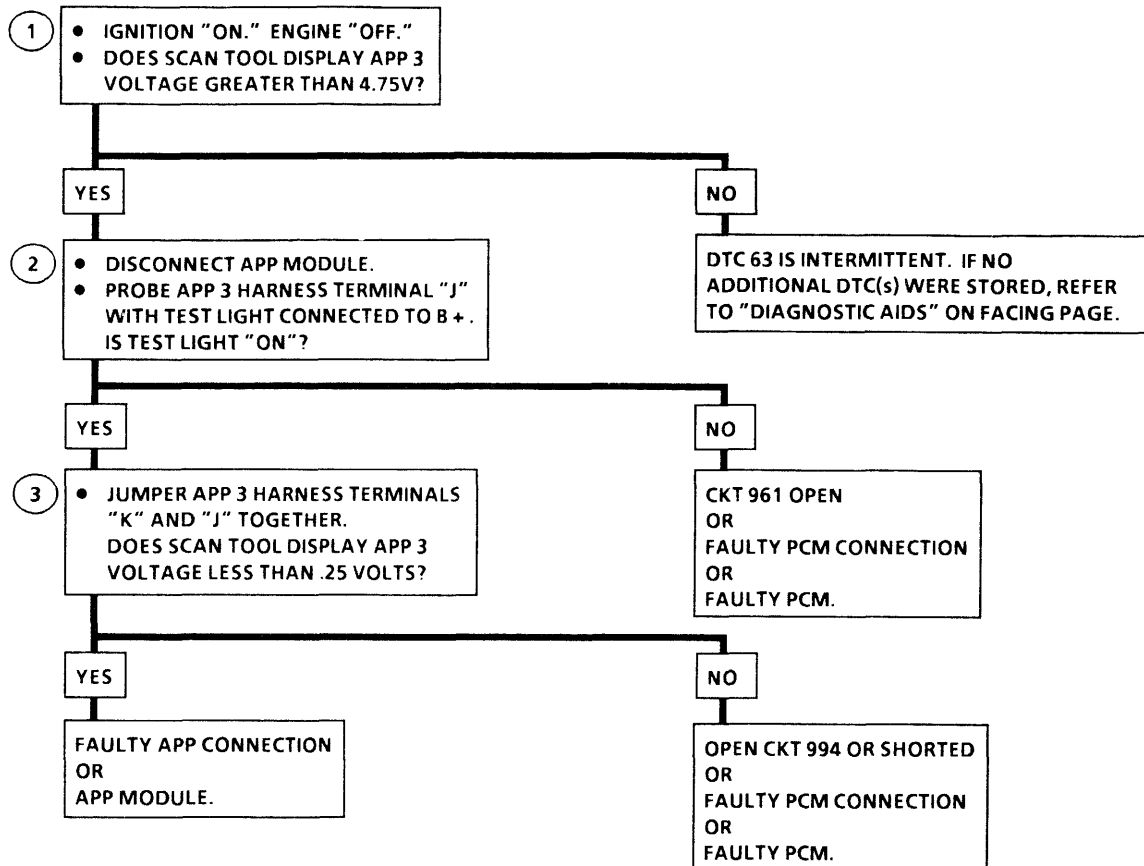
**Diagnostic Aids:** A scan tool reads APP 3 position in volts. Should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also, 90% pedal travel is acceptable for correct APP operation.

Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.0 volts when throttle was closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

## DTC 63

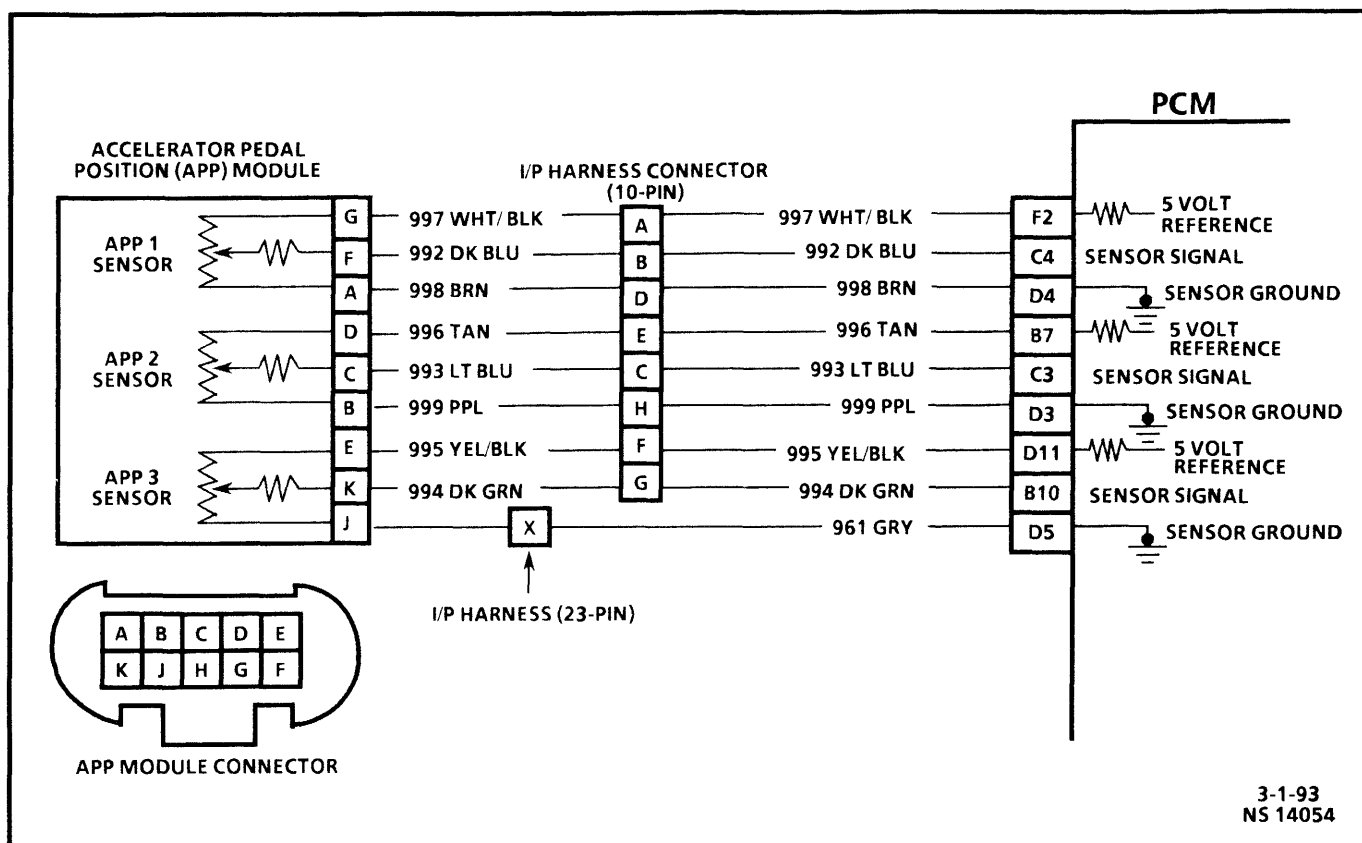
### ACCELERATOR PEDAL POSITION (APP) 3 CIRCUIT HIGH



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15537



## DTC 64

### ACCELERATOR PEDAL POSITION (APP) 3 CIRCUIT LOW

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 64 Will Set When:** Voltage is less than .25 volt for 2 seconds on APP 3 sensor.

**Action Taken (PCM will default to):** The input from APP 3 sensor is ignored. A current and history DTC will set but it will not turn "ON" the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if DTC 64 is the result of a hard failure or an intermittent condition.
2. This step checks the PCM and wiring.
3. This will check the PCM and CKT 994.

**Diagnostic Aids:** A scan tool reads APP 3 position in volts. Should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT) position.

Also, 90% pedal travel is acceptable for correct APP operation.

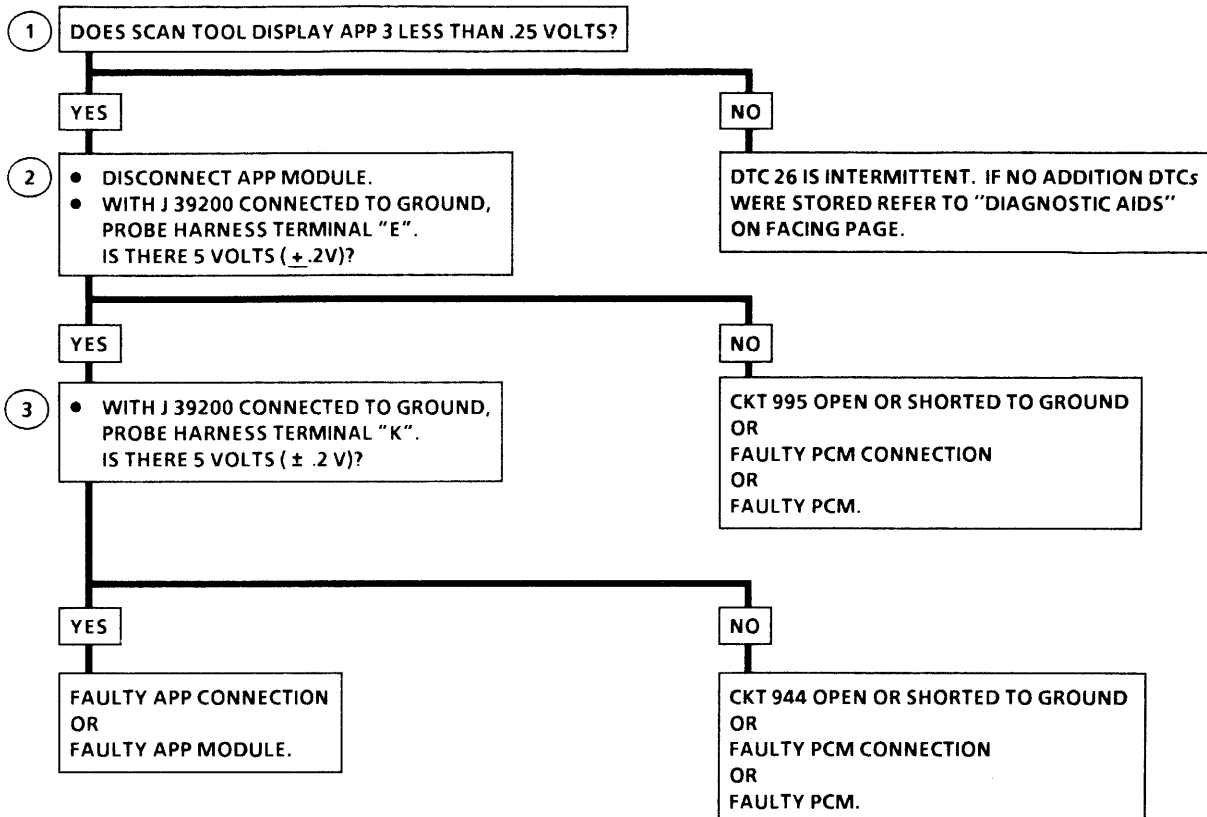
Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.0 volts when throttle was closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

A DTC 64 will result if CKT 995 is open or CKT 994 is shorted to ground.

Refer to "Intermittents," in SECTION 2.

## DTC 64

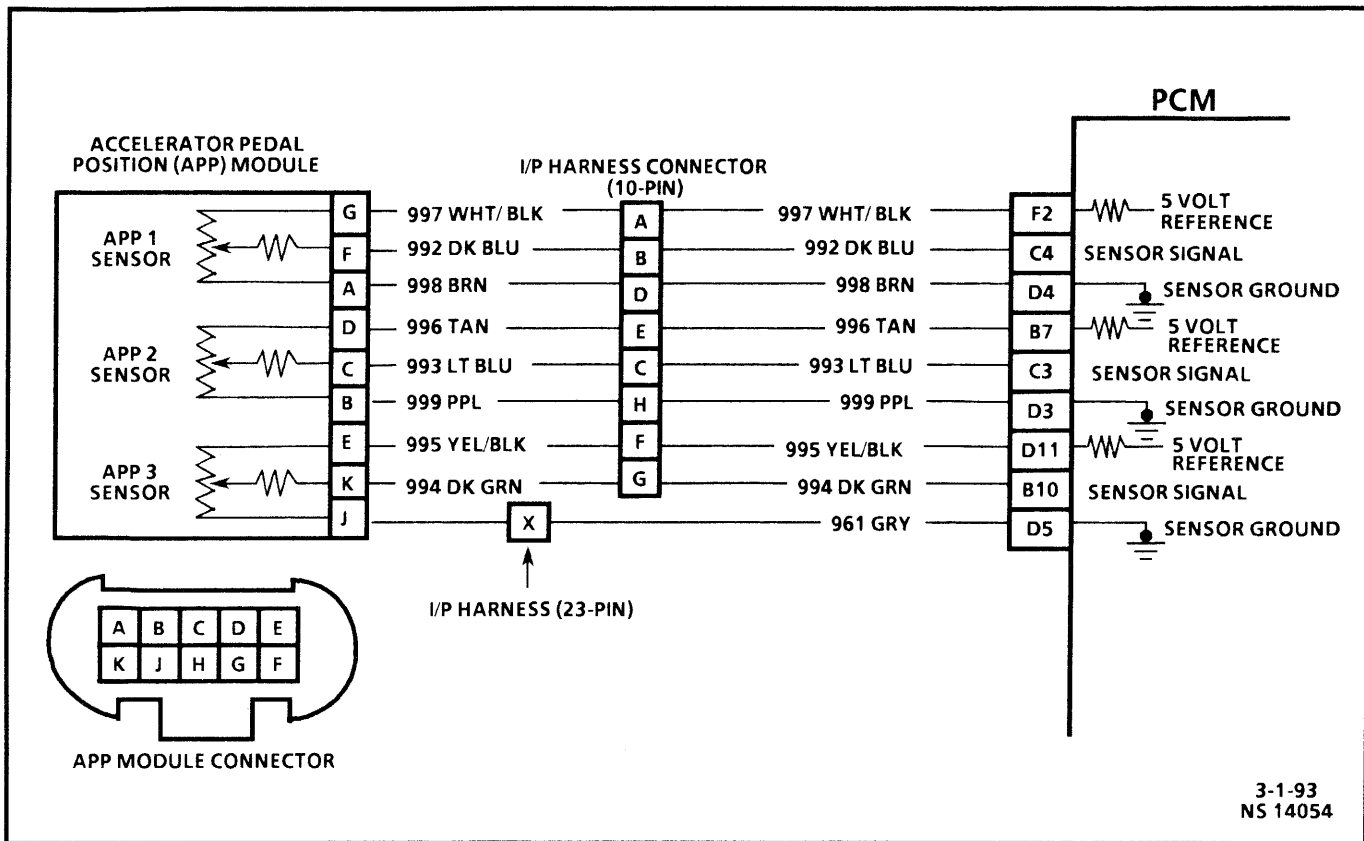
### ACCELERATOR PEDAL POSITION (APP) 3 CIRCUIT LOW



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 17508



## DTC 65

### ACCELERATOR PEDAL POSITION (APP) 3 CIRCUIT RANGE FAULT

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator pedal position. There are three sensors located within the APP module that are scaled differently.

**DTC 65 Will Set When:** PCM has recognized a "skewed" (mis-scaled) sensor. The PCM compares all three sensors to each other (percentage to voltage chart) and determines if there is a 6% difference between APP 1 and APP 2 and a 10 difference to APP 3.

**Action Taken (PCM will default to):** The input from APP 3 sensor is ignored. A current and history DTC will set but it will not turn "ON" a "Service Throttle Soon" lamp. Throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present the PCM will then turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present the "Service Throttle Soon" lamp will be "ON" and only allow the engine to operate at idle.

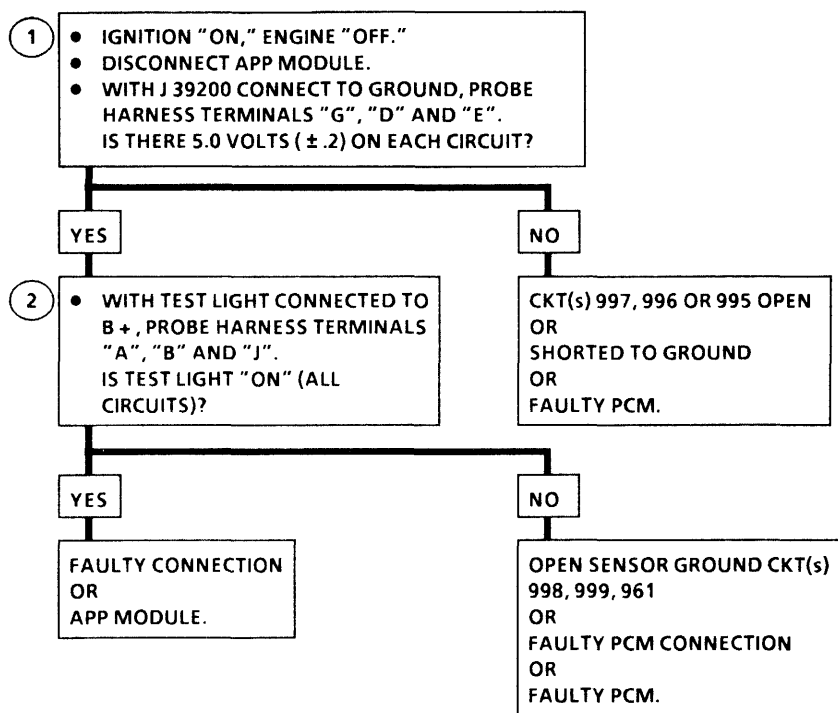
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if there is a good 5 volt reference.
2. This step will check the ground circuits.

**Diagnostic Aids:** A scan tool reads APP 3 position in volts. Should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also, 90% pedal travel is acceptable for correct APP operation.

Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.0 volts when throttle was closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

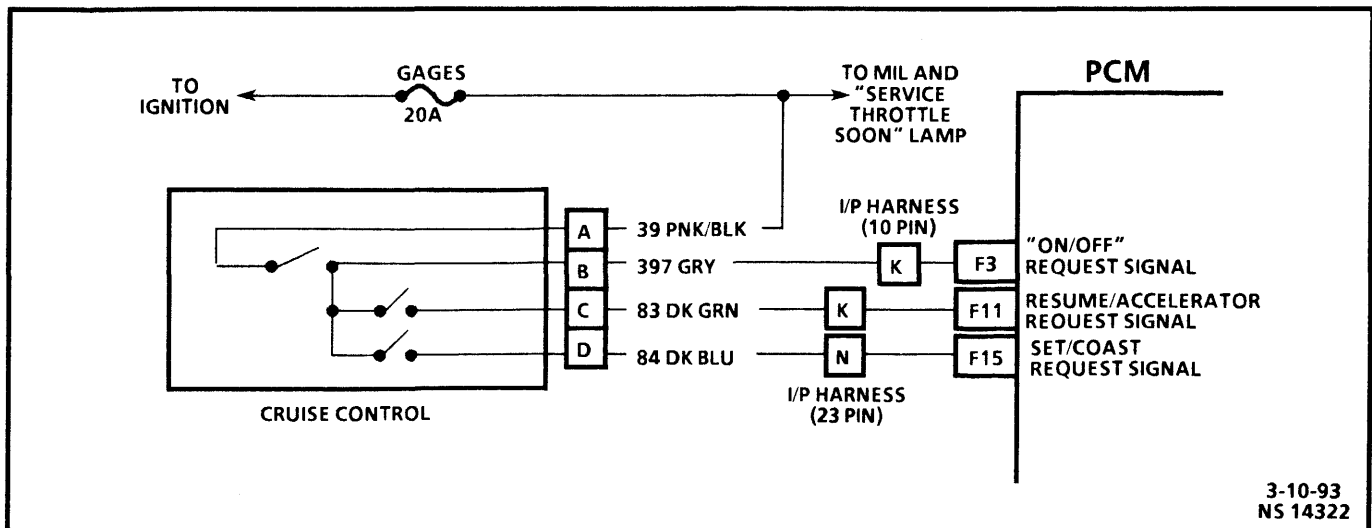
**DTC 65****ACCELERATOR PEDAL POSITION (APP) 3  
CIRCUIT RANGE FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15527





## DTC 71

### SET/COAST SWITCH FAULT

#### Circuit Description:

The cruise "ON/OFF," "set/coast" and "resume/accel" switches are inputs to the fuel control portion of the PCM. These inputs allow the PCM to control and hold a requested speed. CKT 84 supplies ignition voltage to the PCM when set/coast is depressed.

#### DTC 71 Will Set When:

- Cruise control "ON."
- Ignition voltage on Terminal "F15" for more than 20 seconds.

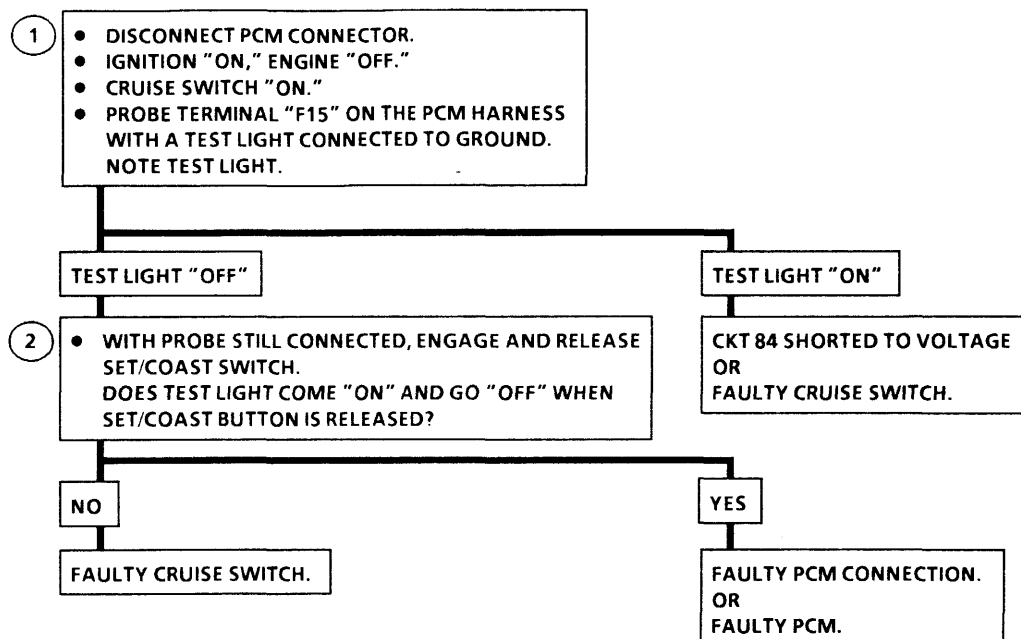
**Action Taken (PCM will default to):** The PCM will disallow all cruise inputs. TCC shift schedules may be affected.

**DTC 71 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if the cruise control switch is OK.
2. This step determines if the PCM or switch is at fault.

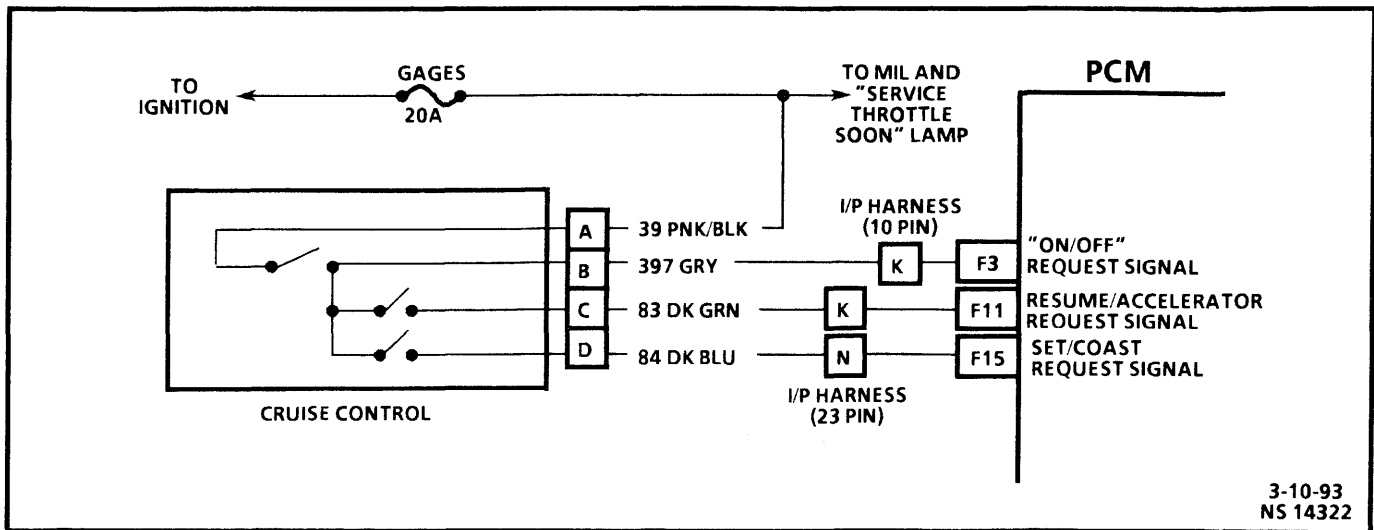
**Diagnostic Aids:** Check for a set/coast switch stuck in the engage position or CKT 84 shorted to voltage.

**DTC 71**  
**SET/COAST SWITCH FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-16-93  
NS 15540



## DTC 76

### RESUME/ACCEL SWITCH FAULT

#### Circuit Description:

The cruise "ON/OFF," "set/coast" and "resume/accel" switches are inputs to the fuel control portion of the PCM. These inputs allow the PCM to control and hold a requested speed. CKT 83 supplies ignition voltage to the PCM.

#### DTC 76 Will Set When:

- Cruise control "ON."
- Ignition voltage on Terminal "F11" for more than 20 seconds.

**Action Taken (PCM will default to):** The PCM will disallow all cruise inputs. TCC shift schedules may be affected.

**DTC 76 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

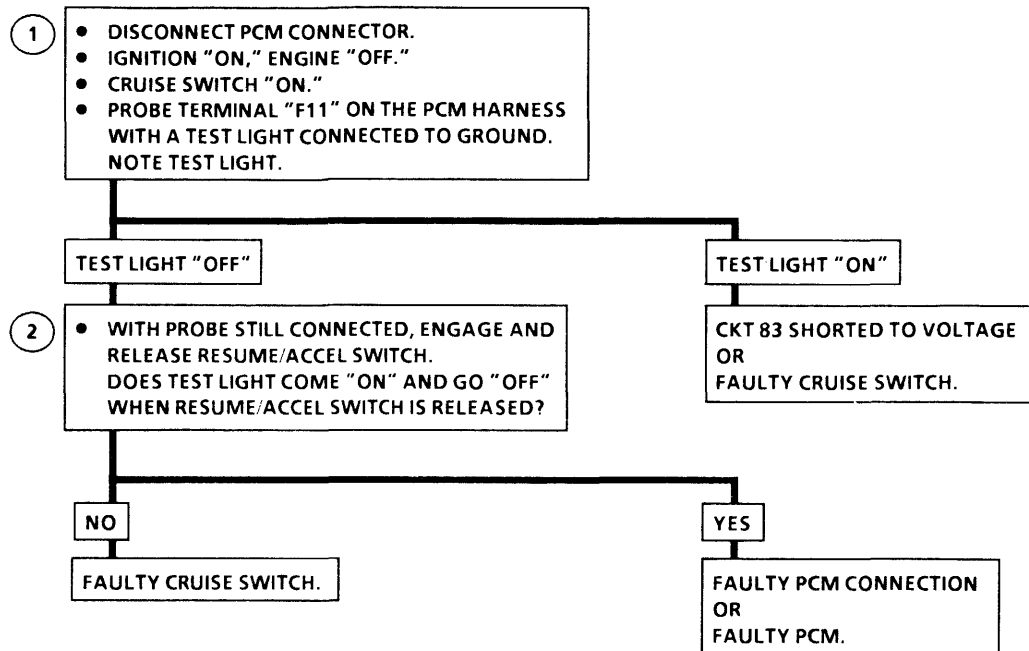
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if CKT 83 is shorted to voltage.
2. This step determines if the PCM or switch is at fault.

**Diagnostic Aids:** Check for a set/coast switch stuck in the engage position or CKT 83 shorted to voltage.

## DTC 76

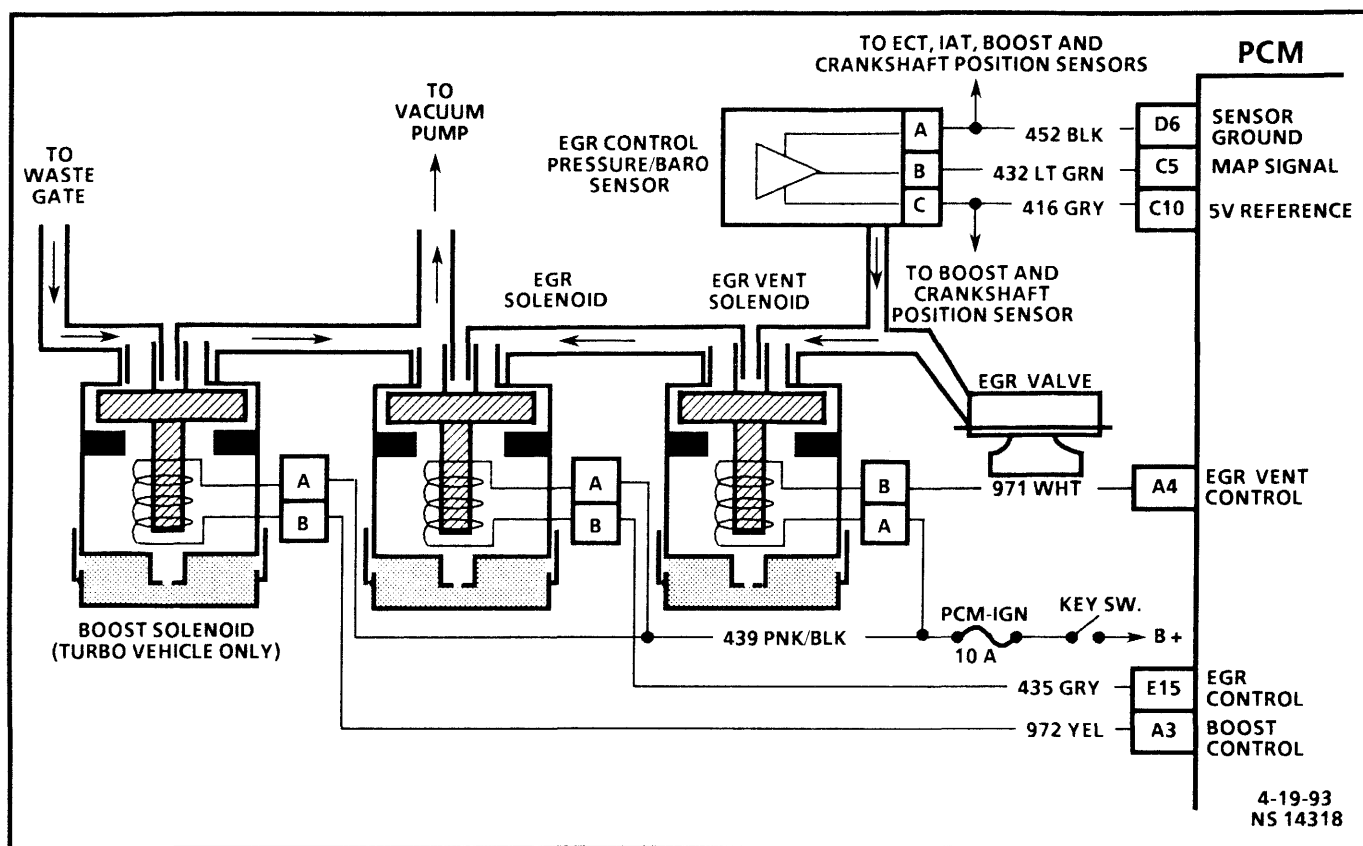
### RESUME/ACCEL SWITCH FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
NS 15858



## DTC 78

### WASTEGATE SOLENOID FAULT

#### Circuit Description:

The PCM operates a solenoid to control boost. This solenoid is normally open. By providing a ground path the PCM energizes the solenoid which then allows vacuum to pass to the wastegate valve.

During normal operation, the PCM compares its wastegate duty cycle signal with the boost signal and makes corrections in the duty cycle accordingly.

#### DTC 78 Will Set When:

- RPM greater than 1800.
- Fuel rate greater than 20 mm.
- Boost pressure greater than or less than desired (internal to PCM).

**Action Taken (PCM will default to):** Boost will shut down. Reduce maximum fuel.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

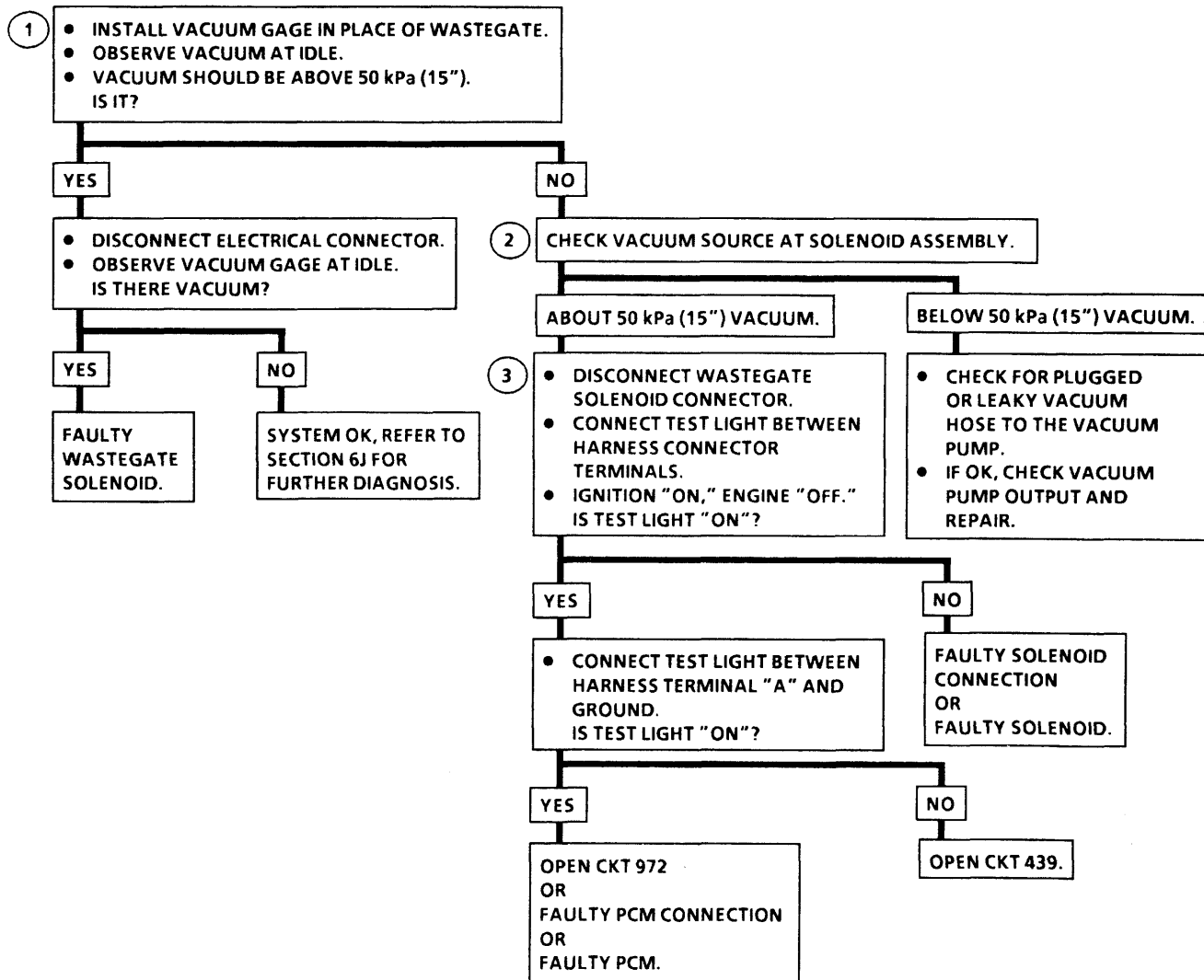
1. This step will check for a good vacuum source.
2. This step will check for a faulty vacuum line or pump.
3. This step checks the solenoid wiring.

**Diagnostic Aids:** A vacuum leak or a pinched vacuum line may cause a DTC 78. Check all vacuum lines and components connected to the hoses for leaks or sharp bends.

Check vacuum source. A possible DTC 32 will store if there is a problem with the vacuum source.

## DTC 78

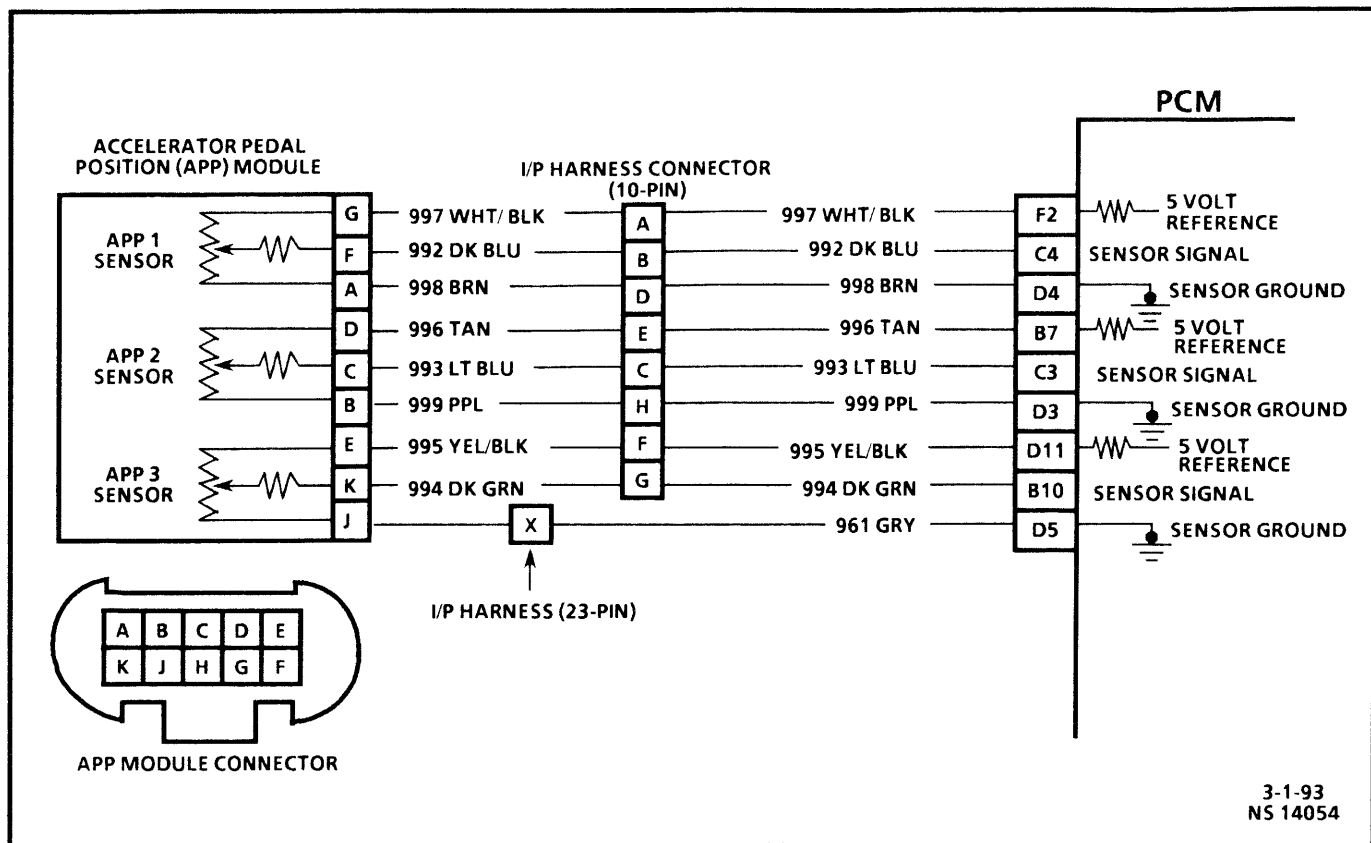
### WASTEGATE SOLENOID FAULT



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM. REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-6-93  
PS 17892



## DTC 84

### ACCELERATOR PEDAL POSITION (APP) CIRCUIT FAULT

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently.

**DTC 84 Will Set When:** PCM has recognized an intermittent APP fault and there are no other current APP faults stored.

**Action Taken (PCM will default to):** When DTC 84 is set, a current and history DTC will set, but will not light the "Service Throttle Soon" lamp, and the vehicle will operate at limited power.

**DTC 84 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if DTC 84 is a hard failure or an intermittent condition.

**Diagnostic Aids:** Check for faulty connections at APP module, PCM and I/P connector.

## **DTC 84**

### **ACCELERATOR PEDAL POSITION (APP) CIRCUIT FAULT**

1

- CHECK COMPLETE APP HARNESS FOR INTERMITTENT SHORTS OR OPENS.
- IF OK, REPLACE APP MODULE.
- IF DTC RESETS, REPLACE PCM.

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-7-93  
PS 16757



## **DTC 88**

### **TDC OFFSET ERROR**

## **DTC 88**

### **TDC OFFSET ERROR**

THIS DTC INDICATES THERE IS A PUMP TIMING PROBLEM.

- THIS DTC WILL SET IF TDC OFFSET IS GREATER THAN  $\pm 2.0^\circ$ , OR THE PCM HAS LOST MEMORY (TDC OFFSET IS STORED IN PCM MEMORY).
- CHECK INJECTION PUMP TIMING, IF OK, REFER TO "ON-VEHICLE SERVICE" TDC OFFSET.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-17-93  
PS 16754

## **DTC 91**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 91 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #1.
- DTC 91 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 92**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 92 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #2.
- DTC 92 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 93**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 93 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #3.
- DTC 93 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 94**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 94 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #4.
- DTC 94 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

CONT'D

## **DTC 95**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 95 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #5.
- DTC 95 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 96**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 96 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #6.
- DTC 96 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 97**

### **CYLINDER BALANCE FAULT**

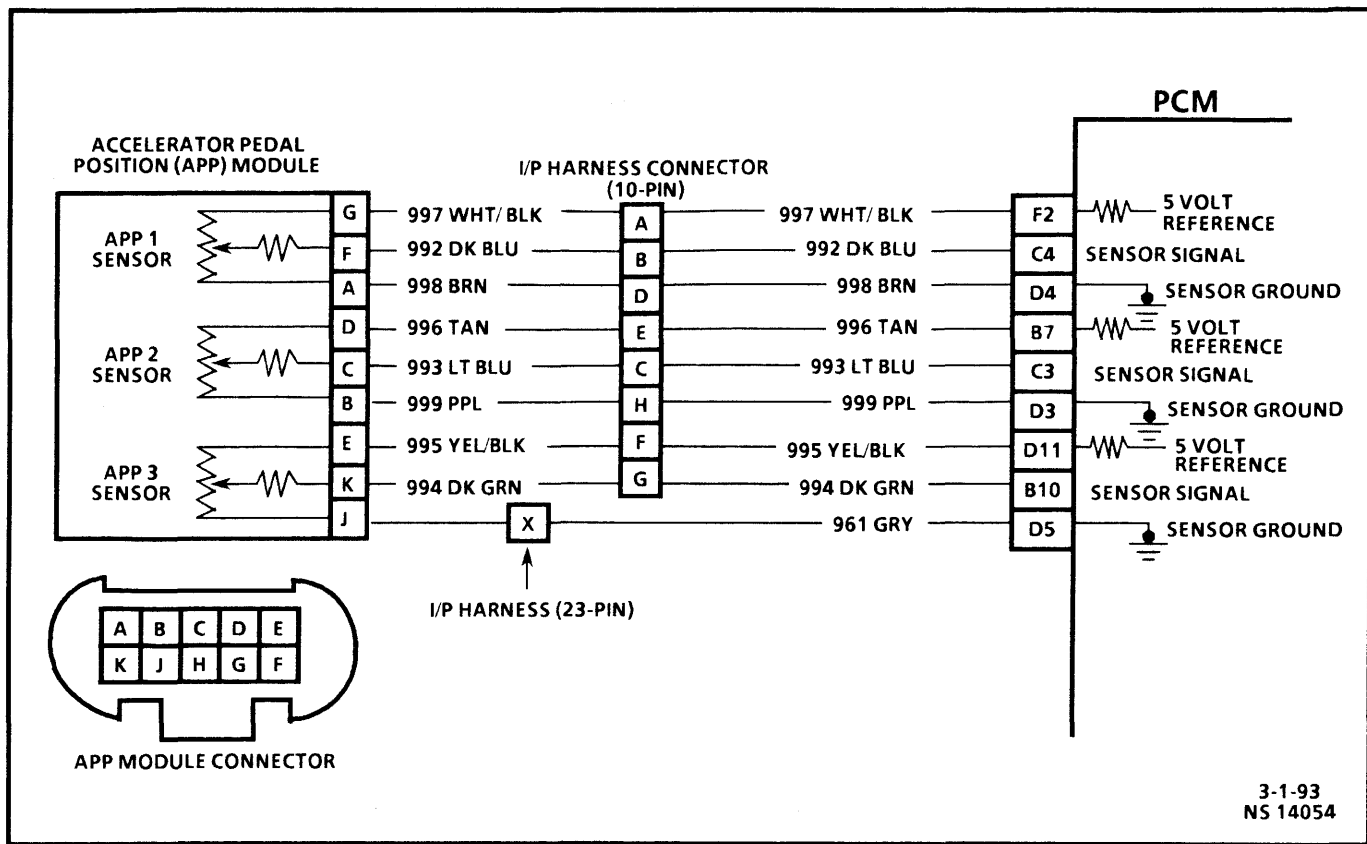
- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 97 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #7.
- DTC 97 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

## **DTC 98**

### **CYLINDER BALANCE FAULT**

- IF ANY OTHER DTC(s) ARE STORED, DIAGNOSE THEM FIRST.
- DTC 98 INDICATES THERE IS A POSSIBLE MECHANICAL ERROR WITH CYLINDER #8.
- DTC 98 WILL NOT TURN ON THE MIL, BUT WILL BE STORED AS A CURRENT AND HISTORY DTC.

**BLANK**



## DTC 99

### ACCELERATOR PEDAL POSITION (APP) 2 5 VOLT REFERENCE FAULT

#### Circuit Description:

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator pedal position. There are three sensors located within the APP module that are scaled differently.

**DTC 99 Will Set When:** Reference voltage on APP 2 below 4.8 volts for 2 seconds.

**Action Taken (PCM will default to):** If DTC 99 is present, the PCM will turn "ON" the "Service Throttle Soon" lamp and limit power.

**DTC 99 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

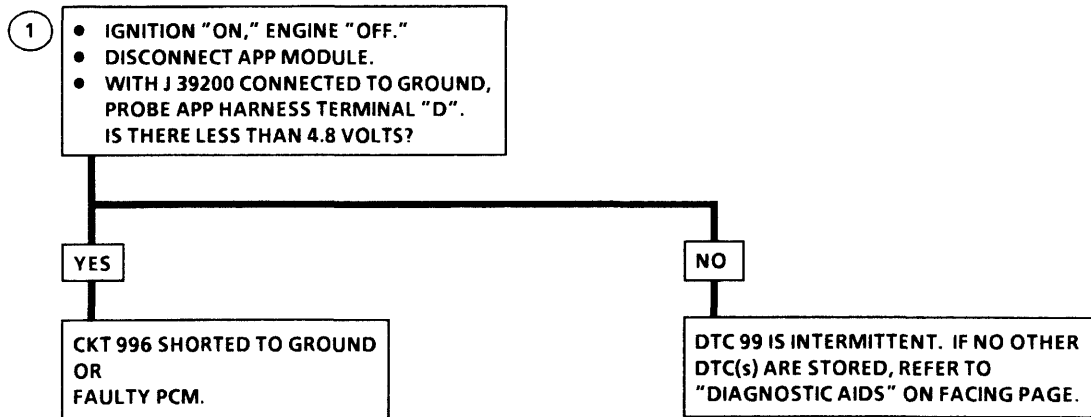
1. This step will determine if there is a good 5 volt reference.

**Diagnostic Aids:** A Tech 1 scan tool reads APP 2 position in volts. It should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

A short to ground in CKT 996 will result in a DTC 99.

Refer to SECTION 2 for "Intermittents."

Scan APP 2 signal while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from about 4.5 volts when throttle was closed, to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

**DTC 99****ACCELERATOR PEDAL POSITION (APP) 2  
5 VOLT REFERENCE FAULT**

IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-23-93  
PS 17111

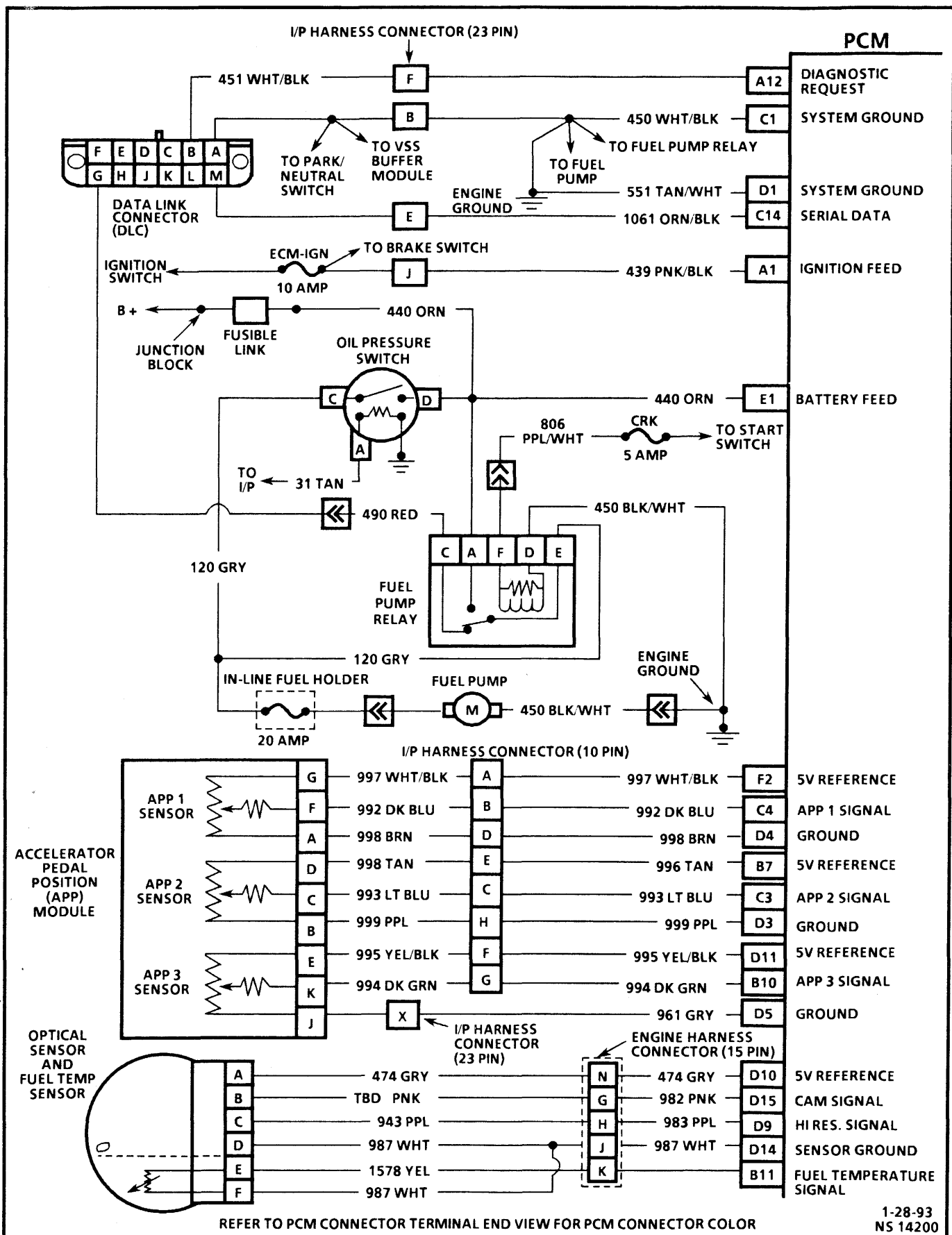


Figure 3-9 - PCM Wiring Diagram 6.5L Diesel (1 of 7)



**Figure 3-10 - PCM Wiring Diagram 6.5L Diesel (2 of 7)**



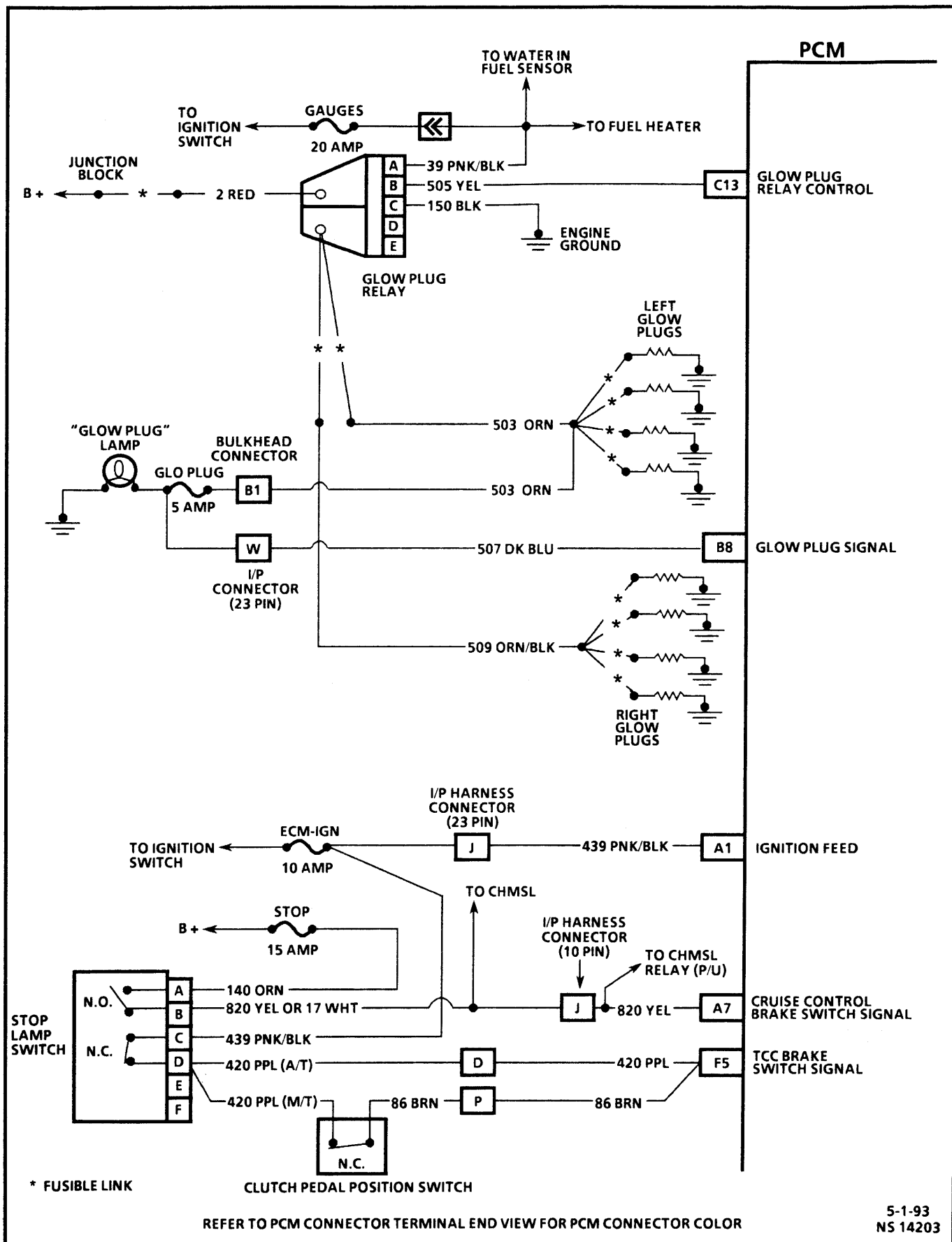
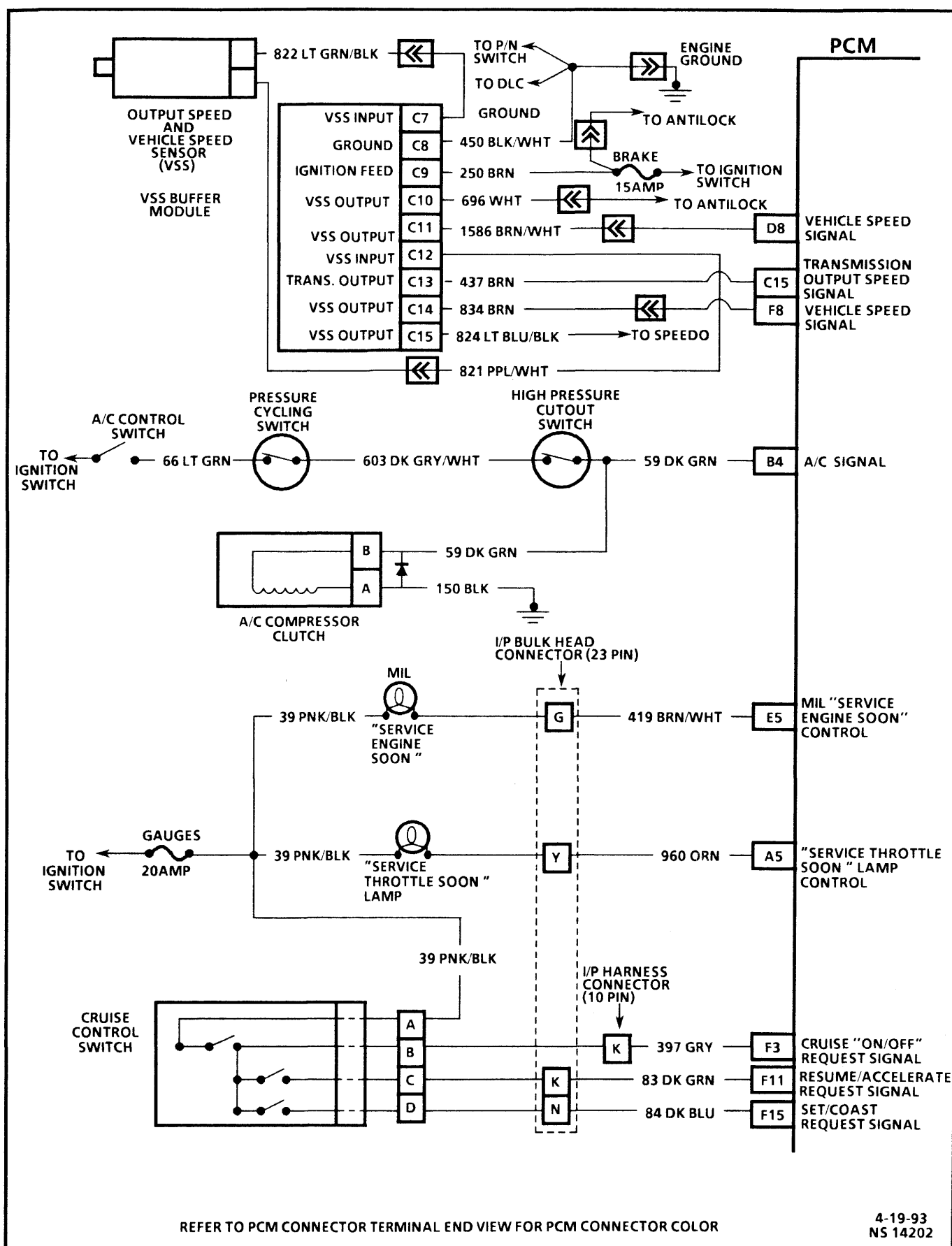


Figure 3-11 - PCM Wiring Diagram 6.5L Diesel (3 of 7)



**Figure 3-12 - PCM Wiring Diagram 6.5L Diesel (4 of 7)**

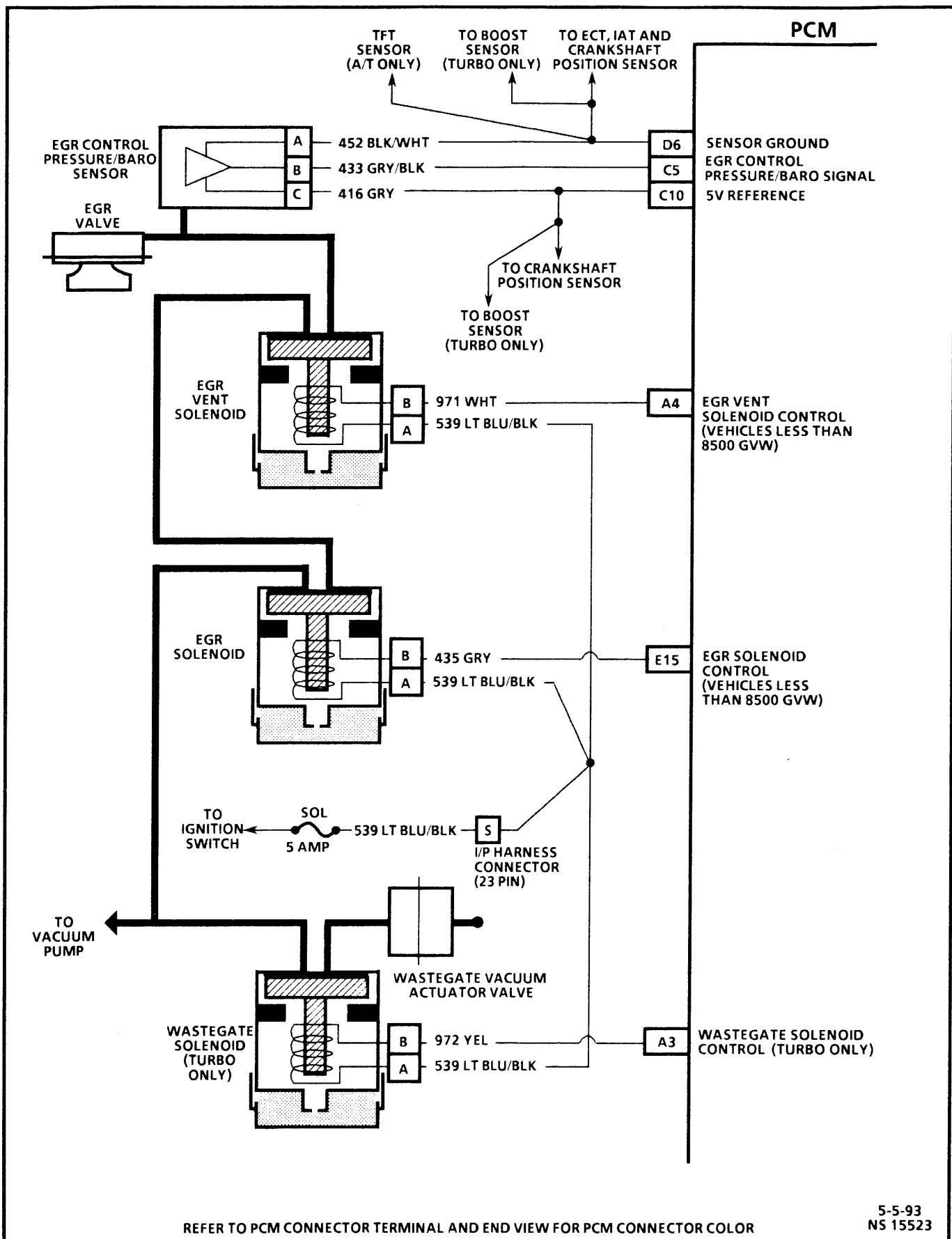


Figure 3-13 - PCM Wiring Diagram 6.5L Diesel (5 of 7)

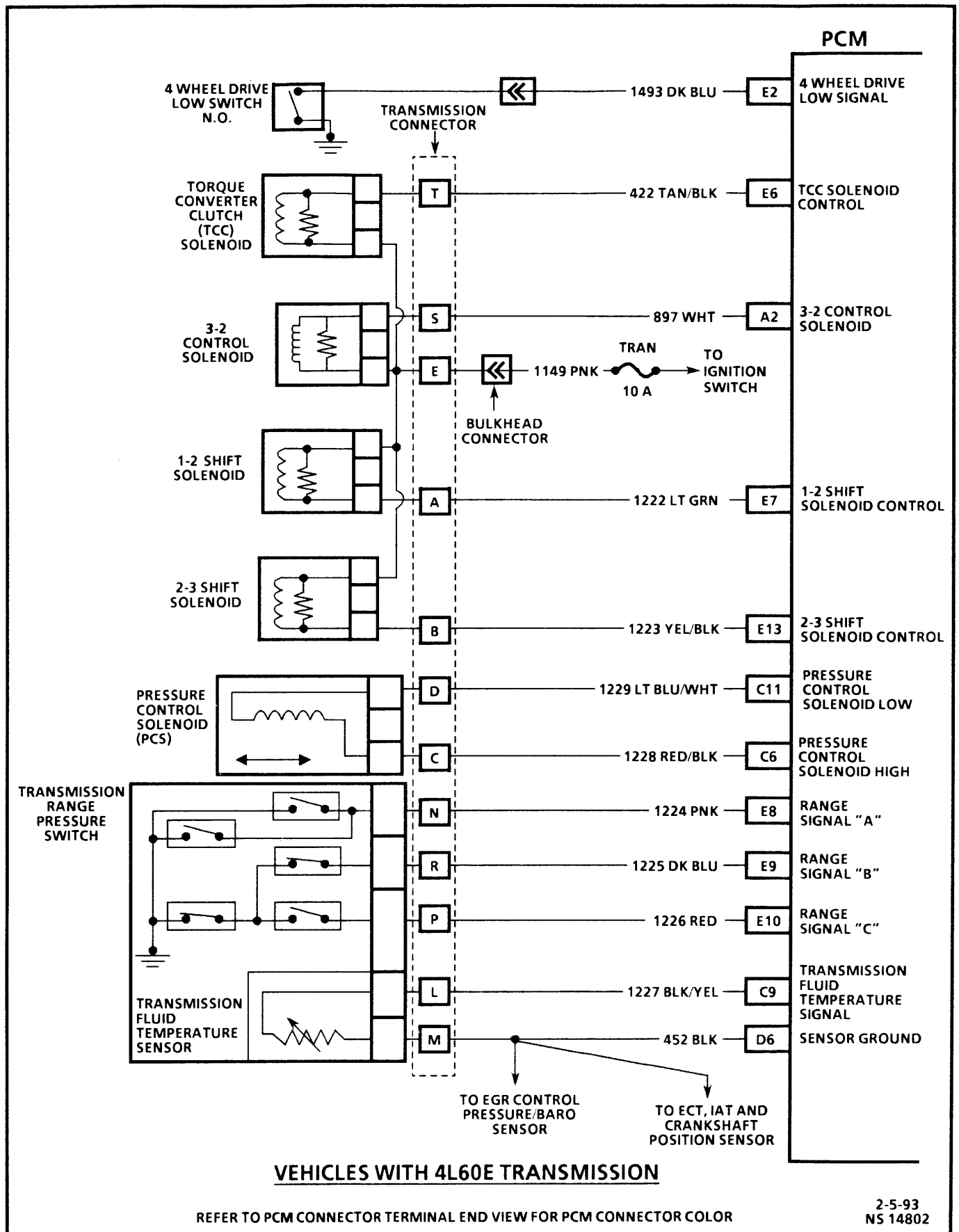


Figure 3-14 - PCM Wiring Diagram 6.5L Diesel (6 of 7)

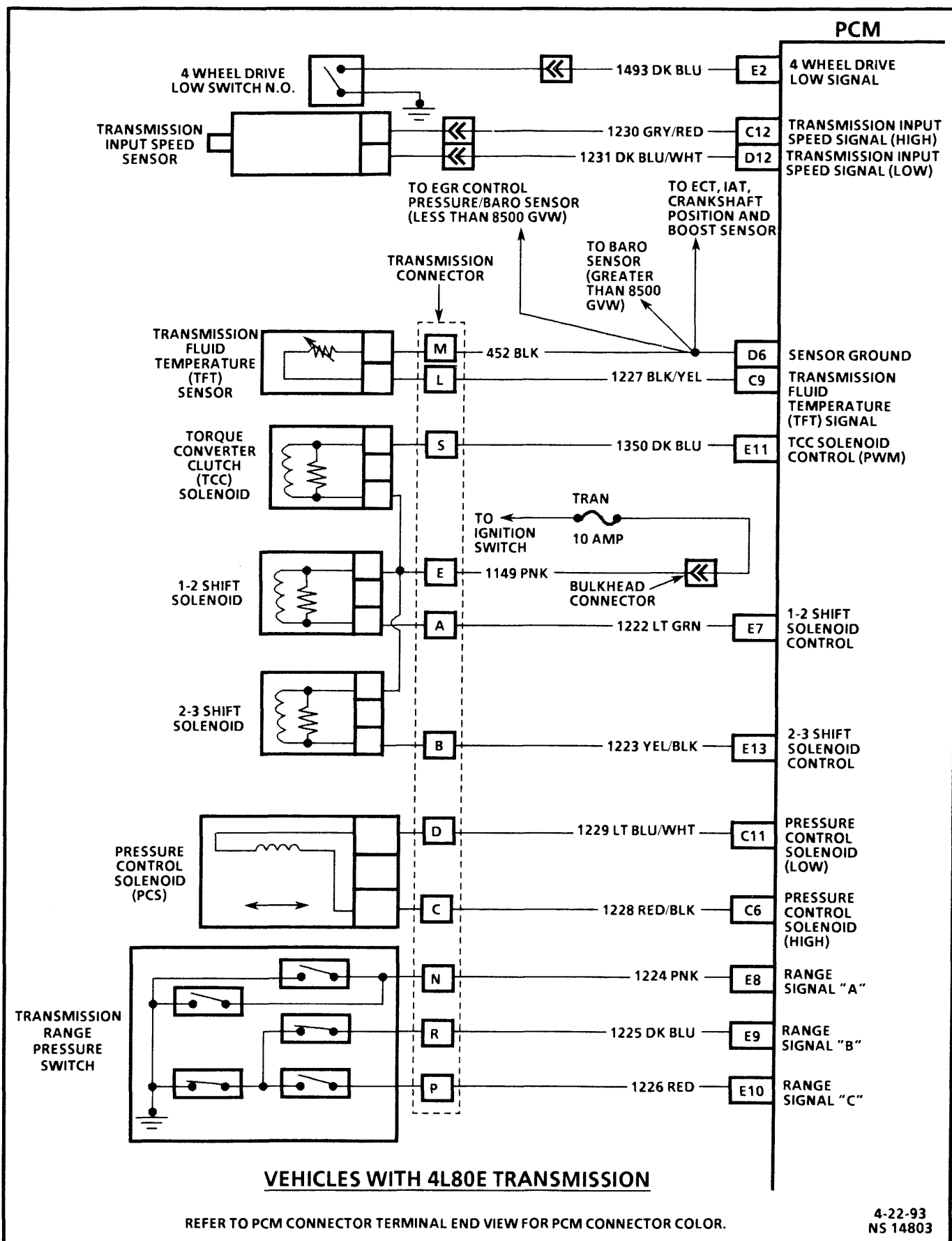


Figure 3-15 - PCM Wiring Diagram 6.5L Diesel (7 of 7)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

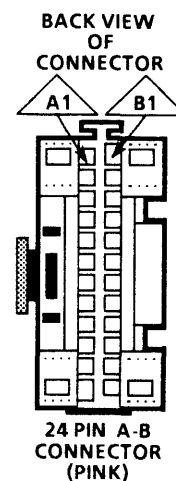
- Engine at operating temperature • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

#### PINK 24 PIN A-B CONNECTOR

| PIN | PIN FUNCTION                             | CKT # | WIRE COLOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS             |
|-----|------------------------------------------|-------|------------|----------------|------------------|-----------------|-------------------------------|
|     |                                          |       |            | KEY "ON"       | ENGINE OPERATING |                 |                               |
| A1  | IGNITION FEED                            | 439   | PNK/BLK    | B +            | B +              | -               | NO START                      |
| A2  | 3-2 CONTROL SOLENOID CONTROL Δ           | 897   | WHT        | B +            | B +              | 66              | 3 <sup>rd</sup> GEAR ONLY     |
| A3  | WASTEGATE SOLENOID CONTROL ▶             | 972   | YEL        | B +            | B +              | 62              | NO TURBO BOOST                |
| A4  | EGR VENT SOLENOID CONTROL (VIN P, VIN S) | 971   | LT BLU     | B +            | B +              | 31, 45          | NO EGR                        |
| A5  | SERVICE THROTTLE SOON LAMP CONTROL       | 960   | YEL        | (4)            | (4)              | 49              | NO SERVICE THROTTLE SOON LAMP |
| A6  | NOT USED                                 |       |            | -              | -                | -               | -                             |
| A7  | CRUISE CONTROL BRAKE SWITCH SIGNAL       | 820   | YEL        | 0              | 0                | 37, 38, 41      | NO BRAKE LIGHTS               |
| A8  | ITS COIL 1 HIGH                          | 565   | RED/BLK    | .9V            | B +              | 34              | POOR PERFORMANCE              |
| A9  | ITS COIL 1 LOW                           | 564   | TAN/BLK    | B +            | .9V              | 34              | POOR PERFORMANCE              |
| A10 | ITS COIL 2 LOW                           | 566   | ORN/BLK    | B +            | .9V              | 34              | POOR PERFORMANCE              |
| A11 | ITS COIL 2 HIGH                          | 567   | YEL/BLK    | .9V            | B +              | 34              | POOR PERFORMANCE              |
| A12 | DIAGNOSTIC REQUEST                       | 451   | WHT/BLK    | 5V             | 5V               | NONE            | -                             |

- (1) VARIES.  
 (2) OPEN CIRCUIT.  
 (3) GROUNDED CIRCUIT.  
 (4) OPEN/GROUNDED CIRCUIT.  
 (5) LESS THAN 1 VOLT.  
 (6) LESS THAN .5 VOLT (500 mV).  
 Δ 4L60E.  
 ▶ TURBO CHARGED.

VEHICLE: C/K TRUCK  
 ENGINE: 6.5L DIESEL VIN P (L49)  
 VIN S (L56)  
 VIN F (L65)  
 TRANSMISSION: 4L60E, 4L80E AND MANUAL



5-1-93  
 NS 14549

Figure 3-16 - PCM Connector Terminal End View (1 of 6)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

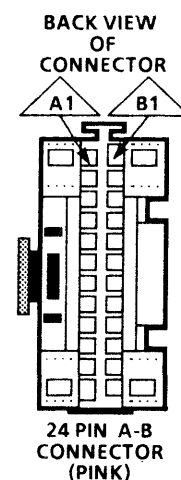
- Engine at operating temperature ● Engine idling (for "Engine Operating" column)
- Test terminal not grounded ● Scan tool not installed

#### PINK 24 PIN A-B CONNECTOR

| PIN | PIN FUNCTION              | CKT # | WIRE COLOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED    | POSSIBLE SYMPTOMS              |
|-----|---------------------------|-------|------------|----------------|------------------|--------------------|--------------------------------|
|     |                           |       |            | KEY "ON"       | ENGINE OPERATING |                    |                                |
| B1  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B2  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B3  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B4  | A/C SIGNAL                | 59    | DK GRN     | 0*Δ            | 0*Δ              | NONE               | A/C STATUS                     |
| B5  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B6  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B7  | APP 2 SENSOR 5V REFERENCE | 996   | TAN        | 5v             | 4.3v             | 25, 26, 27, 84, 99 | POOR PERFORMANCE               |
| B8  | GLOW PLUG SIGNAL          | 507   | DK BLU     | B +            | 0                | 29                 | HARD START                     |
| B9  | NOT USED                  | -     | -          | -              | -                | -                  | -                              |
| B10 | APP 3 SENSOR SIGNAL       | 994   | DK GRN     | 4v             | 4v               | 64, 65, 84         | POOR PERFORMANCE               |
| B11 | FUEL TEMP SIGNAL          | 1578  | YEL        | (2)            | 1.5v (2)         | 42, 43             | POOR PERFORMANCE IN COLD TEMPS |
| B12 | IAT SIGNAL                | 472   | TAN        | (2)            | 1.6v (2)         | 47, 48             | POOR PERFORMANCE IN COLD TEMPS |

- (1) VARIES.  
 (2) VARIES WITH TEMPERATURE.  
 (3) OPEN CIRCUIT.  
 (4) GROUNDED CIRCUIT.  
 (5) OPEN/GROUNDED CIRCUIT.  
 (6) LESS THAN 1 VOLT.  
 \* LESS THAN .5 VOLT (500 mV).  
 Δ B + WITH A/C "ON."

VEHICLE: C/K TRUCK  
 ENGINE: 6.5L DIESEL VIN P (L49)  
 VIN S (L56)  
 VIN F (L65)  
 TRANSMISSION: 4L60E, 4L80E AND MANUAL



5-1-93  
 NS 14550

Figure 3-17 - PCM Connector Terminal End View (2 of 6)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded
- Scan tool not installed

#### PINK 32 PIN C-D CONNECTOR

| PIN | PIN FUNCTION                                                                 | CKT # | WIRE COLOR  | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                                |
|-----|------------------------------------------------------------------------------|-------|-------------|----------------|------------------|-----------------|--------------------------------------------------|
|     |                                                                              |       |             | KEY "ON"       | ENGINE OPERATING |                 |                                                  |
| C1  | SYSTEM GROUND                                                                | 450   | WHT/BLK     | 0*             | 0*               | NONE            | -                                                |
| C2  | FUEL INJECT SIGNAL                                                           | 985   | RED         | 5.6V           | 4.0V             | NONE            | NONE                                             |
| C3  | APP SENSOR 2 SIGNAL                                                          | 993   | LT BLU      | 4.3V           | 4.3V             | 26, 27, 84      | POOR PERFORMANCE                                 |
| C4  | APP SENSOR 1 SIGNAL                                                          | 992   | DK BLU      | .5V            | .5V              | 22, 23, 84      | POOR PERFORMANCE                                 |
| C5  | EGR CONTROL PRESS/BARO SIGNAL (VIN P, VIN S) BARO SIGNAL (VIN F)             | 433   | GRY/BLK     | 4.8V           | 3.2V             | 31, 33          | NO EGR                                           |
| C6  | PRESSURE CONTROL SOLENOID (HIGH) Δ ●                                         | 1228  | RED/BLK     | 0*             | 6.3V             | 73              | HARSH SHIFT                                      |
| C7  | BOOST SIGNAL ▶                                                               | 432   | LT GRN      | 1.4V           | 1.4V             | 61, 62          | NO TURBO BOOST                                   |
| C8  | ECT SIGNAL                                                                   | 410   | YEL         | 3.4V (3)       | 3.0V (3)         | 14, 15          | EARLY TCC                                        |
| C9  | TRANSMISSION FLUID TEMPERATURE (TFT) SIGNAL Δ ●                              | 1227  | BLK/YEL     | 3.5V           | 2.8V             | 58, 59, 79      | EARLY TCC                                        |
| C10 | CRANKSHAFT POSITION EGR CONTROL PRESS/BARO AND BOOST SENSOR 5 VOLT REFERENCE | 416   | GRY         | 5V             | 5V               | 19, 31          | BACK UP FUEL, NO EGR                             |
| C11 | PRESSURE CONTROL SOLENOID (LOW) Δ ●                                          | 1229  | LT BLU/ WHT | 0*             | 1.5V             | 73              | HARSH SHIFT                                      |
| C12 | TRANS INPUT SPEED SIGNAL (HIGH) ●                                            | 1230  | GRY/RED     | 0*             | 0*               | 74              | NO TCC APPLY NO 4 <sup>th</sup> GEAR IN HOT MODE |
| C13 | GLOW PLUG RELAY CONTROL                                                      | 505   | YEL         | B +            | 0                | 29              | HARD START                                       |
| C14 | SERIAL DATA                                                                  | 1061  | ORN/BLK     | 5V             | 5V               | NONE            | NO SCAN TOOL DATA                                |
| C15 | TRANSMISSION OUTPUT SPEED SIGNAL                                             | 437   | BRN         | 0*             | 0*               | 24, 72          | 2 <sup>nd</sup> GEAR ONLY                        |
| C16 | NOT USED                                                                     | -     | -           | -              | -                | -               | -                                                |

(1) VARIES FROM 0 TO BATTERY VOLTAGE, DEPENDING ON POSITION OF DRIVE WHEELS.

(2) VARIES.

(3) VARIES WITH TEMPERATURE.

(4) OPEN CIRCUIT.

(5) GROUNDED CIRCUIT.

(6) OPEN/GROUNDED CIRCUIT.

(7) LESS THAN 1 VOLT.

(8) B + WHEN GLOW PLUG LAMP "ON."

\* LESS THAN .5 VOLT (500 mV).

Δ 4L60E.

● 4L80E.

▶ TURBO CHARGED.

VEHICLE:  
ENGINE:

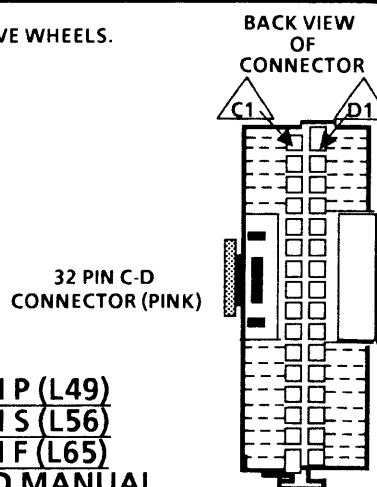
C/K TRUCK  
6.5L DIESEL

VIN P (L49)

VIN S (L56)

VIN F (L65)

TRANSMISSION: 4L60E, 4L80E AND MANUAL



5-12-93  
NS 14551

Figure 3-18 - PCM Connector Terminal End View (3 of 6)



### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

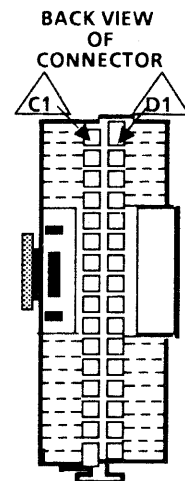
- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded
- Scan tool not installed

#### PINK 32 PIN C-D CONNECTOR

| PIN | PIN FUNCTION                                                              | CKT # | WIRE COLOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS                                 |
|-----|---------------------------------------------------------------------------|-------|------------|----------------|------------------|-----------------|---------------------------------------------------|
|     |                                                                           |       |            | KEY "ON"       | ENGINE OPERATING |                 |                                                   |
| D1  | SYSTEM GROUND                                                             | 551   | TAN/WHT    | 0*             | 0*               | NONE            | -                                                 |
| D2  | CLOSURE GROUND                                                            | 950   | LT GRN     | (4)            | (4)              | NONE            | NO START                                          |
| D3  | APP 2 SENSOR GROUND                                                       | 999   | PPL        | 0              | 0                | 26, 27, 84      | POOR PERFORMANCE                                  |
| D4  | APP 1 SENSOR GROUND                                                       | 998   | BRN        | 0              | 0                | 22, 23, 84      | POOR PERFORMANCE                                  |
| D5  | APP 3 SENSOR GROUND                                                       | 961   | RED        | 0              | 0                | 64, 65, 84      | POOR PERFORMANCE                                  |
| D6  | ECT, IAT, CRANKSHAFT POSITION, TFT AND EGR CONTROL PRESSURE SENSOR GROUND | 452   | BLK        | 0*             | 0*               | 14, 47, 19, 58  | FAST IDLE, BACK UP FUEL                           |
| D7  | NOT USED                                                                  | -     | -          | -              | -                | -               | -                                                 |
| D8  | VEHICLE SPEED SIGNAL                                                      | 1586  | BRN/WHT    | 0*             | 0*               | 16              | FUEL CUTOFF                                       |
| D9  | HIGH RESOLUTION SIGNAL                                                    | 983   | PPL        | 5V             | 2.5V             | 17              | BACK UP FUEL                                      |
| D10 | OPTICAL SENSOR 5V REFERENCE                                               | 474   | GRY        | 5V             | 5V               | 17, 18          | BACK UP FUEL                                      |
| D11 | APP 3 SENSOR 5V REFERENCE                                                 | 995   | YEL/BLK    | 5V             | 5V               | 64, 65, 84      | POOR PERFORMANCE                                  |
| D12 | TRANSMISSION INPUT SPEED SIGNAL (LOW) •                                   | 1231  | DK BLU/WHT | 0*             | 0*               | 74              | NO TCC APPLY, NO 4 <sup>th</sup> GEAR IN HOT MODE |
| D13 | CRANKSHAFT POSITION SIGNAL                                                | 643   | BLU/WHT    | 5V             | 4.5V             | 19              | BACK UP FUEL                                      |
| D14 | OPTICAL SENSOR GROUND                                                     | 987   | GRN/WHT    | 0*             | 0*               | 17, 18          | BACK UP FUEL                                      |
| D15 | OPTICAL SENSOR CAM SIGNAL                                                 | 442   | PNK        | .2V            | .5V              | 18              | BACK UP FUEL                                      |
| D16 | NOT USED                                                                  | -     | -          | -              | -                | -               | -                                                 |

- (1) VARIES FROM 0 TO BATTERY VOLTAGE, DEPENDING ON POSITION OF DRIVE WHEELS.
- (2) VARIES.
- (3) OPEN CIRCUIT.
- (4) GROUNDED CIRCUIT.
- (5) OPEN/GROUNDED CIRCUIT.
- (6) LESS THAN 1 VOLT.
- \* LESS THAN .5 VOLT (500 mV).
- 4L80E.

VEHICLE: C/K TRUCK  
ENGINE: 6.5L DIESEL VIN P (L49)  
VIN S (L56)  
VIN F (L65)  
TRANSMISSION: 4L60E, 4L80E AND MANUAL



32 PIN C-D CONNECTOR (PINK)

5-1-93  
NS 14552

Figure 3-19 - PCM Connector Terminal End View (4 of 6)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded
- Scan tool not installed

#### LT BLUE 32 PIN E-F CONNECTOR

| PIN | PIN FUNCTION                       | CKT # | WIRE COLOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED          | POSSIBLE SYMPTOMS                        |
|-----|------------------------------------|-------|------------|----------------|------------------|--------------------------|------------------------------------------|
|     |                                    |       |            | KEY "ON"       | ENGINE OPERATING |                          |                                          |
| E1  | BATTERY FEED                       | 440   | ORN        | B +            | B +              | NONE                     | NO START                                 |
| E2  | FWD LOW SWITCH Δ •                 | 1493  | DK BLU     | B +            | B +              | NONE                     | POOR START                               |
| E3  | NOT USED                           | -     | -          | -              | -                | -                        | -                                        |
| E4  | NOT USED                           | -     | -          | -              | -                | -                        | -                                        |
| E5  | MIL "SERVICE ENGINE SOON" CONTROL  | 419   | BRN/WHT    | (5)            | (5)              | 46                       | NO MIL                                   |
| E6  | TCC SOLENOID CONTROL Δ             | 422   | TAN/BLK    | B +            | B +              | 67, 69                   | POOR FUEL ECONOMY                        |
| E7  | 1-2 SHIFT SOLENOID CONTROL Δ •     | 1222  | LT GRN     | B +            | .4V              | 82                       | NO 3 <sup>rd</sup> /4 <sup>th</sup> GEAR |
| E8  | RANGE SIGNAL "A" Δ •               | 1224  | PNK        | B +            | B +              | 24, 28, 72               | -                                        |
| E9  | RANGE SIGNAL "B" Δ •               | 1225  | DK BLU     | 0              | 0                | 24, 28, 72               | -                                        |
| E10 | RANGE SIGNAL "C" Δ •               | 1226  | RED        | B +            | B +              | 24, 28, 72               | -                                        |
| E11 | TCC SOLENOID CONTROL (PWM) •       | 1350  | TAN/BLK    | B +            | .4V              | 67 - 4L60E<br>8E - 4L80E | -                                        |
| E12 | NOT USED                           | -     | -          | -              | -                | -                        | -                                        |
| E13 | 2-3 SHIFT SOLENOID CONTROL Δ •     | 1223  | YEL/BLK    | B +            | .4V              | 81                       | -                                        |
| E14 | FUEL INJECT CONTROL                | 984   | LT GRN     | 0              | 1.9V             | NONE                     | NONE                                     |
| E15 | EGR SOLENOID CONTROL (VIN P AND S) | 435   | GRY        | B +            | 9.5V             | 32, 44                   | NO EGR                                   |
| E16 | ENGINE SHUT-OFF SOLENOID CONTROL   | 981   | DK BLU/WHT | (5)            | (5)              | 13                       | NO START                                 |

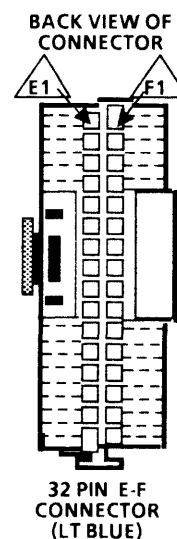
**NOTICE:** THE PCM UTILIZES A 24 PIN "PINK" CONNECTOR, A 32 PIN "PINK" CONNECTOR AND A 32 PIN "BLUE" CONNECTOR. THE 24 PIN "PINK" CONNECTOR IS LABELED "A" AND "B", THE 32 PIN "PINK" CONNECTOR IS LABELED "C" AND "D" AND THE 32 PIN "BLUE" CONNECTOR IS LABELED "C" AND "D". WHEN REFERENCING PCM CONNECTOR PIN OUTS, THE "BLUE" PCM CONNECTOR WILL BE REFERRED TO AS THE "E" AND "F" CONNECTOR.

- (1) VARIES.
- (2) READS BATTERY VOLTAGE IN GEAR.
- (3) OPEN CIRCUIT.
- (4) GROUNDED CIRCUIT.
- (5) OPEN/GROUNDED CIRCUIT.
- (6) LESS THAN 1 VOLT.
- \* LESS THAN .5 VOLT (500 mV)
- Δ 4L60E.
- 4L80E.

VEHICLE:  
ENGINE:

C/K TRUCK  
6.5L DIESEL  
VIN P (L49)  
VIN S (L56)  
VIN F (L65)

TRANSMISSION: 4L60E, 4L80E AND MANUAL



5-12-93  
NS 14553

Figure 3-20 - PCM Connector Terminal End View (5 of 6)

### PCM Connector and Driveability Symptoms Identification

This PCM voltage chart is for use with a J 39200 to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The "B + " symbol indicates a nominal system voltage of 12-14 volts.

#### THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature • Engine idling (for "Engine Operating" column)
- Test terminal not grounded • Scan tool not installed

#### LT BLUE 32 PIN E-F CONNECTOR

| PIN | PIN FUNCTION                   | CKT #     | WIRE COLOR | NORMAL VOLTAGE |                  | DTC(s) AFFECTED | POSSIBLE SYMPTOMS |
|-----|--------------------------------|-----------|------------|----------------|------------------|-----------------|-------------------|
|     |                                |           |            | KEY "ON"       | ENGINE OPERATING |                 |                   |
| F1  | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F2  | APP 1 SENSOR 5V REFERENCE      | 997       | WHT/BLK    | 5V             | 5V               | 21, 22, 23, 84  | POOR PERFORMANCE  |
| F3  | CRUISE "ON/OFF" REQUEST SIGNAL | 397       | GRY        | (4)            | (4)              | NONE            | NO CRUISE         |
| F4  | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F5  | TCC BRAKE SWITCH               | 420<br>86 | PPL        | B +            | B +              | 37, 38, 41      | NO TCC            |
| F6  | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F7  | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F8  | VEHICLE SPEED SIGNAL           | 834       | BRN        | *              | *                | 16              | NO CRUISE         |
| F9  | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F10 | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F11 | RESUME/ACCEL REQUEST SIGNAL    | 83        | DK GRN     | B +            | B +              | 76              | NO CRUISE         |
| F12 | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F13 | FUEL INJECT CONTROL            | 984       | LT GRN     | 0              | 1.9V             | NONE            | NONE              |
| F14 | NOT USED                       | -         | -          | -              | -                | -               | -                 |
| F15 | SET/COAST REQUEST SIGNAL       | 84        | DK BLU     | B +            | B +              | 71              | NO CRUISE         |
| F16 | NOT USED                       | -         | -          | -              | -                | -               | -                 |

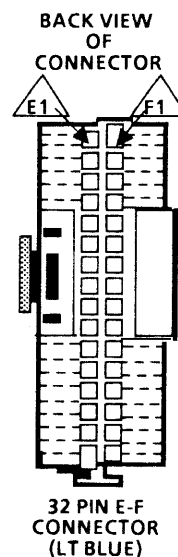
**NOTICE:** THE PCM UTILIZES A 24 PIN "PINK" CONNECTOR, A 32 PIN "PINK" CONNECTOR AND A 32 PIN "BLUE" CONNECTOR. THE 24 PIN "PINK" CONNECTOR IS LABELED "A" AND "B", THE 32 PIN "PINK" CONNECTOR IS LABELED "C" AND "D" AND THE 32 PIN "BLUE" CONNECTOR IS LABELED "C" AND "D". WHEN REFERENCING PCM CONNECTOR PIN OUTS, THE "BLUE" PCM CONNECTOR WILL BE REFERRED TO AS THE "E" AND "F" CONNECTOR.

- (1) VARIES.
- (2) OPEN CIRCUIT.
- (3) GROUNDED CIRCUIT.
- (4) OPEN/GROUNDED CIRCUIT.
- (5) LESS THAN 1 VOLT.
- \* LESS THAN .5 VOLT (500 mV)
- # MANUAL TRANSMISSION.
- Δ 4L60E.
- 4L80E.

VEHICLE:  
ENGINE:

C/K TRUCK  
6.5L DIESEL VIN P (L49)  
VIN S (L56)  
VIN F (L65)

TRANSMISSION: 4L60E, 4L80E AND MANUAL



5-3-93  
NS 14554

Figure 3-21 - PCM Connector Terminal End View (6 of 6)

## ON-VEHICLE SERVICE

## WIRE HARNESS

The PCM harness electrically connects the PCM to the various solenoids, switches, and sensors in vehicle engine transmission and passenger compartment.

Wire harnesses should be replaced with proper part number harnesses. When signal wires are spliced, into a harness, use wire with high temperature insulation only.

With the low current and voltage levels found in the system, it is important that the best possible bond at all wire splices be made by soldering the splices, as shown in Figure 3-22.

Molded on connectors require complete replacement of the connector. This means splicing a new connector assembly into the harness.

Replacement connectors and terminals are listed in Group 8.965, of the Standard Parts Catalog.

## CONNECTORS AND TERMINALS

Use care, when probing a connector or replacing terminals in them. It is possible to short between opposite terminals.

If this happens, to the wrong terminal pair, it is possible to damage certain components. Always use jumper wires between connectors, for circuit checking. **NEVER** probe through the Weather-Pack seals. Use tachometer adapter J 35812, or equivalent, which provides an easy hook up of the tach. lead. The connector test adapter kit J 35616, or equivalent, contains an assortment of flexible connectors, used to probe terminals during diagnosis. Fuse remover and test tool BT 8616, or equivalent, is used for removing a fuse and to adapt fuse holder, with a meter, for diagnosis.

When diagnosing, open circuits are often difficult to locate by sight, because oxidation, or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may correct the open circuit condition. This should always be considered, when an open circuit, or failed sensor is indicated. Intermittent problems may, also, be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar, but are serviced differently.

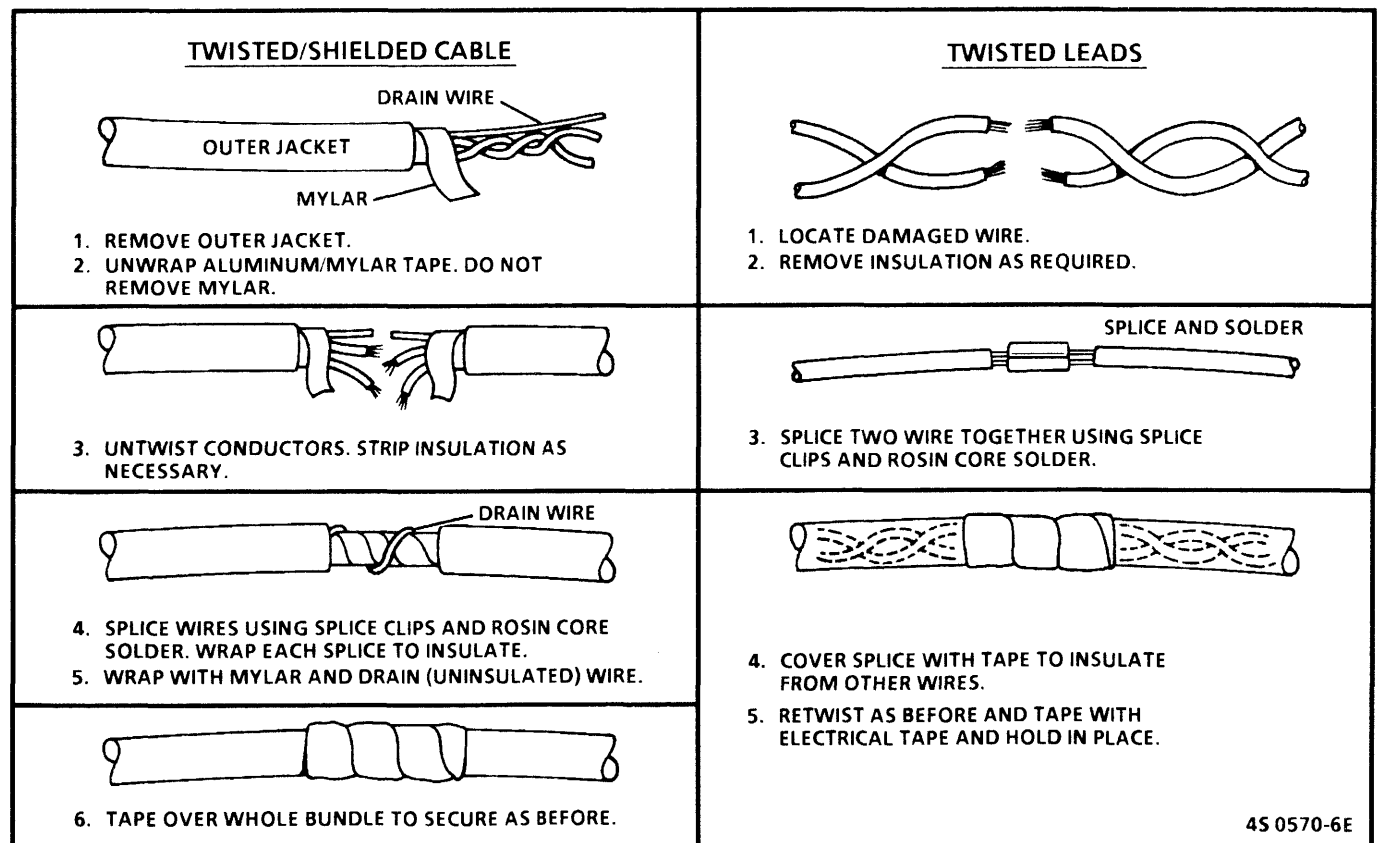


Figure 3-22 - Wire Harness Repair

## Micro-Pack

Refer to Figure 3-23 and repair procedure for replacement of a Micro-Pack terminal.

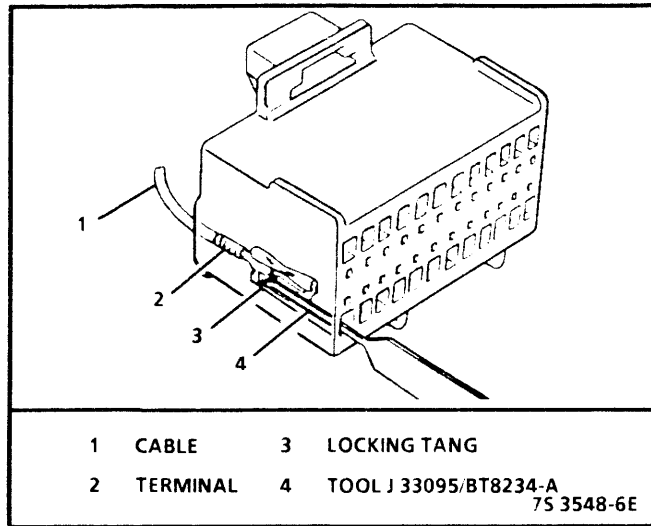


Figure 3-23 - Micro-Pack Connector

## Metri-Pack

Some connectors use terminals called Metri-Pack Series 150 (Figure 3-24). These may be used at the coolant sensor, as well as TBI/CPI units.

They are also called "Pull-To-Seat" terminals, because, to install a terminal on a wire, the wire is first inserted through the seal (5) and connector (4). The terminal is then crimped on the wire and the terminal pulled back into the connector to seat it in place.

To remove a terminal:

1. Slide the seal back on the wire.
2. Insert tool (3) BT-8518, or J 35689, or equivalent, as shown in insert "A" and "B," to release the terminal locking tab (2).
3. Push the wire and terminal out through the connector.

If reusing the terminal, reshape the locking tang (2).

## Weather-Pack

A Weather-Pack connector can be identified by a rubber seal, at the rear of the connector. This connector, which is used in the engine compartment, protects against moisture and dirt, which could create oxidation and deposits on the terminals. This protection is important, because of the very low voltage and current levels found in the electronic system.

Repair of a Weather-Pack terminal is shown in Figure 3-25. Use tool J M28742, or BT-8234-A to remove the pin and sleeve terminals.

If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent, or deformed. Unlike standard blade type terminals, these terminals cannot be straightened once they are bent.

Make certain that the connectors are properly seated and all of the sealing rings in place, when connecting leads. The hinge type flap provides a backup, or secondary locking feature for the connector. They are used to improve the connector reliability by retaining the terminals, if the small terminal lock tangs are not positioned properly.

Weather-Pack connections cannot be replaced with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

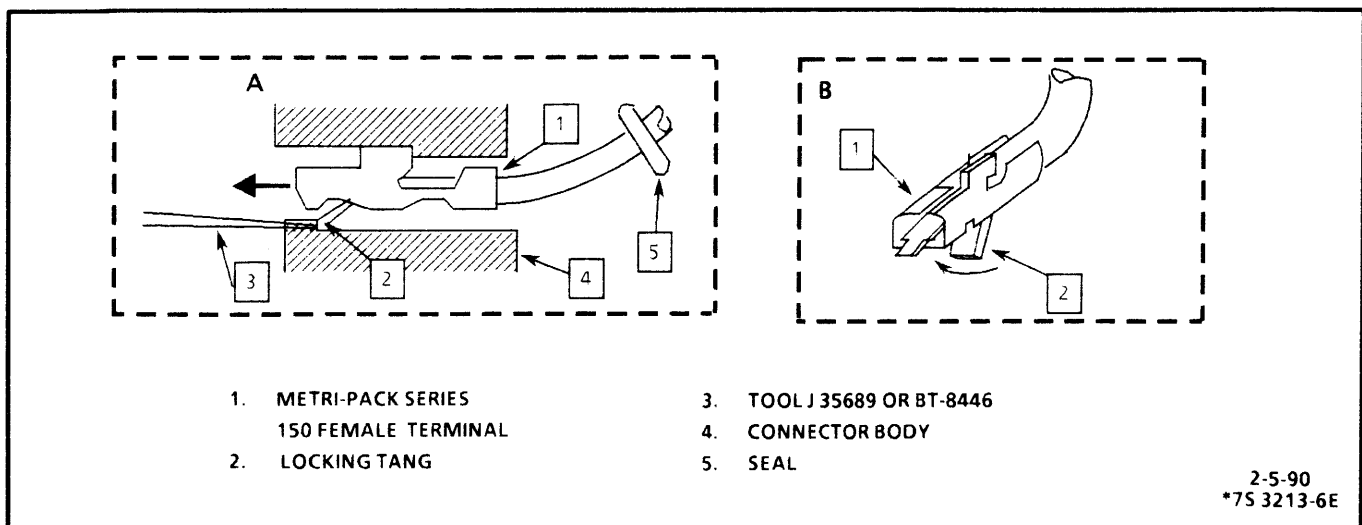


Figure 3-24 - Metri-Pack Series 150 Terminal Removal

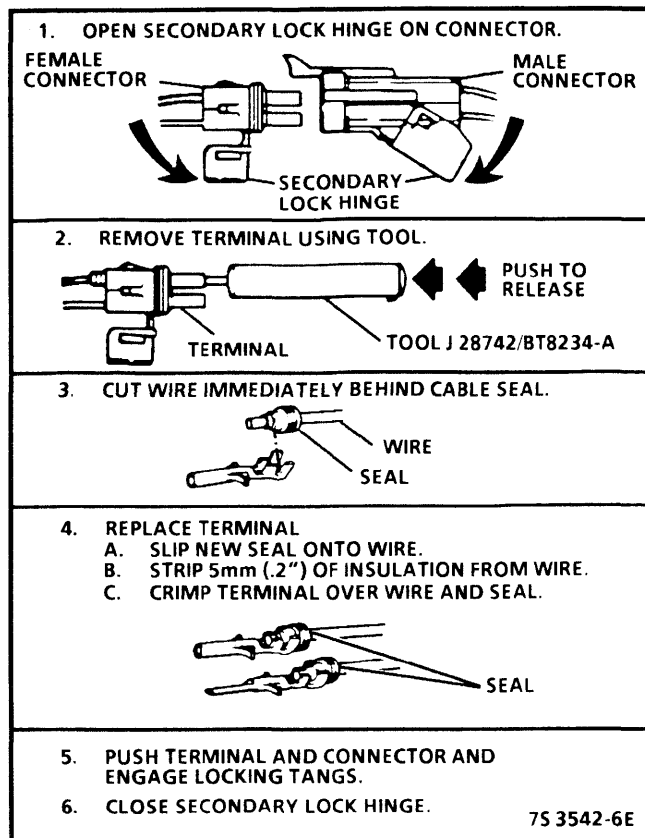


Figure 3-25 - Weather-Pack Terminal Repair

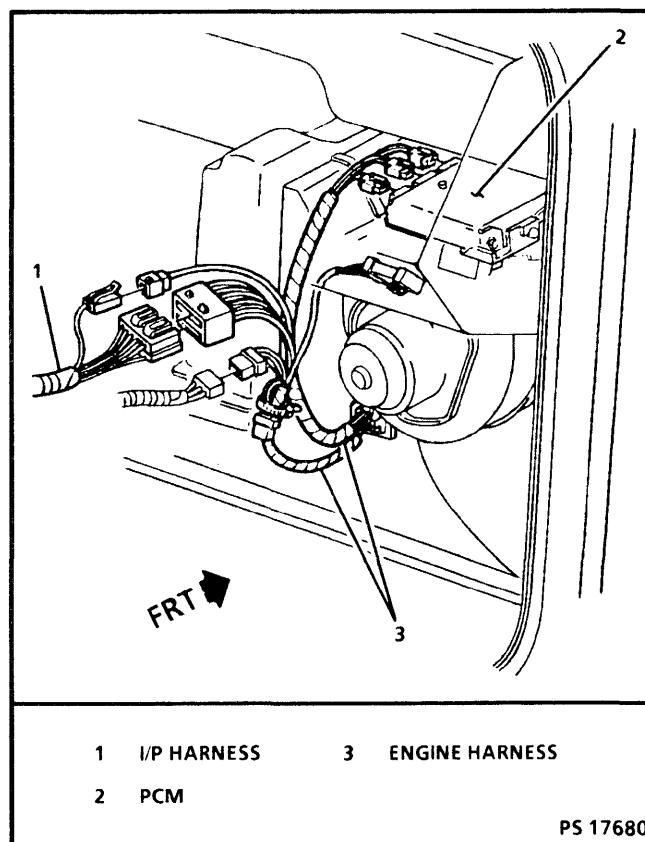


Figure 3-26 - Powertrain Control Module

## Compact Three

The Compact Three connector, which looks similar to a Weather-Pack connector, is not sealed and is used where resistance to the environment is not required. This type of connector, most likely, is used at the air control solenoid. Use the standard method, when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742, or BT-8234-A, as these will damage the terminals.

## POWERTRAIN CONTROL MODULE (PCM)

Service of the PCM should normally consist of either replacement of the PCM or a PROM change.

If the diagnostic procedures call for the PCM to be replaced, the PROM and PCM should be checked first to see if they are the correct parts. If they are, remove the PROM from the faulty PCM and install it in the new service PCM. **THE SERVICE PCM WILL NOT CONTAIN A PROM.** DTC 51 indicates the PROM is installed improperly or has malfunctioned. When DTC 51 is obtained, check the PCM installation for bent pins or pin not fully seated in the socket. If it is installed correctly and DTC 51 is still displayed, replace the PROM.

### ! Important

- When replacing the production PCM with a service PCM, a DTC 88 will be stored. It is important to program "TDC Offset" into the service PCM. Refer to "TDC Offset Program Procedure."

### ! Important

- When replacing the production PCM with a service PCM (controller), it is important to transfer the broadcast code and production PCM number to the service PCM label. Please Do Not record on PCM cover. This will allow positive identification of PCM parts throughout the service life of the vehicle.

### ! Important

- To prevent internal PCM damage, the ignition must be "OFF" when disconnecting or reconnecting power to PCM (for example, battery cable, PCM pigtail, PCM fuse, jumper cables, etc.). The ignition should be "OFF" for at least 30 seconds before disconnecting power to the PCM.

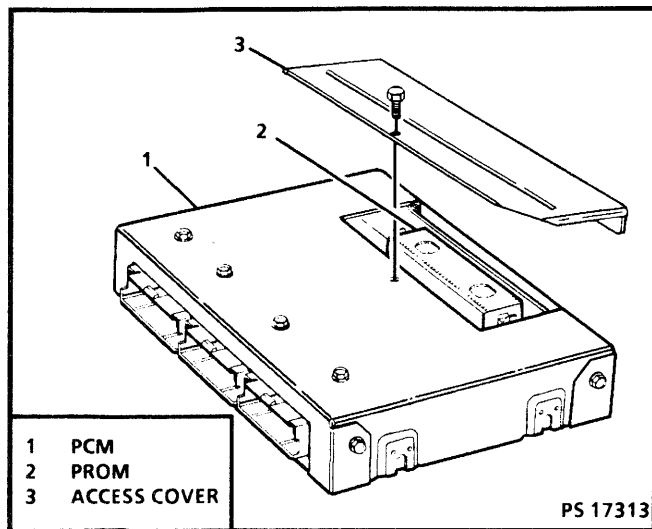


Figure 3-27 - PCM and PROM

## PCM OR PROM REPLACEMENT

Figure 3-26

### Remove or Disconnect

1. Negative battery cable.
2. Connectors from PCM.
3. PCM mounting hardware.
4. PCM from passenger compartment.
5. PCM access cover (Figure 3-27).
6. PROM.

### Important

- A replacement Powertrain Control Module (PCM) is supplied without a PROM, so care should be used when removing it from the defective PCM because it will be reused in the new PCM.

**NOTICE:** To prevent possible electrostatic discharge to the PCM or PROM, do not touch the component leads, and do not remove integrated circuit from carrier.

Using two fingers, grasp the PROM at both ends and lift it up out of the socket. Do not remove the cover of the PROM. Use of unapproved PROM removal methods may cause damage to the PROM or socket.

### Inspect

- For alignment notches of the PROM and carefully set it aside.

## IF PCM IS BEING REPLACED

### Remove or Disconnect

1. New PCM from its packaging and check the service number to make sure it is the same as the defective PCM.
2. Access cover.

### Install or Connect

1. PROM in PROM socket.

### Important

- Gently press down on PROM.
2. Access cover on PCM.
  3. PCM in passenger compartment.
  4. Connectors to PCM.

## Functional Check

1. Turn ignition "ON."
2. Enter diagnostics mode.
  - A. DTC 12 should flash three times (if no other DTCs are present). This indicates the PROM is installed properly, and the PCM is functioning.
  - B. If DTC 51 occurs, or if the MIL (Service Engine Soon) is "ON" constantly with no DTC(s), the PROM is not fully seated or is defective.
    - If not fully seated, press firmly on the ends of the PROM.
    - If it is necessary to remove the PROM, follow the previous removal instructions.

## TDC OFFSET PROGRAM PROCEDURE

This procedure allows the PCM memory to be updated with the correct TDC offset for the vehicle.

DTC 88 will be stored until this procedure has been completed.

Set up:

- Battery is fully charged.
- Engine operating at idle.
- Vehicle at operating temperature.
- Connect Tech 1 scan tool.
- Select "OUTPUT TESTS" and "INJ. PUMP."
- Activate "TDC LEARN."

**NOTICE:** It takes PCM 20 seconds to learn TDC offset.

- Verify "TDC OFFSET" in data list.
- DTC 88 will be stored if procedure has not been done correctly.

**NOTICE:** If the PCM fails to program the TDC OFFSET, do the following:

- Check all PCM connections.
- Check Techline terminal/equipment for latest software version.
- Try again to program the PCM. If it fails again replace the PCM. Refer to "PCM Replacement."

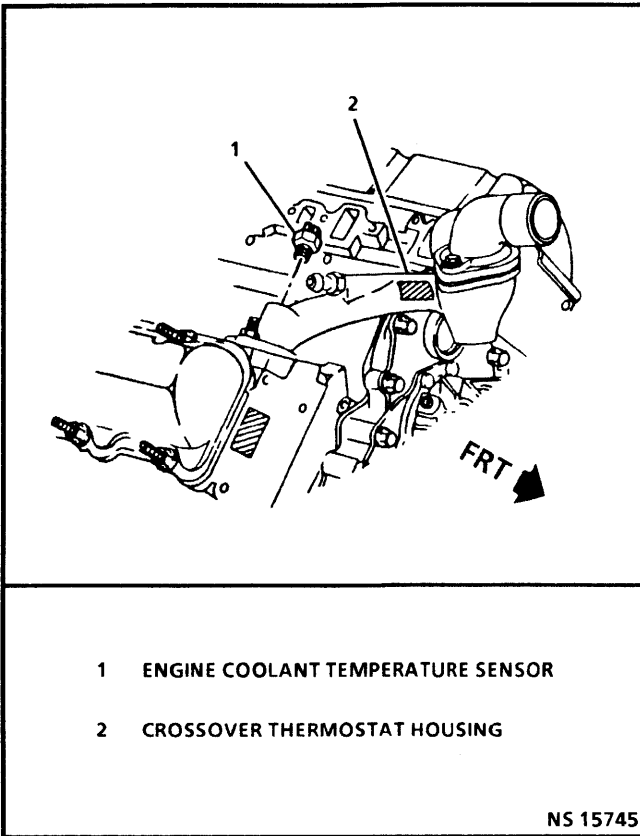


Figure 3-28 - Engine Coolant Temperature (ECT) Sensor

## PCM SENSORS AND INPUT SWITCHES

### Engine Coolant Temperature (ECT) Sensor Figure 3-28

**NOTICE:** Care must be taken, when handling sensor. Damage to sensor will affect proper operation of the fuel control system.

#### Remove or Disconnect

1. Negative battery cable.
2. Drain cooling system below level of sensor.
3. Electrical connector releasing locking tab.
4. Sensor.

#### Install or Connect

1. Sensor in engine.
2. Electrical connector.
3. Refill coolant system.
4. Negative battery cable.

### Accelerator Pedal Position (APP) Module

Refer to SECTION 4 for replacement.

### Optical/Fuel Temperature Sensor

These sensors are only serviceable with electronic fuel injection pump. Refer to SECTION 4.

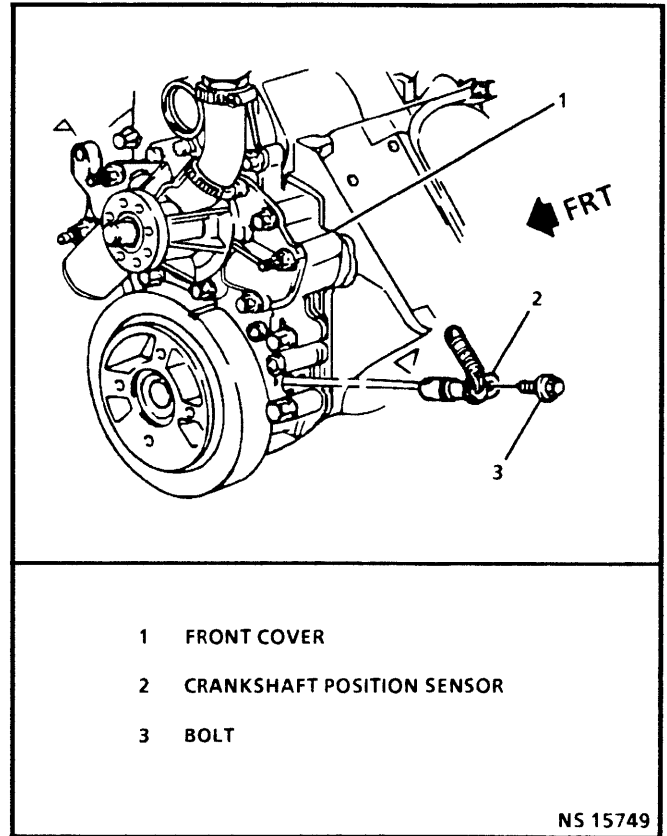


Figure 3-29 - Crankshaft Position Sensor

### Crankshaft Position Sensor Figure 3-29

#### Remove or Disconnect

1. Negative battery cable.
2. Sensor electrical connector.
3. Sensor bolt.
4. Sensor from engine.

#### Inspect

- Sensor O-ring for wear, cracks or leakage. Replace if necessary. Lube new O-ring with engine oil before installing.

#### Install or Connect

1. Sensor in engine.
2. Sensor bolt, tighten to 25 N·m (17 lb. ft.).
3. Sensor electrical connector.
4. Negative battery cable.

#### Important

- The procedure, called the "TDC Offset Program Procedure," utilizes the capabilities of the Tech 1 scan tool. This procedure must be done when a crankshaft position sensor is replaced. Refer to "TDC Offset Program Procedure."



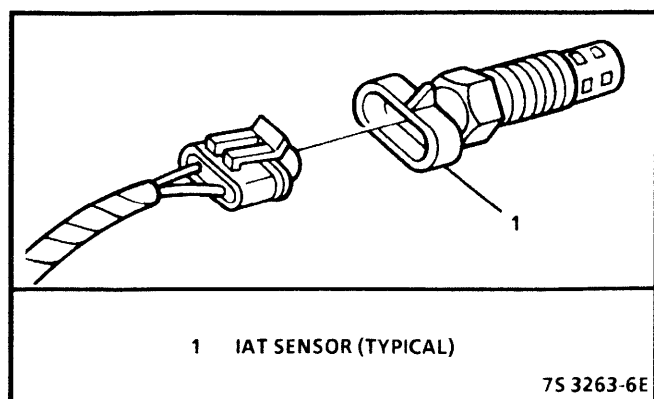


Figure 3-30 - IAT Sensor

## Intake Air Temperature (IAT) Sensor Figure 3-30

### Remove or Disconnect

1. Negative battery cable.
2. Electrical connector releasing locking tab.
3. IAT sensor.

### Install or Connect

1. IAT sensor.
2. Electrical connector.
3. Negative battery cable.

## EGR Control Pressure/BARO Sensor Figure 3-31

Other than checking for loose hoses and electrical connections, the only service possible is unit replacement if diagnosis shows sensor to be faulty.

### Remove or Disconnect

1. Negative battery cable.
2. Vacuum harness assembly. (If equipped.)
3. Electrical connector releasing locking tab.
4. Bolts or release lock tabs and remove sensor.

### Install or Connect

1. Bolts (3.5 N·m 27 lb. in.) or snap sensor on bracket.
2. Electrical connector.
3. Vacuum harness. (If equipped.)
4. Negative battery cable.

## Boost Sensor Figure 3-32

Other than checking for loose electrical connections, the only service possible is unit replacement if diagnosis shows sensor to be faulty.

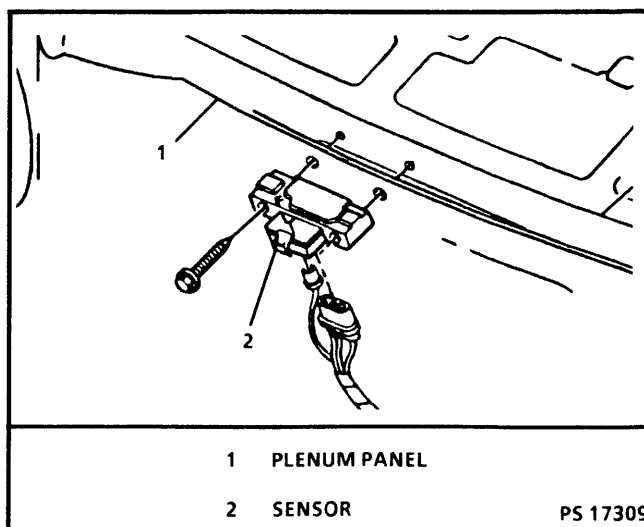


Figure 3-31 - EGR Control Pressure/BARO Sensor

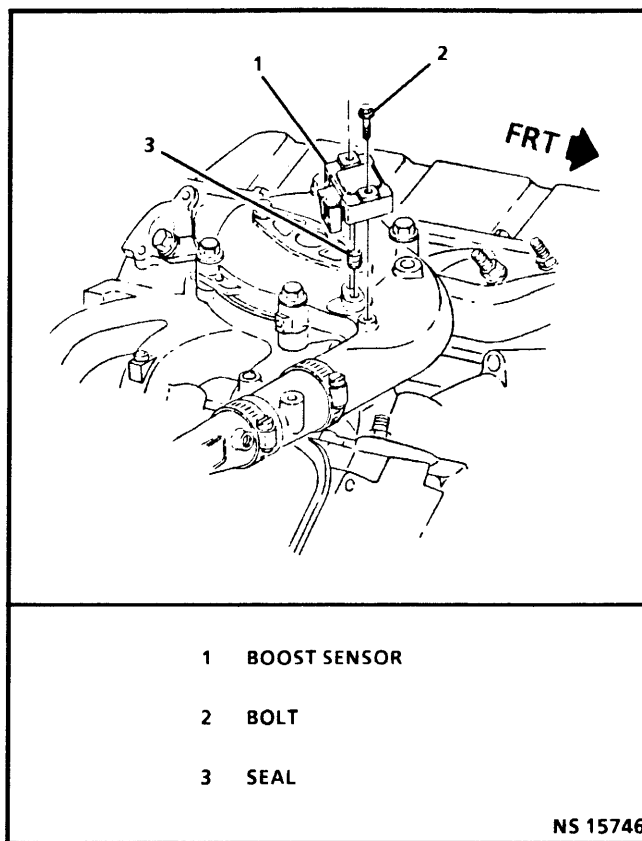


Figure 3-32 - Boost Sensor

### Remove or Disconnect

1. Negative battery cable.
2. Vacuum harness assembly.
3. Electrical connector releasing locking tab.
4. Bolts.

**↔ Install or Connect**

1. Bolts (3.5 N·m 27 lb. in.).
2. Electrical connector.
3. Vacuum harness.
4. Negative battery cable.

**Wastegate Solenoid**

**Figure 3-34**

**↔ Remove or Disconnect**

1. Negative battery cables.
2. Electrical connector from the solenoid.
3. Vacuum hoses.
4. Wastegate solenoid.

**↔ Install or Connect**

1. Wastegate solenoid.
2. Vacuum hoses.
3. Electrical connector from the solenoid.
4. Negative battery cables.
5. Perform "On-Board Diagnostic (OBD) System Check."

**Vehicle Speed Sensor (VSS)**

Refer to SECTION 10 for on-vehicle service of the transmission mounted VSS.

**VSS Buffer Module**

**Figure 3-33**

The VSS buffer module is mounted in the instrument panel. Refer to SECTION 8C of the appropriate service manual for on-vehicle service.

**Brake Switches**

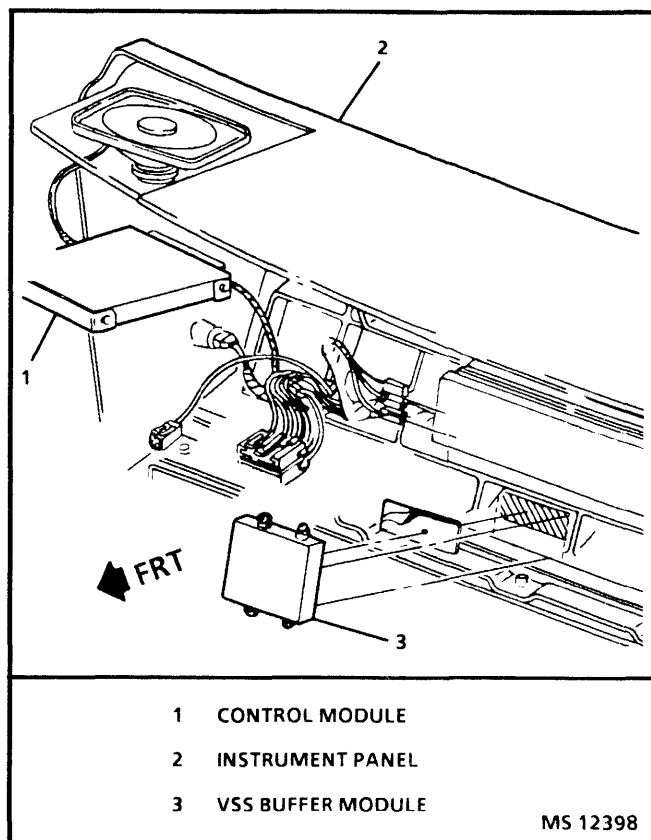
Refer to SECTION 5 of the appropriate service manual for on-vehicle service of the brake (stoplamp) switches.

**Cruise Control Switches**

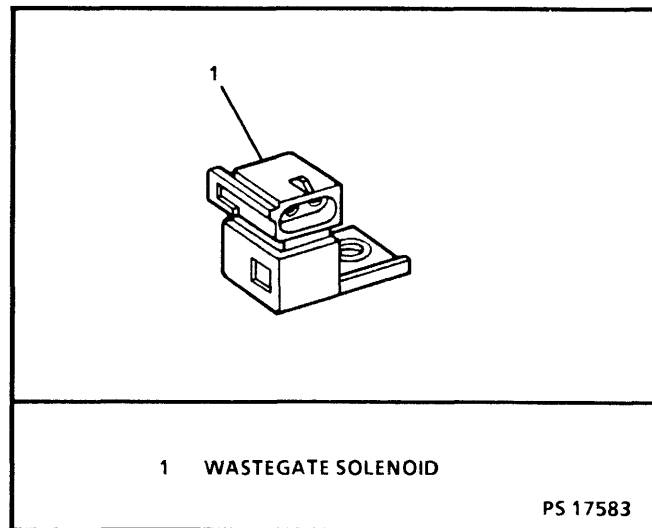
The cruise control switches are part of the multi-function turn signal lever. Refer to SECTION 3F of the appropriate service manual.

**PARTS INFORMATION**

| PART NAME                             | GROUP |
|---------------------------------------|-------|
| Module, Eng. Cont. . . . .            | 3.670 |
| PROM, ECM . . . . .                   | 3.670 |
| Sensor, Engine Coolant Temp . . . . . | 3.682 |



**Figure 3-33 - VSS Buffer Module**



**Figure 3-34 - Wastegate Solenoid**

**BLANK**

## SECTION 4

# FUEL SYSTEM

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## GENERAL DESCRIPTION

The function of the fuel system is to deliver the correct amount of fuel to the engine under all operating conditions. Fuel is stored and supplied by the fuel supply system and delivered by the fuel injection system. The fuel injection system is controlled by the Powertrain Control Module (PCM).

## MODES OF OPERATION

The PCM monitors voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions called "modes." All the modes are controlled by the PCM.

### Starting Mode

When the key is first turned "ON," the PCM turns "ON" the glow plug control system. The PCM checks the Engine Coolant Temperature (ECT) sensor, Accelerator Pedal Position (APP) sensor, and the Barometric Pressure (BARO) sensor, then determines the proper fuel for starting.

The PCM controls the amount of fuel delivered in the starting mode by changing how long the injection solenoid is turned "ON."

### Fuel Cutoff Mode

Fuel cutoff occurs at high engine RPM or high vehicle speed to protect internal engine components from damage.

## FUEL SYSTEM COMPONENTS

**Figure 4-1**

The fuel system consists of the following components:

- Fuel supply system components.
  - Fuel tank.
  - Fuel sender with strainer.
  - Fuel lift pump.
  - Fuel manager/filter.
  - Fuel pipes and hoses.
- Fuel injection system components.
  - Electronic fuel injection pump with PCM controlled solenoids and PCM sensors.
  - High pressure injection lines.
  - Injection nozzles.
- Fuel return system.
- Accelerator control system.

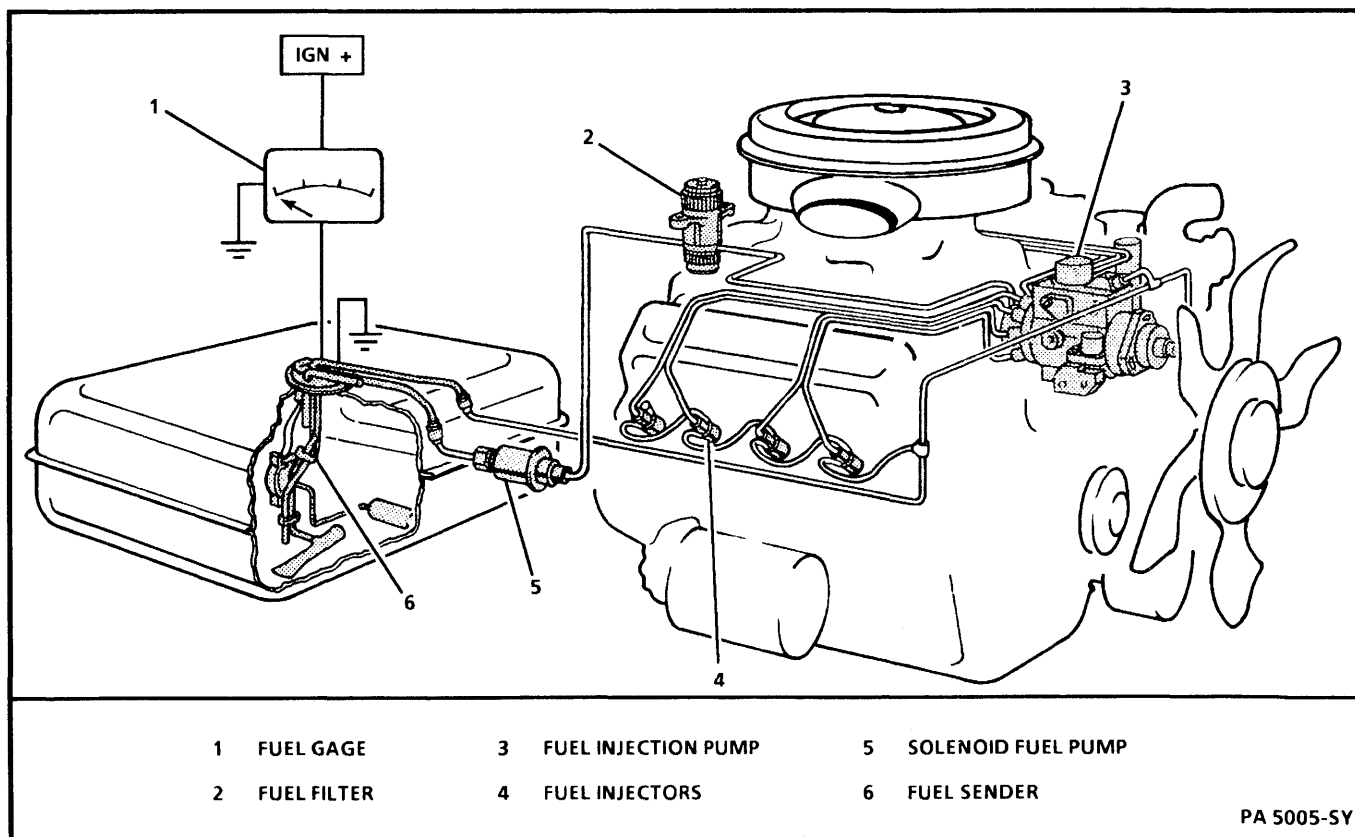
### FUEL SUPPLY SYSTEM

**Figure 4-1**

The fuel supply is stored in the fuel tank. Fuel is drawn from the fuel tank by the fuel lift pump. Fuel is then pumped through the fuel manager/filter. The fuel manager/filter is located on the intake manifold. The fuel is then transferred to the injection pump. Unused fuel is returned to the fuel tank by a separate line.

### Fuel Tank

The fuel tank is held in place by two metal straps and a cross strap attached to the underbody.



**Figure 4-1 - Fuel System**

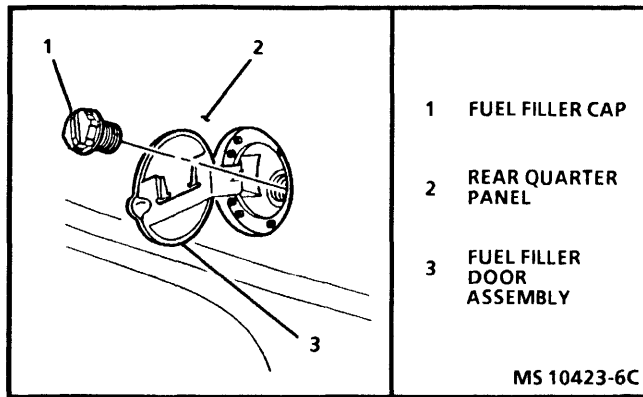


Figure 4-2 - Fuel Filler Cap

### Fuel Tank Filler Neck

The fuel tank filler neck is positioned at the left rear quarter panel of the vehicle.

### Fuel Filler Cap Figure 4-2

The fuel tank filler neck is equipped with a threaded-type cap. The threaded part of the cap requires several turns counterclockwise to remove. A built-in torque-limiting device prevents over tightening. To install, turn the cap clockwise until a clicking noise is heard. This signals that the correct torque has been reached and the cap is fully seated.

**NOTICE:** If a fuel filler cap requires replacement, use only a cap with the same features. Failure to use the correct cap can result in a serious malfunction of the system.

### Fuel Sender Figure 4-1

The fuel sender is located inside the fuel tank and is attached to the top of the fuel tank.

The fuel sender has a float, wire float arm, and a rheostat. Fuel level is sensed by the position of the float and float arm which operate the 90 ohm rheostat. As the float position changes, the amount of current passing through the rheostat varies, thus changing the gage reading on the instrument panel.

### Fuel Strainer

A woven plastic strainer is located on the lower end of the fuel sender pickup tube in the fuel tank. This strainer prevents dirt and water from entering into the fuel line unless it becomes completely submerged in water.

Diesel engine vehicles have a check valve that will permit fuel to pass if the strainer becomes plugged with paraffin during cold weather operation.

When this plugging occurs, the last four gallons of fuel will not be used due to the location of the check valve. Therefore, it is important to keep the fuel tank above the  $\frac{1}{4}$  mark at temperatures below  $-6^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ) when using number two diesel fuel.

### Lift Pump Figure 4-3

The electric fuel lift pump mounts on the inside of the left frame rail, and is used to deliver fuel at a low pressure (40 to 60 kPa or 5.8 to 8.7 psi) at the rate of 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds (15 GPH). The lift pump is controlled by the lift pump electrical circuit.

### Lift Pump Electrical Circuit

When the ignition switch is in the "crank" position, the fuel pump relay is energized which sends voltage to the lift pump. During this time, oil pressure is building to the point of closing the contacts of the oil pressure switch. A minimum of 28 kPa (4 psi) is required to close the switch contacts.

When the ignition switch is returned to the "run" position, the oil pressure of the running engine maintains voltage to the lift pump. If engine oil pressure drops below 28 kPa (4 psi), the engine will run poorly or stall when the lift pump circuit opens.

### Fuel Manager/Filter Figure 4-1

The fuel manager/filter is an in-line type filter which combines several different functions. It acts as a two-stage fuel filter, water separator, water detector, water drain, and a fuel heater.

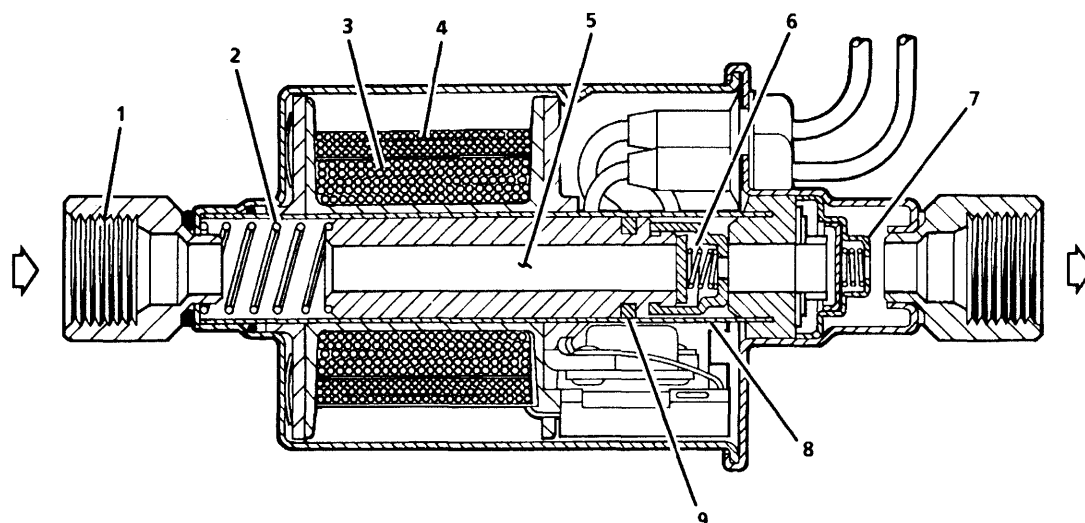
The fuel manager/filter mounts on the rear of the intake manifold. The filter housing has an inlet fitting connecting to the pipe/hose from the lift pump and an outlet fitting connecting to the fuel injection pump with a hose. A third fitting connects through a hose to a drain valve mounted on the water crossover/thermostat housing.

The fuel manager/filter has a two-stage replaceable element. The element has an air vent valve on its top surface that is used during lift pump diagnosis and filter element replacement procedure. The fuel manager/filter also has a water in fuel sensor and a fuel heater.

### Fuel Filter

The fuel filter element separates particles larger than 10 microns (0.00039-in.) from fuel moving through it under lift pump pressure. Filter action is very critical to the operation of internal parts of the fuel injection pump.

## 4-4 DRIVEABILITY AND EMISSIONS (DIESEL)



- |   |                               |   |              |
|---|-------------------------------|---|--------------|
| 1 | INLET PORT                    | 6 | INLET VALVE  |
| 2 | PRESSURE SPRING               | 7 | OUTLET VALVE |
| 3 | PRIMARY WINDING               | 8 | CYLINDER     |
| 4 | SECONDARY WINDING (FEED BACK) | 9 | TEFLON™ RING |
| 5 | PISTON AND VALVE ASSEMBLY     |   |              |

PA 5062-SY

Figure 4-3 - Lift Pump

### Water in Fuel Sensor

The design of the fuel manager/filter includes an area that allows water droplets (as small as one micron) to separate from the fuel and collect in a lower portion of the housing. The water in fuel sensor will detect a certain amount of water in the fuel inside the filter housing and then turn the "Water in Fuel" lamp "ON" in the instrument cluster.

When the ignition switch is first turned to the "run" position, the "Water in Fuel" lamp will come "ON" for 2 to 5 seconds. This action provides a bulb check.

### Fuel Heater

The fuel heater operates when the temperature of fuel at the inlet of the filter housing is cold enough to possibly cause waxing that could restrict flow to the injection pump. A control circuit inside the fuel heater completes the circuit for the heater element when it senses a temperature below 8°C (46°F).

### Fuel Pipes and Hoses

The fuel feed and return pipes and hoses extend from the fuel sender to the fuel manager/filter. They are secured with clamps and are routed along the frame side member.

### Fuel Pipe O-Rings

Some fuel feed pipes have threaded connections that are sealed with replaceable O-ring seals. These O-ring seals are made of special material, and should only be serviced with the correct service part.

## FUEL INJECTION SYSTEM

The fuel injection system has a PCM controlled fuel injection pump mounted on top of the engine under the intake manifold. The pump is driven by the camshaft through two gears, one attached to the front of the camshaft and the other attached to the end of the pump shaft. These gears are the same size and have the same number of teeth; therefore, the injection pump shaft turns at the same speed as the camshaft.

### Electronic Fuel Injection Pump

The injection pump is a high pressure rotary type pump that is controlled by the PCM and meters, pressurizes, and distributes fuel to the eight injector nozzles by way of eight high-pressure lines. An outlet port in the injection pump allows fuel to enter the fuel return system and travel back to the fuel tank.

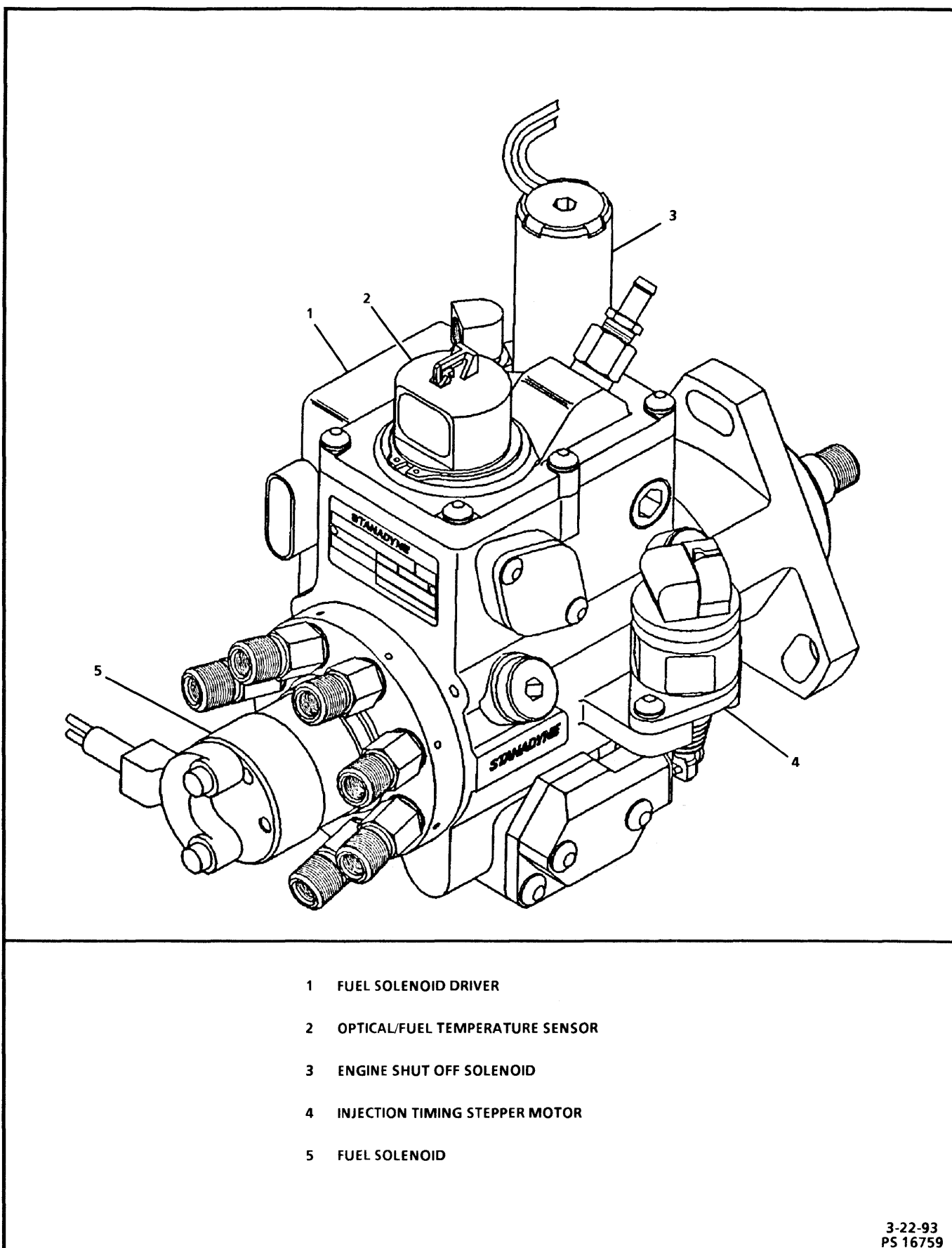


Figure 4-4 - Electronic Fuel Injection Pump



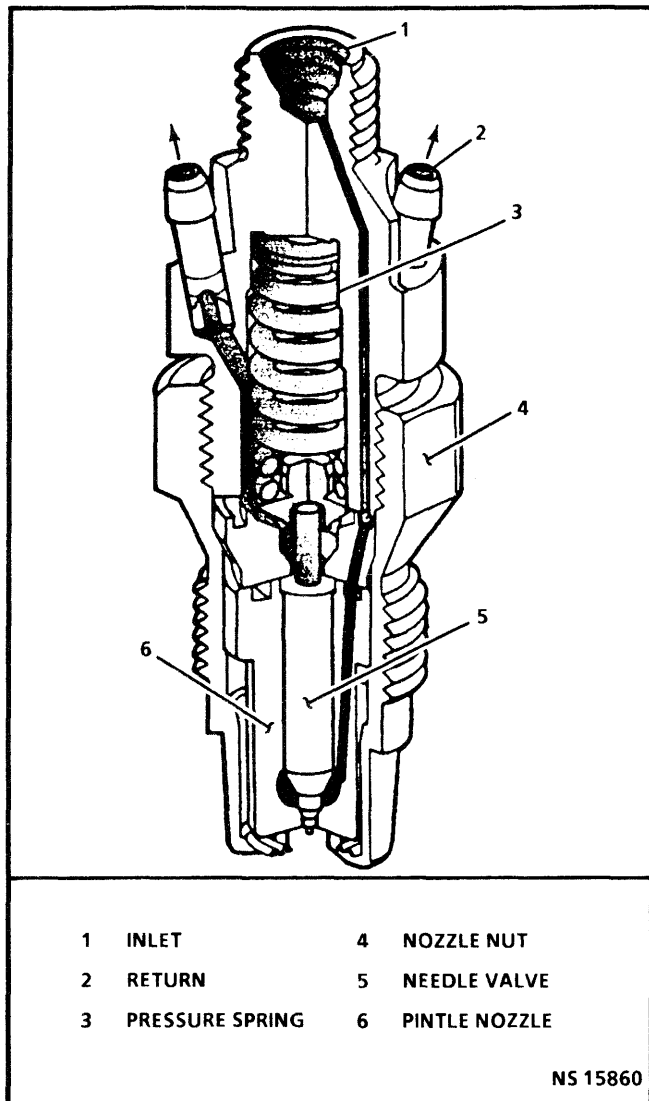


Figure 4-5 - Injection Nozzles

### Fuel Metering

Fuel metering is accomplished by the fuel solenoid driver using signals from the PCM to control the fuel injection solenoid.

### Injection Timing

The injection timing stepper motor advances or retards injection timing by signals received from the PCM.

### Engine Shutoff Solenoid

When not activated by the PCM, the engine shutoff solenoid blocks fuel flow from entering the charging passages inside the injection pump and stops engine operation.

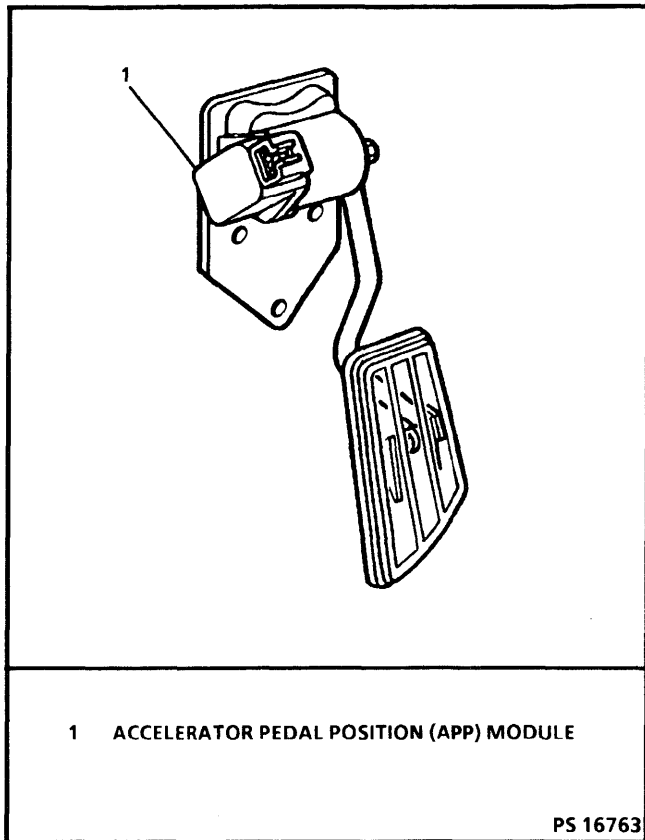


Figure 4-6 - Accelerator Pedal Position (APP) Module

### Injection Lines

The high-pressure discharge fittings on the head of the injection pump connect to the injection nozzles with steel lines of equal length and interior volume.

When the engine is not running, fuel is contained in the injection lines. During engine operation, a residual pressure of approximately 500 psi is maintained in each injection line. As injection occurs in each line, a small amount of fuel enters the line, pushing a similar amount into the nozzle at the other end with a pressure wave.

### Injection Nozzles

#### Figure 4-5

Each cylinder has an identical fuel injection nozzle mounted in the pre-combustion chamber.

As the pressure wave of injection reaches a nozzle, the needle valve is lifted against spring force and fuel exits into the pre-combustion chamber of the cylinder as a highly atomized spray. A small amount of fuel travels between the needle valve and pintle nozzle, providing lubrication.

Two passages inside the upper half of the nozzle body allow fuel that has lubricated the needle valve to exit into the fuel return system.

## FUEL RETURN SYSTEM

The fuel return system has several different sizes and types of hoses and pipes connected to the injection pump and each of the injection nozzles.

At the rear of the engine, the return system pipe under the intake manifold connects to a series of hoses and pipes that send fuel back to the fuel tank.

## ACCELERATOR CONTROL SYSTEM

### Figure 4-6

The accelerator control system is an electronically controlled throttle type with an accelerator pedal attached to an accelerator pedal position module. This module sends signals to the powertrain control module which controls the fuel injection pump. Refer to SECTION 3 for more information about the accelerator pedal position module.

## DIAGNOSIS

### FUEL SYSTEM CONTAMINATION

Fungi and other microorganisms can survive and multiply in diesel fuel if water is present. The fungi can be present in any part of the fuel handling system. These fungi grow into long strings and will form into large globules. The growths appear slimy and are usually black, green, or brown. The fungi may grow anywhere in the fuel but are most plentiful where diesel fuel and water meet. As the fuel is agitated (when service station tanks are being filled), fungi are distributed throughout the tank and may be pumped into a vehicle.

Fungi use the fuel as their main energy supply and need only trace amounts of water and minerals. As they grow and multiply, they change fuel into water, sludge, acids, and products of metabolism. The most common symptom is fuel filter plugging; however, various metal components (fuel tank, pipes, and injection pump) can corrode.

**CAUTION: To avoid personal injury, do not come into physical contact with biocides.**

If fungi have caused fuel system contamination, use a diesel fuel biocide to sterilize the fuel system. Do not exceed the dosage recommended on the label. Discontinue the use of a biocide when towing a trailer. It is permissible to have biocide in the fuel when starting to tow, but do not add any biocide while towing.

Steam cleaning may be necessary if most of the fungus growth cannot be removed with biocides.

The presence of water or gasoline in diesel fuel may also cause injection pump and nozzle damage.

### Contamination Testing Procedure

This procedure checks for the presence of water and gasoline in diesel fuel that may cause injection pump and nozzle damage.

1. Remove the fuel filter element and inspect it:
  - If water, gasoline or fungi/bacteria are not present, end the inspection.
  - If water or fungi/bacteria are present, go to Step 2.
  - If gasoline is present, go to Step 3.
2. Clean water from the fuel system in these steps:
  - A. Disconnect the batteries.
  - B. Drain the fuel tank.
  - C. Remove the fuel tank. (Refer to "Fuel Tank Replacement" in this section.)
  - D. Remove the fuel sender unit. (Refer to "Fuel Sender Replacement" in this section.)
  - E. Inspect the fuel tank and fuel sender for rust, fungi or bacteria:
    - If no rust is present, clean the inside of the fuel tank and fuel sender with hot water, then dry them with compressed air.
    - If rust is present, replace the parts.
  - F. Disconnect the ends of the following lines:
    - Lift pump suction.
    - Lift pump feed.
    - Fuel filter outlet.
    - Fuel filter drain.
    - Fuel return.
  - G. Inspect each of the pipes and replace any rusted pipes.
  - H. Dry the inside of each line with low pressure air.
  - I. Clean the inside of the fuel filter housing and dry it with compressed air.
  - J. Disconnect the electrical connector to the fuel injection solenoid and fuel solenoid driver on the injection pump.
  - K. Install a new fuel filter element.
  - L. Install the fuel sender and fuel tank (add clean diesel fuel to  $\frac{1}{4}$  full).
  - M. Connect the following lines:
    - Lift pump suction (both ends).
    - Lift pump feed (both ends).
    - Fuel filter drain.
    - Fuel return (at injection pump).

- N. Connect the fuel filter outlet and the fuel return line at the fuel sender to hoses that flow to metal containers.
  - O. Connect the batteries and crank the engine until clean fuel flows from the fuel filter outlet into a metal container.
  - P. Connect the hose from the fuel filter outlet to the injection pump inlet.
  - Q. Open each injection line at its nozzle end and crank the engine until clean fuel flows from it:
    - Use two wrenches when loosening the injection line fittings.
    - Allow a maximum of 15 seconds cranking time, followed by 1 minute of cranking motor cooling time.
  - R. Tighten each injection line fitting at its nozzle:
    - Use two wrenches when tightening the injection line fittings.
  - S. Connect the electrical connector to the fuel injection solenoid and fuel solenoid driver on the injection pump.
  - T. Start and run the engine for 15 minutes while fuel flows from the fuel return line into a metal container.
  - U. Stop the engine.
  - V. Connect the fuel return hose to the fuel sender.
  - W. Clean the engine of fuel spillage.
  - X. Fill the fuel tank and add a biocide, if needed.
3. Clean gasoline from the fuel system in these steps:
- A. Determine a procedure:
    - If the engine runs, follow Steps B, C, J and K.
    - If the engine does not run, begin at Step C.
  - B. Drain the fuel tank.
  - C. Fill the fuel tank.
  - D. Disconnect the electrical connector for fuel injection solenoid and fuel solenoid driver on the injection pump.
  - E. Remove the fuel filter outlet and connect it to a hose that flows to a metal container.
  - F. Crank the engine until clean fuel flows from the fuel filter outlet into a metal container.
    - Allow a maximum of 15 seconds cranking time, followed by 1 minute of cranking motor cooling time.
  - G. Connect the hose from the fuel filter outlet to the injection pump inlet.
  - H. Connect the electrical connector for the fuel injection solenoid and fuel solenoid driver on the injection pump.
  - I. Start and run the engine for 15 minutes.
  - J. Stop the engine.
  - K. Clean the engine of fuel spillage.
  - L. Clear engine DTC(s).

## FUEL QUALITY

Fuel quality may cause driveability problems such as hesitation, lack of power, stall, no start, etc.

### Specific Gravity Testing Procedure Figure 4-7

#### Important

- The fuel quality hydrometer provides a general indication of fuel quality and should not be considered scientifically accurate.
1. Drain the fuel filter housing by doing these things:
    - Stop the engine.
    - Place a container under the drain valve exit hose at the left front side of the engine.
    - Open the drain valve.
    - Start the engine and operate it at operating speed until clear fuel appears at the drain valve exit hose.
    - Fill a 1-liter (0.946 quart) container with a sample of clean fuel.
    - Close the drain valve and stop the engine.
    - Bring the fuel sample to 16°C (60°F).
  2. Obtain a fuel quality hydrometer (J 34352).
  3. Fill the hydrometer with the fuel sample by doing these things:
    - Squeeze the hydrometer bulb.
    - Submerge the hydrometer tip into the sample.
    - Release the bulb, allowing fuel to enter the glass tube until it floats the glass bulb inside the tube.
    - Gently spin the hydrometer to relieve the surface tension of the fuel sample.
  4. Read the scale on the glass bulb at the point where the top of the fuel sample contacts it.

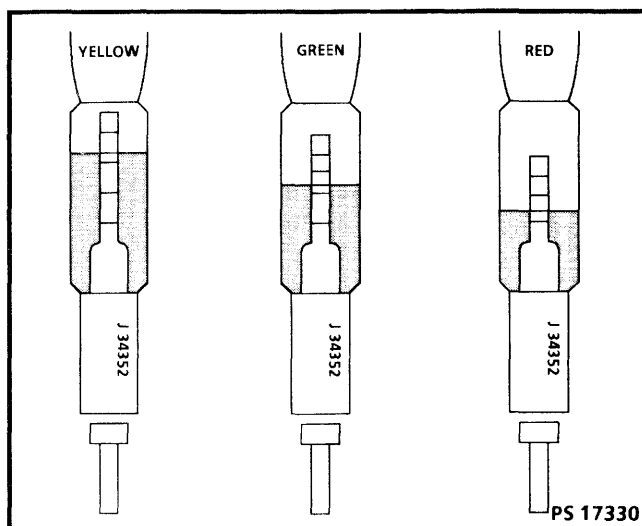


Figure 4-7 - Fuel Specific Gravity Test

- If the top of the fuel sample is in the yellow part of the glass bulb scale (above the green part), suspect the presence of gasoline in the fuel.
- If the top of the fuel sample is in the green part of the glass bulb scale, the fuel has high quality (approximate cetane rating of 46 to 50).
- If the top of the fuel sample is in the yellow part of the glass bulb scale (below the green part), the fuel has moderate quality (approximate cetane rating of 41 to 45).
- If the top of the fuel sample is in the red part of the glass bulb scale, the fuel has low quality (approximate cetane rating of 38 to 40).

## FUEL TANK

The diagnosis of fuel odor may be a condition of leaking fuel tank, filler neck, or filler cap.

A defective filler cap, a plugged or pinched vent pipe can cause a collapsed fuel tank.

Loose mounting straps, or foreign material in tank, may be the cause of a rattle at the fuel tank.

## Fuel Tank Leak Check

### ! Important

- Before attempting "Fuel Tank Leak Check," place a dry chemical (Class B) fire extinguisher near work area.
  - Before removing the fuel tank for a suspected leak, make sure fuel pipes or tubes are not leaking onto the tank. Once removed, make sure fuel is not leaking around fuel sender O-ring.
  - This check requires the fuel sender with O-ring to be installed.
1. Disconnect battery cable.
  2. Drain fuel tank see "Draining Fuel Tank" in this section.
  3. Remove fuel tank see "Fuel Tank Replacement" in this section.
  4. Cap fuel feed tube, fuel return tube on fuel sender.
  5. Connect a piece of hose to the filler tube nipple and plug opposite end.
  6. Submerge tank in water or apply soap solution to outside of tank.
  7. Apply 35 kPa (5 psi) air pressure to the vent hose on the fuel tank.

## FUEL SENDER

For diagnosis of the fuel sender and gauge, refer to SECTION 8C of the appropriate service manual. For diagnosis of the pickup tube, refer to "Fuel Supply System Checks."

## Fuel Strainer

The strainer is self cleaning and normally requires no maintenance. Fuel stoppage at this point indicates that the fuel tank contains an abnormal amount of sediment or water and should be thoroughly cleaned.

## FUEL SUPPLY SYSTEM CHECKS

If the fuel supply system is not delivering enough fuel, or air is being drawn into the fuel injection system, driveability could be greatly effected or a "Crank But Will Not Run" symptom could exist. If other diagnosis indicates, or if the fuel supply system is suspected of not delivering enough fuel or drawing air, it should be tested as follows:

### ! Important

- Air leaks or restrictions on the suction side of the fuel pump will seriously affect pump output.
- Make certain that there is sufficient fuel in the tank.
- Check for leaks at all fuel connections from the fuel tank to the injection pump.
- Tighten any loose connections.
- With the engine running, check all hoses and lines for flattening or kinks that would restrict the flow of fuel.

## Lift Pump Flow Check

1. Disconnect the electrical connector for the engine shutoff solenoid at the injection pump.
2. Disconnect the pipe at the lift pump outlet fitting.
3. Install a hose at the lift pump outlet fitting and place a 1 liter (0.946 quart) container at the hose to collect fuel.
4. Crank the engine and measure the amount of fuel:
  - If more than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, refer to "Lift Pump Pressure Check" in this section.
  - If less than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, refer to "Lift Pump Suction Line Check" in this section.

## Lift Pump Suction Line Check

1. Remove the fuel tank cap and repeat the "Lift Pump Flow Check."
  - If flow is more than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, replace the defective fuel tank cap and refer to "Lift Pump Pressure Check."
  - If flow is less than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, go to next step.
2. Separate the lift pump suction line from the fuel sender.

## 4-10 DRIVEABILITY AND EMISSIONS (DIESEL)

3. Connect the suction line to a source of clean fuel, using an additional hose.
4. Repeat the "Lift Pump Flow Check."
  - If flow is more than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, remove the fuel sender and check it for restriction.
  - If flow is less than 0.24 liter ( $\frac{1}{2}$  pint) in 15 seconds, go to Step 5.
5. Check the lift pump suction line for restriction:
  - If restriction exists, repair it and recheck lift pump flow.
  - If no restriction exists, replace the lift pump and recheck lift pump flow.
6. Attach the lift pump suction line to the fuel sender.

### Lift Pump Pressure Check

1. Install a tee adaptor between the lift pump outlet fitting and outlet pipe.
2. Connect a pressure gauge with a dial indication of 0 to 103 kPa (0 to 15 psi) to the tee adaptor.
3. Run engine and measure fuel pressure.
  - If pressure is between 40 and 60 kPa (5.8 and 8.7 psi), go to Step 4.
  - If pressure is less than 40 kPa (5.8 psi), replace the lift pump and recheck pressure.
4. Remove pressure gauge and tee adaptor.
5. Connect outlet pipe at the lift pump outlet fitting.
6. Clean any fuel spillage.
7. Run the engine to check for fuel leakage.

### Fuel System Air Leak Check

1. Install a transparent hose between the filter outlet and injection pump inlet.
2. Start and run the engine, observing the fuel for air bubbles.
  - If air bubbles are not present, stop the engine and go to Step 6.
  - If air bubbles are present, stop the engine and go to Step 3.
3. Check the lift pump suction line for air leakage:
  - Disconnect the fuel pipe from the fuel sender and plug it.
  - Disconnect the fuel pipe from the lift pump, and install a hand held vacuum pump with gauge.
  - Apply vacuum to the fuel pipe and observe the gauge reading:
    - If vacuum does not drop, connect fuel pipe and go to Step 4.
    - If vacuum drops, repair the air leak in the suction line and install the suction line pipe and hose.
4. Check the fuel sender for air leakage:
  - Remove the fuel tank.

- Remove the fuel sender from the fuel tank, remove strainer and plug the bottom end of the pickup tube.
  - Apply a vacuum to the upper end of the pickup tube, and observe the gauge reading.
    - If vacuum does not drop, install the fuel sender and fuel tank.
    - If vacuum drops, replace the fuel sender, install the fuel tank, connect the fuel pipe and go to Step 5.
5. Start and run the engine, observing the fuel for air bubbles:
    - If air bubbles are present, stop the engine and recheck Steps 3 and 4.
    - If air bubbles are not present, stop the engine and go to Step 6.
  6. Remove the transparent hose and connect the hose of the filter outlet to the injection pump inlet fitting.
  7. Disconnect the return hose at the injection pump.
  8. Install a transparent hose between the injection pump and the hose of the return line.
  9. Start and run the engine, observing the fuel for air bubbles:
    - If air bubbles are not present, go to Step 10.
    - If air bubbles are present, replace the injection pump.
  10. Stop the engine.
  11. Remove the transparent hose and attach the fuel return hose at the injection pump.
  12. Clean any fuel spillage.
  13. Run the engine to check for fuel leakage.

### LIFT PUMP ELECTRICAL CIRCUIT

For the location of the fuel pump relay, refer to SECTION 1. For diagnosis of the lift pump electrical circuit, refer to CHART A-5 in SECTION 3.

### FUEL MANAGER/FILTER

Diagnosis of the fuel filter can be found in the "Contamination Testing Procedure." For diagnosis of the "Water in Fuel" lamp circuit, refer to the "Water in Fuel Lamp Circuit Check."

Diagnosis of the fuel heater can be found in the "Fuel Heater Functional Check."

### FUEL PIPES AND HOSES

The diagnosis of fuel odor may be a condition of a leaking fuel feed, or return pipe or hose. Fuel pipes that are pinched, plugged, or mis-routed may cause restricted fuel delivery.

## FUEL INJECTION SYSTEM

Always begin diagnosis of the electronic fuel injection system with the "On-Board Diagnostic (OBD) System Check" found in SECTION 3, before proceeding to any other diagnostics. This will reduce diagnosis time and prevent unnecessary replacement of parts. The "On-Board Diagnostic (OBD) System Check" will give direction to further diagnostics, such as "Engine Cranks But Will Not Run" or a diagnostic trouble code chart. Diagnosis of electronic fuel injection pump, including the fuel injection solenoid, fuel solenoid driver, injection timing stepper motor and engine shutoff solenoid also starts with the "On-Board Diagnostic (OBD) System Check."

If a driveability symptom exists, refer to the particular symptom in the "Driveability Symptoms," SECTION 2.

### Injection Lines

Damage to the injection lines including kinking that causes restrictions or leakage could effect driveability or cause a diagnostic trouble code to set.

### Injection Nozzles

If an injection nozzle is not properly delivering fuel into the pre-combustion chamber of a cylinder, driveability could be greatly effected, or a diagnostic trouble code could be set. If other diagnosis indicates, or if the injection nozzles are suspected of not properly delivering fuel, they should be tested.

Nozzle testing is comprised of the following checks:

- Nozzle opening pressure.
- Leakage.
- Chatter.

### Important

- Each test should be considered independent of the others (for example, when checking opening pressure, do not check for leakage).
- If all of the following tests are satisfied, the nozzle assembly can be reused. If any one of the tests is not satisfied, the complete nozzle assembly must be replaced.
- When performing the injection nozzle tests, refer to the instructions provided with the nozzle tester J 29075-B.

### Preparation for Injection Nozzle Test

- Position a nozzle tester on a workbench.
- Install one nozzle on the tester fitting.
- Place a container under the nozzle that will deflect the nozzle spray absorb the test fluid.

- Install two clear plastic hoses (1½ in. long) over the leak-off fittings.
- Close the shutoff valve at the pressure gauge.
- Operate the lever of the nozzle tester repeatedly and briskly to fill and flush the nozzle with test oil.

**CAUTION:** When testing nozzles, do not place your hands or arms near the tip of the nozzle. The high pressure atomized fuel spray from a nozzle has sufficient penetrating power to puncture flesh and destroy tissue and may result in blood poisoning. The nozzle tip should always be enclosed in a receptacle, preferably transparent, to contain the spray.

### Nozzle Opening Pressure Test

**CAUTION:** When testing nozzles, do not place your hands or arms near the tip of the nozzle. The high pressure atomized fuel spray from a nozzle has sufficient penetrating power to puncture flesh and destroy tissue and may result in blood poisoning. The nozzle tip should always be enclosed in a receptacle, preferably transparent, to contain the spray.

1. Open the shutoff valve at the pressure gage one-quarter turn.
2. Depress the tester lever slowly. Note at what pressure the needle of the pressure gage stopped. The maximum observed pressure is the opening pressure.
  - Some nozzles may pop while other nozzles may drip down (this is not leakage).
3. The opening pressure should not fall below the lower limit of 105 bar (1500 psi) for naturally aspirated engines and 117 bar (1700 psi) for turbo-charged engines for used nozzles.
4. Replace nozzles which fall below the lower limit.

### Nozzle Leakage Test

**CAUTION:** When testing nozzles, do not place your hands or arms near the tip of the nozzle. The high pressure atomized fuel spray from a nozzle has sufficient penetrating power to puncture flesh and destroy tissue and may result in blood poisoning. The nozzle tip should always be enclosed in a receptacle, preferably transparent, to contain the spray.

1. Further open the shutoff valve at the pressure gage (½ to 1½ turns).
2. Blow dry the nozzle tip.

## 4-12 DRIVEABILITY AND EMISSIONS (DIESEL)

3. Depress the lever of the manual test stand slowly until the gage reads a pressure of 95 bar (1400 psi). Observe the nozzle tip. A drop may form on the end of the nozzle but should not drop off within a period of 10 seconds.
4. Replace the nozzle assembly if a drop falls during the 10 seconds.

### Chatter Test

**CAUTION:** When testing nozzles, do not place your hands or arms near the tip of the nozzle. The high pressure atomized fuel spray from a nozzle has sufficient penetrating power to puncture flesh and destroy tissue and may result in blood poisoning. The nozzle tip should always be enclosed in a receptacle, preferably transparent, to contain the spray.

### Important

- When testing for chatter, it should be noted that the sound (chatter) for new and used nozzles may vary. This is due to carbonized fuel deposits on the pintle and nozzle tip of used nozzles. With some used nozzles, chatter is difficult to detect during slow actuation of the hand lever.
  - Some nozzles may chatter louder than others. As long as there is chatter, the nozzle is acceptable.
1. Close the shutoff lever at the pressure gage.
  2. Depress the lever of the test stand slowly and note whether chatter noise can be heard.
  3. If no chatter is heard, move the lever faster until it chatters. At fast lever movement, the nozzle may

make a "hissing" or "squealing" sound rather than then normal chatter. This is acceptable.

4. These sounds indicate that the nozzle needle moves freely and that the nozzle seat, guide, and pintle are OK.
5. Replace nozzles that do not chatter.

## FUEL RETURN SYSTEM DIAGNOSIS

Any restriction in the fuel return system could greatly effect driveability. If other diagnosis indicates or the fuel return system is suspected of being restricted, it should be tested.

### Fuel Return System Restriction Check

1. Disconnect the hose of the fuel return line at the fuel sender.
2. Disconnect the hose of the fuel return line at the injection pump, and connect a vacuum pump with gauge to the hose.
3. Apply vacuum to the return line and observe the gage reading.
  - If vacuum does not build and hold, go to Step 4.
  - If vacuum builds and holds, repair the return line restriction.
4. Connect the fuel return line at the injection pump and fuel sender.
5. Clean any fuel spillage.
6. Run the engine to check for fuel leakage.

## ACCELERATOR PEDAL POSITION MODULE

Diagnosis of the accelerator pedal position module can be found in SECTION 3.

## ON-VEHICLE SERVICE

### Important

- Before attempting any "On-Vehicle Service" place a dry chemical (Class B) fire extinguisher near work area.

### DRAINING WATER FROM FUEL MANAGER/ FILTER

#### Figure 4-8

**CAUTION:** The water/diesel fuel mixture is flammable, and could be hot. To help avoid personal injury and/or property damage, do not touch the fuel coming from the drain hose, and do not expose the fuel to open flames or sparks. Be sure you do not overfill the container. Heat (such as from the engine ) can cause

the fuel to expand. If the container is too full, fuel could be forced out of the container. This could lead to a fire and the risk of personal injury and/or vehicle damage.

1. Turn "OFF" the engine and apply the parking brake.
2. Place a suitable container under the filter drain hose.
3. Open the drain valve.
4. Start the engine and allow it to idle for one to two minutes or until clear fuel is observed.
5. Close the drain valve and stop the engine.
6. Dispose of the drained mixture in a proper manner.

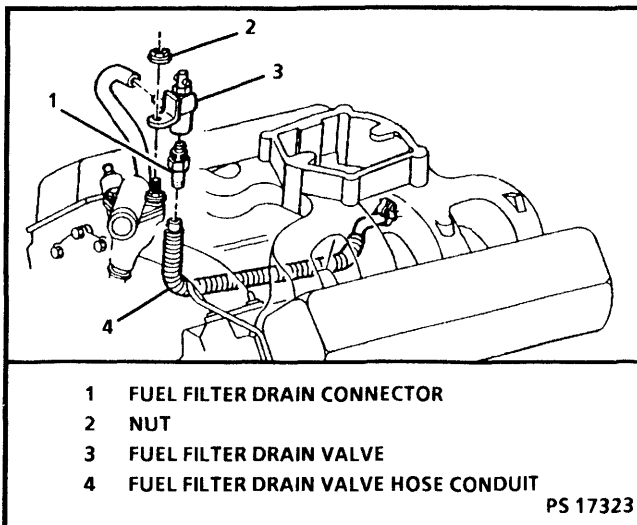


Figure 4-8 - Fuel Filter Drain Valve

**! Important**

- If the "Water in Fuel" lamp remains "ON" after the fuel manager/filter is purged of water, remove the water sensor. (Refer to "Water in Fuel Sensor Replacement.") Wipe the tip of the water sensor clean. Reinstall the water sensor. If the "Water in Fuel" lamp remains "ON," replace the water in fuel sensor.

**FUEL FILTER ELEMENT REPLACEMENT**  
**Figure 4-9**

**↔ Remove or Disconnect**

1. Open air bleed valve on top of the fuel manager/filter to release any pressure in the fuel supply system.
2. Element nut turning it by hand in a counterclockwise direction. If unable to turn by hand, a strap wrench (oil filter type) may be used to "break loose" the element nut.
3. Element by lifting it straight up and out of the header assembly. It is not necessary to drain fuel from the header assembly to change the filter element since the fuel will remain in the header assembly's cavity.

**! Important**

- Make sure the mating surface between the element assembly and the header assembly is clean before installation.

**→ Install or Connect**

1. New element assembly by aligning the widest key slot located under the element assembly cap with the widest key in the header assembly.
  - Push the element in a downwards direction until the mating surfaces make contact.
2. Element nut.

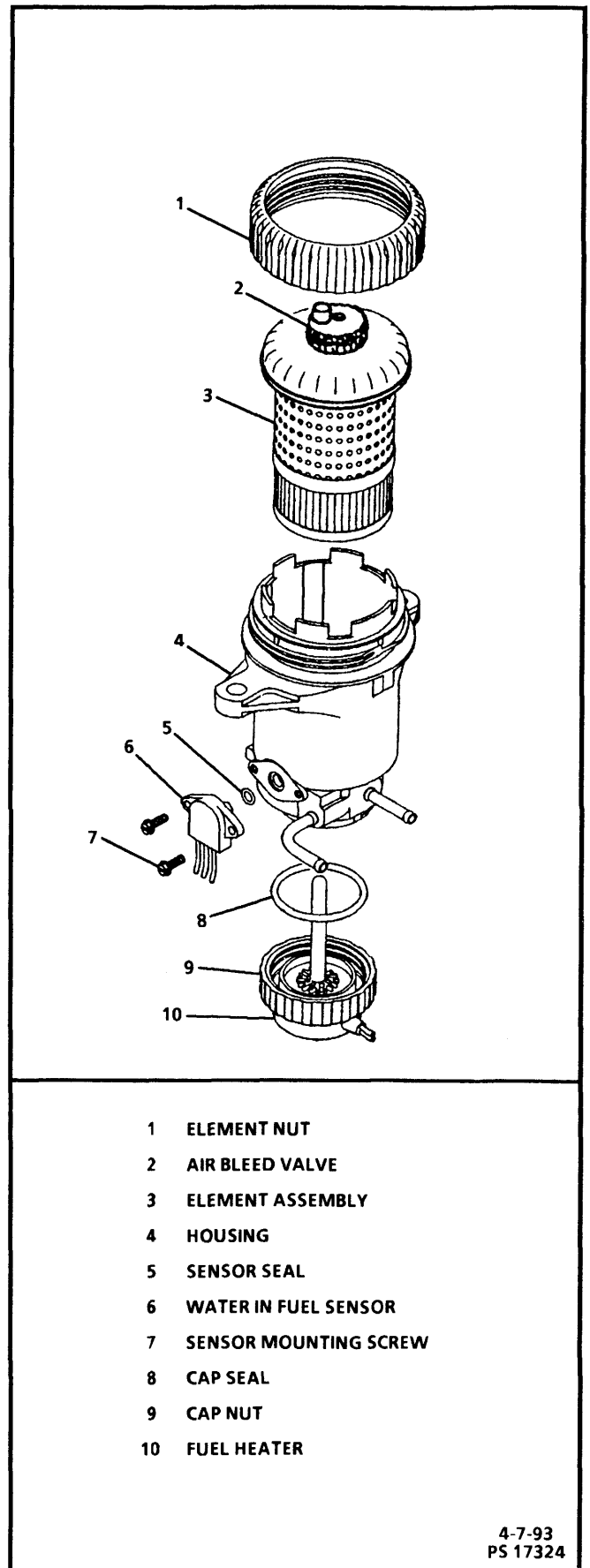


Figure 4-9 - Fuel Manager/Filter



## Tighten

- Element nut securely by hand.
3. Bleed air from fuel manager/filter.

## Bleeding Air from Fuel Supply System

1. Open the air bleed valve on top of the fuel manager/filter.
2. Connect a hose to the air bleed valve located on top of the fuel manager/filter and place the other end of the hose into a suitable container.

**CAUTION:** The water/diesel fuel mixture is flammable, and could be hot. To help avoid personal injury and/or property damage, do not touch the fuel coming from the drain hose, and do not expose the fuel to open flames or sparks.

Be sure you do not overfill the container. Heat (such as from the engine) can cause the fuel to expand. If the container is too full, fuel could be forced out of the container. This could lead to a fire and the risk of personal injury and/or vehicle damage.

3. Disconnect the engine shutoff solenoid.
4. Crank the engine in 10 to 15 second intervals until clear fuel is observed at the air bleed hose (wait for one minute between cranking intervals).
5. Close the air bleed valve.
6. Connect engine shutoff solenoid.
7. Start the engine and allow to run for five minutes at idle.
8. Check for fuel leaks.
9. Clear engine DTC(s).

## FUEL MANAGER/FILTER REPLACEMENT Figure 4-9

### Remove or Disconnect

1. Open air bleed valve on top of the fuel manager/filter to release any pressure in the fuel supply system.
2. Mounting bolts which attach the fuel manager/filter to the intake manifold.
3. Wiring harnesses and fuel hoses.
4. Fuel manager/filter.

### Install or Connect

1. Fuel hoses and wiring harnesses.
  - Position fuel manager/filter to intake manifold.
2. Fuel manager/filter to intake manifold bolts.

## Tighten

- Bolts to 25 N·m (18 lb. ft.).
3. Bleed air from fuel manager/filter (refer to "Bleeding Air from Fuel Supply System").

## WATER IN FUEL SENSOR REPLACEMENT Figure 4-9

### Remove or Disconnect

1. Open air bleed valve on top of the fuel manager/filter to release any pressure in the fuel supply system.
2. Mounting bolts that connect the fuel manager/filter to the intake manifold and move the fuel manager/filter to a position that enables access to the sensor mounting screws.
3. Sensor wiring harness.
4. Sensor mounting screws.

### Install or Connect

1. New water sensor and a new water sensor seal.

## Tighten

- Screws to 2 N·m (13 lb. in.).
2. Fuel manager/filter to intake manifold with mounting bolts.

## Tighten

- Bolts to 25 N·m (18 lb. ft.).
3. Bleed air from fuel manager/filter (refer to "Bleeding Air from Fuel Supply System").

## FUEL HEATER REPLACEMENT Figure 4-9

### Remove or Disconnect

1. Open air bleed valve on top of the fuel manager/filter to release any pressure in the fuel supply system.
2. Fuel manager/filter (refer to "Fuel Manager/Filter Replacement").
3. Fuel heater threaded nut, using hand pressure or a strap wrench.
4. Fuel heater from the filter housing.

## Clean

- Fuel heater to housing sealing surfaces.

### Install or Connect

1. Cap seal into filter housing.
2. Fuel heater.
3. Cap nut.

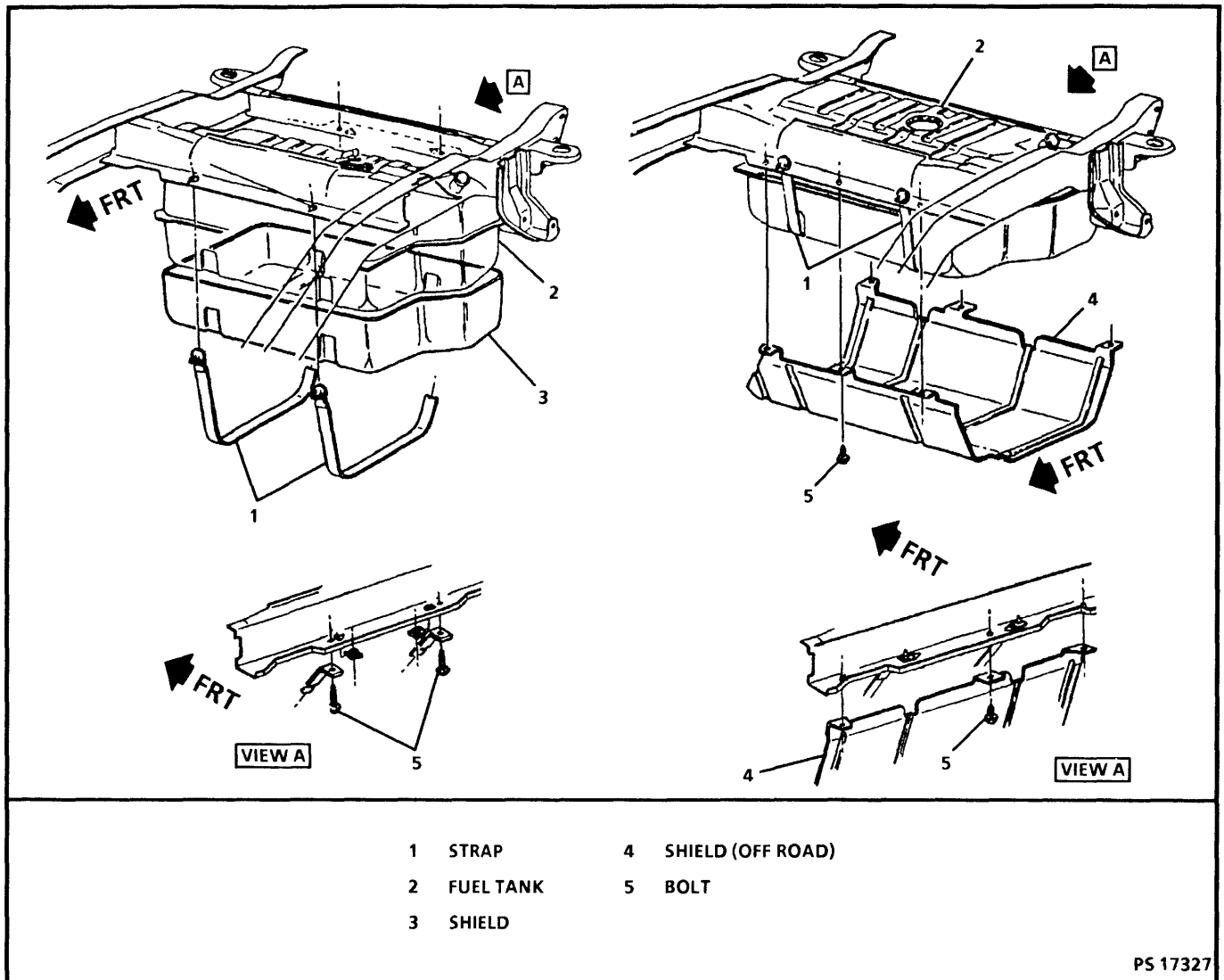


Figure 4-10 - Fuel Tank (Suburban)



### Tighten

- Cap nut securely by hand.
- 4. Fuel manager/filter (refer to "Fuel Manager Replacement").
- 5. Bleed air from fuel manager/filter (refer to "Bleeding Air from Fuel Supply System").

### DRAINING FUEL TANK

To drain the fuel tank is to remove as much fuel as possible before servicing the fuel tank.

1. Disconnect the negative battery cable.
  - Have a dry chemical (Class B) fire extinguisher nearby.

**CAUTION:** Never drain or store fuel in an open container, due to the possibility of fire or explosion.

2. Use a hand operated pump device to drain as much fuel as possible through the filler neck. Remove fuel and reinstall filler cap.

### FUEL TANK REPLACEMENT Figures 4-10 through 4-13



### Remove or Disconnect

1. Drain fuel tank (refer to "Draining Fuel Tank").
2. Raise vehicle.
3. Off road shield (if equipped).



### Clean

- Clean all fuel pipe and hose connections and surrounding areas before disconnecting to avoid possible contamination of the fuel system.
- 4. Vent hose at fuel tank.
- 5. Filler tube connection at fuel tank.

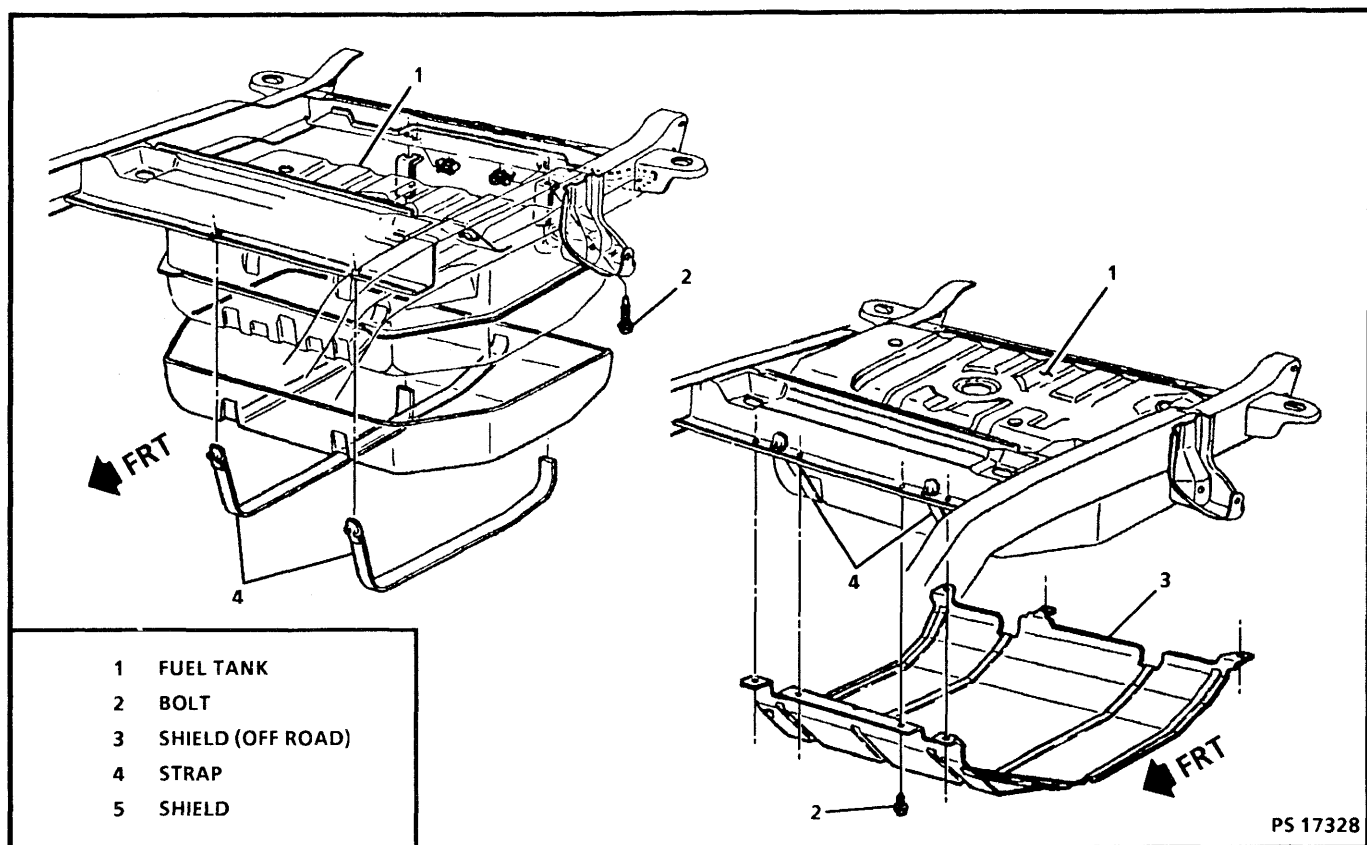


Figure 4-11 - Fuel Tank (Utility)

6. With aid of an assistant, support tank, and remove fuel tank strap attaching bolts and retaining fuel tank straps and shield.

**NOTICE:** Do not bend fuel tank straps, as this may damage straps.

- Lower tank enough to disconnect fuel sender electrical connector and remove the retaining clips.
- Hoses from fuel sender.
- Fuel tank from vehicle and place in a suitable work area.

## Disassemble

- If fuel tank is not being replaced proceed to "Install or Connect."
- Fuel sender (refer to "Fuel Sender Replacement").

## Assemble

- Install fuel sender assembly with new O-rings on pipes (refer to "Fuel Sender Replacement").

## Install or Connect

1. Position and support fuel tank. Position fuel tank straps with insulators and connect:
  - Fuel feed and return hoses to fuel sender fittings.

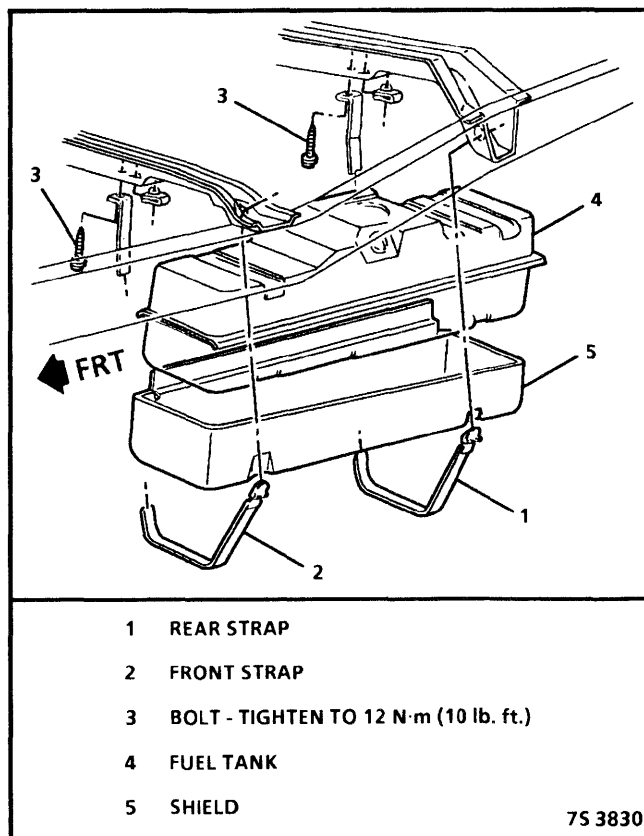


Figure 4-12 - Fuel Tank (Pick-Up)

### Tighten

- Fuel feed and return hoses to sender pipe fittings to 22 N·m (16 lb. ft.).
- Fuel sender electrical connector and install retaining clips.
- Fuel filler vent hose to vent pipe.
- Fuel filler neck connecting tube to fuel tank.
- Shield (if equipped).

### Tighten

- Fuel tank strap bolts or nuts to 13 N·m (115 lb. in.).
2. Negative battery cable.
  3. Bleed air from system. (Refer to "Bleeding Air from Fuel Supply System.")
  4. Start engine and check for leaks.

## FUEL SYSTEM CLEANING

**CAUTION:** Never drain or store fuel in an open container due to the possibility of fire or explosion.

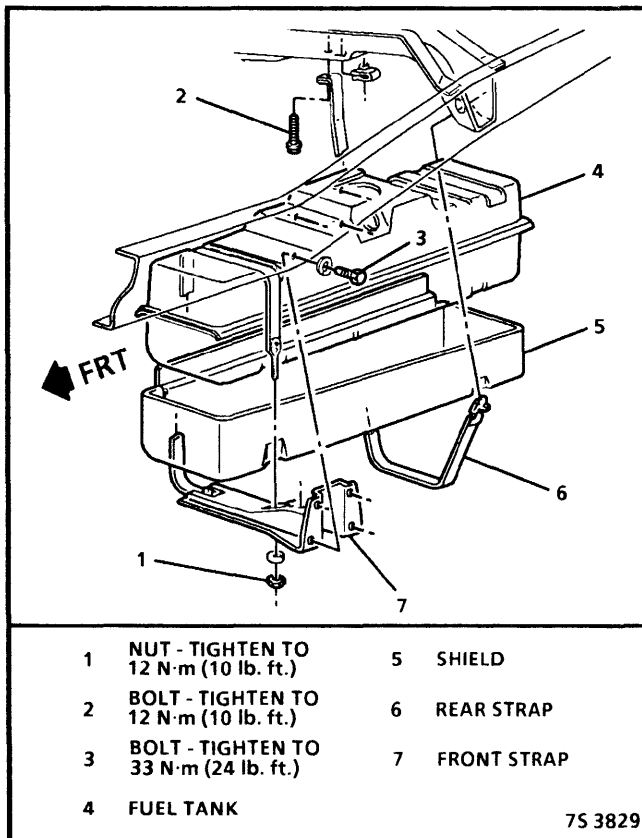


Figure 4-13 - Fuel Tank (Option, Pick-Up)

## Water in the Fuel System

### Remove or Disconnect

1. Negative battery cable.
2. Fuel from the tank. (Refer to "Draining the Fuel Tank.")
3. Fuel tank. (Refer to "Fuel Tank Replacement.")
4. Fuel sender. (Refer to "Fuel Sender Replacement.")

### Clean

- Fuel tank.
    - The tank should be replaced if it is rusted internally.
  - Fuel strainer or replace if necessary. (Refer to "Fuel Strainer Replacement.")
5. Fuel feed hose at the fuel lift pump.
  6. Fuel return line at the injection pump.
    - Use low air pressure to blow out the lines toward the rear of the vehicle.
    - Replace the pipes if they are rusted internally.
  7. Engine shutoff solenoid connector.
  8. Fuel filter. (Refer to "Fuel Filter Element Replacement.")

### Install or Connect

1. Fuel sender. (Refer to "Fuel Sender Replacement.")
2. Fuel tank. (Refer to "Fuel Tank Replacement.")
3. Fuel feed pipes at fuel lift pump.
4. Clean diesel fuel into the tank until it is  $\frac{1}{4}$  full.
5. Fuel tank cap.
6. Negative battery cable.
  - Crank the engine for 15 seconds with one minute cooling periods until clean fuel is pumped out.
  - Use a suitable container to catch the fuel.
7. New fuel filter. (Refer to "Fuel Filter Element Replacement.")
8. A hose from the return line at the fuel injection pump to a closed metal container with a capacity of at least 8 liters (2 gallons).
  - Crank the engine for 15 seconds with one minute cooling periods until clean fuel appears at the return line.
9. Engine shutoff solenoid connector.
  - Crack open each injection line at the nozzle. Use two wrenches to prevent nozzle damage.
  - Crank the engine for 15 seconds with one minute cooling periods until clean fuel appears from each nozzle.

### Tighten

- Injection line to nozzle fitting to 25 N·m (18 lb. ft.).
    - Use two wrenches to prevent nozzle damage.
  - Start the engine and allow it to idle for 15 minutes.
    - Make sure the fuel return line is in the metal container and that the container does not overflow.
  - Remove the hose from the metal container.
10. Fuel return line to the injection pump.
    - Check for leaks.
  11. Clear engine DTC(s).

## Gasoline in the Fuel System

### Engine Will Run or Start

1. Drain the fuel tank. (Refer to "Draining Fuel Tank.")
2. Fill the tank with diesel fuel.
3. Run the engine for 15 minutes.

### Engine Will Not Run

1. Drain the fuel tank. (Refer to "Draining Fuel Tank.")
2. Fill the tank with diesel fuel.
3. Disconnect engine shutoff solenoid connector.
4. Remove the fuel hose between the fuel manager/filter and the injection pump.
5. Connect a hose to the fuel manager/filter outlet and run it to a closed metal container.
6. Crank the engine for 15 seconds with one minute cooling periods to purge gasoline from the system.
7. Install the fuel hose between the fuel filter and the injection pump.
8. Connect the engine shutoff solenoid connector.
9. Start the engine and check for leaks.
10. Run the engine for 15 minutes.
11. Clear engine DTC(s).

## FUEL SENDER REPLACEMENT

Figure 4-14

### Remove or Disconnect

1. Negative battery cable.
2. Drain fuel tank (refer to "Draining Fuel Tank").
3. Fuel tank (refer to "Fuel Tank Replacement").

### Clean

- Clean all fuel pipe and hose connections and surrounding areas before disconnecting to avoid possible contamination of the fuel system.

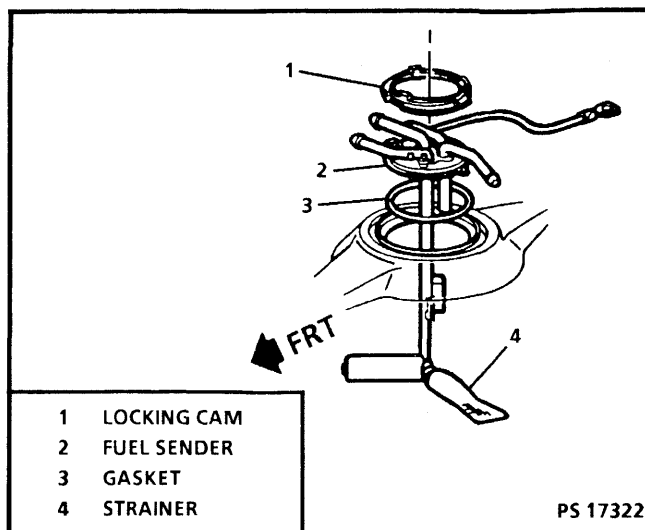


Figure 4-14 - Fuel Sender

### Disassemble

- Using J 35731 remove fuel sender retaining cam, fuel sender assembly and O-ring from fuel tank. Discard fuel sender assembly, assembly O-ring, and fuel feed and return tube O-rings.

### Clean and Inspect

- Fuel sender O-ring sealing surfaces.
- Inspect fuel tank for contamination and clean tank if necessary.

### Important

- Always replace fuel sender O-ring when reinstalling fuel sender.
- Always replace fuel feed and return pipe O-ring seals whenever a fuel pipe has been disconnected.

### Assemble

1. Position new fuel sender O-ring on fuel tank.

### Important

- Care should be taken not to fold over or twist the fuel strainer when installing the fuel sender as this will restrict fuel flow. Also, assure that the fuel strainer does not block full travel of float arm.

2. Fuel sender and fuel sender retainer cam using J 35731.
3. Position new O-rings on fuel sender fuel feed and return pipes.

### Install or Connect

1. Fuel tank (see "Fuel Tank Replacement").
2. Add fuel to tank.
3. Negative battery cable.
4. Bleed air from system.
5. Start engine and check for leaks.

## Fuel Strainer Replacement Figure 4-14

### Remove or Disconnect

1. Negative battery cable.
2. Drain fuel tank (see "Draining Fuel Tank").
3. Fuel tank (see "Fuel Tank Replacement").
4. Fuel sender (see "Fuel Sender Replacement").

### Disassemble

- Support sender with one hand and grasp strainer with other hand.
  - Rotate strainer in one direction and pull off of pickup tube. Discard strainer after inspection.

### Inspect

- Fuel strainer. If strainer is contaminated, the fuel tank should be cleaned and the fuel filter must be replaced.

### Assemble

- Position new strainer on pickup tube and push on outer edge of ferrule until fully seated.

### Install or Connect

1. Fuel sender (refer to "Fuel Sender Replacement").
2. Fuel tank (refer to "Fuel Tank Replacement").
3. Add fuel and install fuel filler cap.
4. Bleed air from system.
5. Negative battery cable.
6. Start engine and check for leaks.

## FUEL LIFT PUMP REPLACEMENT Figure 4-15

### Remove or Disconnect

1. Negative battery cable.
2. Harness connector.

### Clean

- Clean both fuel pipe connections and surrounding areas at fuel lift pump before disconnecting to avoid possible contamination of the fuel system.
3. Both fuel pipes from lift pump.
  4. Slide lift pump out of bracket.

### Install or Connect

1. New fuel pipe O-rings.
2. Position new pump in pump bracket.
3. Fuel feed pipe and suction pipe to the lift pump.

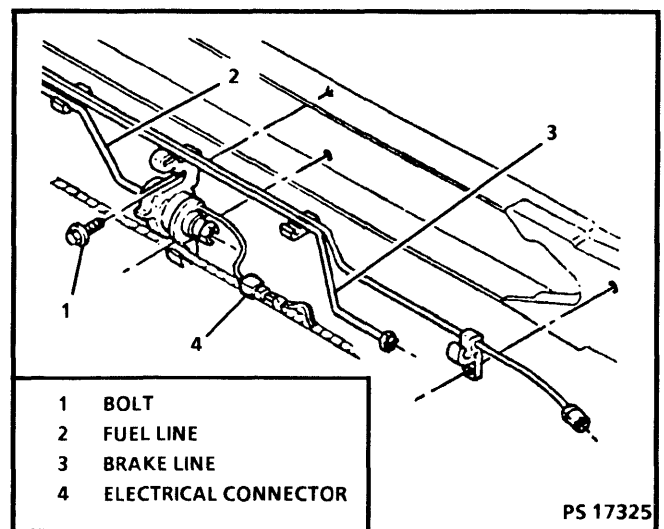


Figure 4-15 - Fuel Lift Pump

### Tighten

- Use backup wrench to prevent pump from turning.
  - Fittings to 30 N·m (22 lb. ft.).
4. Harness connector.
  5. Bleed air from system.
  6. Start engine and check for leaks.

## FUEL PUMP RELAY Figure 4-16

### Remove or Disconnect

1. Protective cover.
2. Retainer, if installed.
3. Electrical connector.
4. Relay by depressing bracket clip at rear of relay, or removing bolts from retaining bracket.

### Install or Connect

1. Relay.
2. Electrical connector.
3. Retainer.
4. Protective cover.

## OIL PRESSURE SWITCH Figure 4-17

### Remove or Disconnect

1. Electrical connector.
2. Oil pressure switch using wrench J 35748.

### Install or Connect

1. Oil pressure switch.
2. Electrical connector.

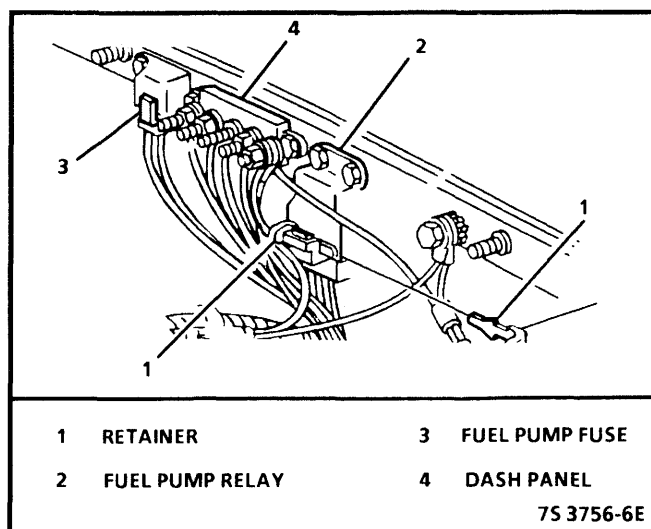


Figure 4-16 - Fuel Pump Relay

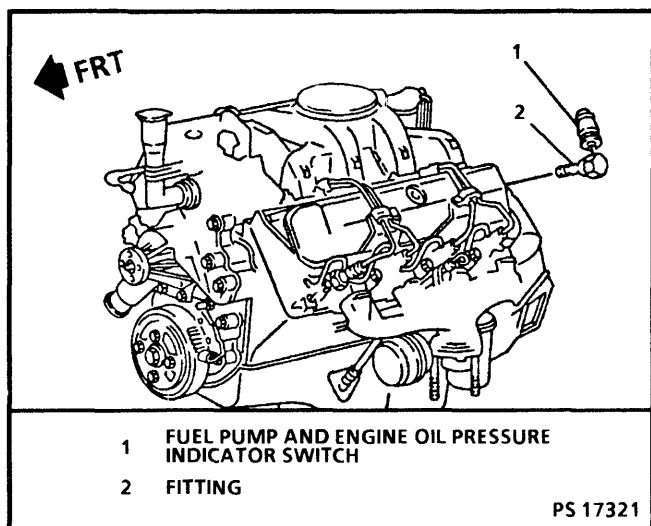


Figure 4-17 - Oil Pressure Switch

## ENGINE AND CHASSIS PIPES AND HOSES

### Materials

**Fuel Lines** - These are welded steel tubes, meeting GM Specifications 124-M, or its equivalent. Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibration.

**Coupled hose** - These are not to be repaired and are replaced only as an assembly.

**Uncoupled Hose** - Use only reinforced fuel resistant hose, made of "Fluoroelastomer" material. Do not use a hose within 4" (100 mm) of any part of the exhaust system, or within 10" (254 mm) of the catalytic converter. The hose's inside diameter must match the outside diameter of the steel tubing.

**Clamps** - These are stainless steel, screw bank-type clamps, #2494772, or equivalent.

### Fuel Pipe Repair

1. Cut a piece of fuel hose 4" (100 mm) longer than the section of pipe to be removed. If more than 6" (152 mm) is to be removed, use a combination of steel pipe and hose. The hose length should not be more than 10" total.
2. Cut a section of the pipe to be replaced with a tube cutter. Use the first step of a double flaring tool to form a bead on the ends of the pipe and, also, on the new section of pipe, if used.
3. Slide the hose clamps onto the pipe and push the hose 2" (51 mm) onto each portion of the fuel pipe. Tighten a clamp on each side of the repair.
4. Secure fuel line to the frame.

## FUEL INJECTION COMPONENTS

### Intake Manifold

Removing the fuel injection pump and injection lines requires removing the intake manifold.



#### Clean

- Top of engine to prevent dirt and other contaminants from entering open lines and passages.
- All line fittings that will be loosened or removed



#### Remove or Disconnect

1. Negative battery cable.
2. Air cleaner (non-turbo). Noise cover and air inlet (turbo).
3. Fuel manager/filter (refer to "Fuel Manager/Filter Replacement").
4. Generator rear bracket.
5. EGR/boost solenoids with bracket from the intake manifold studs (if equipped).
6. CDR hose at the manifold.
7. EGR and crankcase ventilation hoses (if equipped).
8. Fuel line bracket and ground strap.
9. Intake manifold bolts and fuel line clips.
10. Intake manifold and gasket.



#### Important

- Before any further service work is to be done, cover the intake ports with J 29664-1.



#### Clean

- Gasket surfaces on intake manifold and cylinder heads.

## Install or Connect

### Figures 4-18 or 4-19

1. New gaskets.

## Important

- Be sure to use the correct gasket. The gaskets for light duty emissions models have openings for the EGR ports. The gaskets for heavy duty emissions models do not.
2. Intake manifold.
  3. Intake manifold bolts and fuel line clips.

## Tighten

- Intake manifold bolts to 42 N·m (32 lb. ft.). Use the tightening sequence shown in Figures 4-17 and 4-18.
4. Fuel line bracket and ground strap.
  5. EGR and crankcase ventilation hoses (if equipped).
  6. CDR hose (if equipped).
  7. EGR/boost solenoids with bracket (if equipped).
  8. Generator rear bracket.
  9. Fuel manager/filter (refer to "Fuel Manager/Filter Replacement").
  10. Air cleaner (non-turbo). Air inlet and noise cover (turbo).
  11. Negative battery cables.

## INJECTION LINE REPLACEMENT

### Figure 4-20

## Clean

- All line fittings that will be loosened or removed.

## Remove or Disconnect

1. Negative battery cables.
2. Intake manifold (refer to "Intake Manifold").

## Important

- Before any further service work is to be done, cover the intake ports with J 29664-1.
3. Injection line clips at the loom brackets.
  4. Injection lines at the nozzles.
    - Cap the lines and nozzles immediately.
    - Do not bend injection lines.
  5. Injection lines at the pump.
    - Cap the lines and the pump fittings immediately.
    - Tag the lines for installation.

## Install or Connect

### Figure 4-20

1. Injection lines at the pump.
  - Uncap the lines and pump fittings.
  - Refer to the tags for correct installation.
2. Injection lines at the nozzles.
  - Uncap the lines and nozzles.

## Tighten

- Fittings to 25 N·m (20 lb. ft.).
3. Injection line clips at the loom brackets.
    - Remove J 29664-1.
  4. Intake manifold. (Refer to "Intake Manifold.")
  5. Negative battery cables.

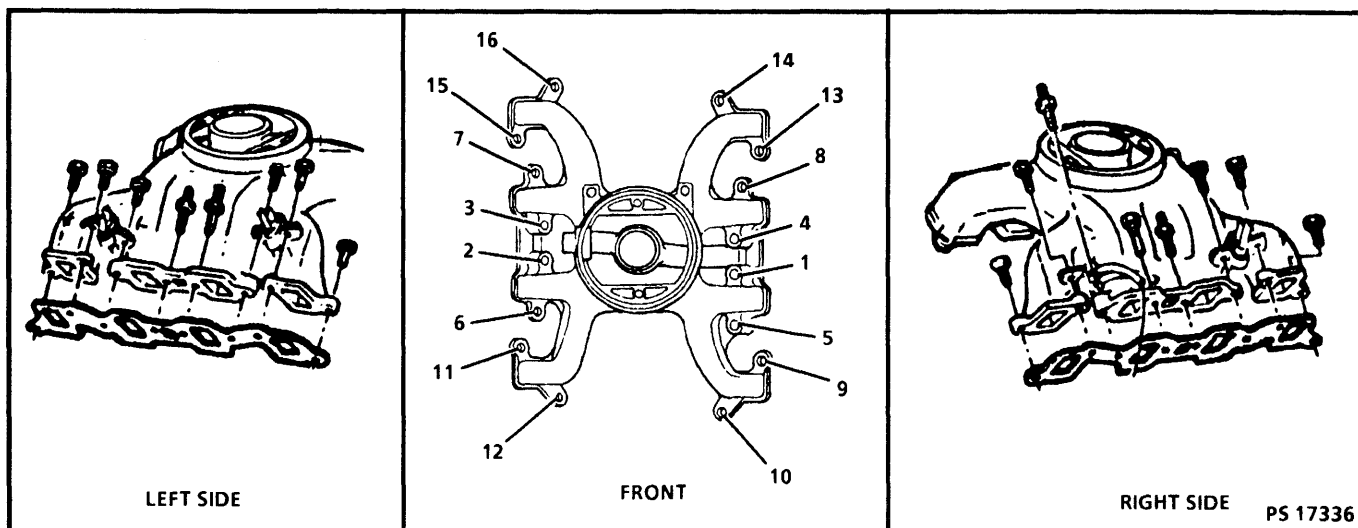


Figure 4-18 - Intake Manifold (Non-Turbocharged)



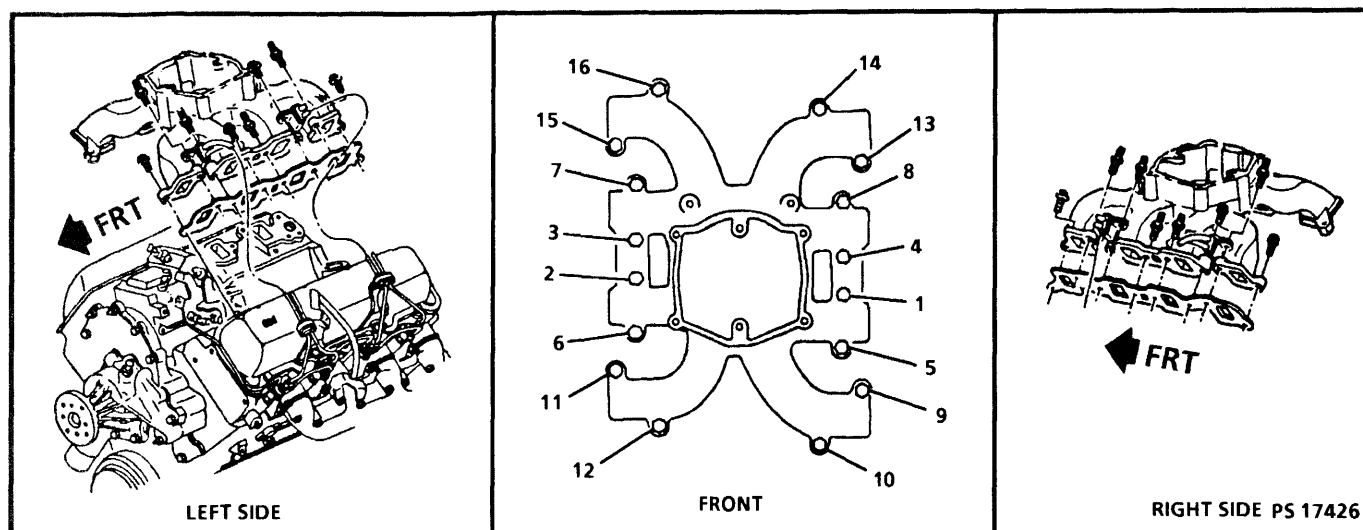


Figure 4-19 - Intake Manifold (Turbocharged)

## INJECTION PUMP REPLACEMENT

### Remove or Disconnect

1. Negative battery cable.
2. Intake manifold. (Refer to "Intake Manifold.")
3. Injection lines. (Refer to "Injection Line Replacement.")
4. Fuel inlet line from the injection pump.
5. All necessary harness connectors and hoses from the injection pump.
6. Fuel return line at the top of the injection pump.
7. Oil fill tube.
8. Grommet for oil filler tube.

**NOTICE:** Never engage the starter motor to rotate the engine when the injection pump is removed as severe engine damage will occur. With the injection pump removed the pump driven gear could jam in the front housing by engaging the starter motor, resulting in a sheared crankshaft or camshaft gear key and possible valvetrain damage. Always bar the engine over by hand to avoid internal damage.

- Scribe or paint a mark on the front cover and the injection pump flange.
  - Rotate the engine to gain access to the bolts that hold the driven gear to the injection pump.
    - Access is gained through the oil filler neck hole (Figure 4-21).
9. Bolts (Figure 4-20).
  10. Flange nuts.
  11. Pump.
    - Cap all open lines and nozzles.
  12. Gasket.

### Install or Connect

1. New gasket.

**NOTICE:** Be sure the locating pin on the pump hub goes into the slotted hole in the driven gear and not the hole in the gear.

2. Injection pump to the front cover.
  - Align the locating pin on the pump hub with the slot in the injection pump driven gear (Figure 4-22).
3. Flange nuts.

### Tighten

- Nuts to 40 N·m (30 lb. ft.).
4. Drive gear to injection pump bolts (Figure 4-21).

### Tighten

- Bolts to 25 N·m (20 lb. ft.).
5. Grommet for oil filler tube.
  6. Oil filler tube.
  7. Fuel feed line at the injection pump.

### Tighten

- Fitting to 25 N·m (20 lb. ft.).
8. Fuel return line to the top of the injection pump.
  9. All necessary harness connectors.
  10. Injection lines. (Refer to "Injection Line Replacement").
  11. Intake manifold. (Refer to "Intake Manifold Replacement").
  12. Negative battery cables.
  13. Adjust injection timing. (Refer to "Injection Timing.")

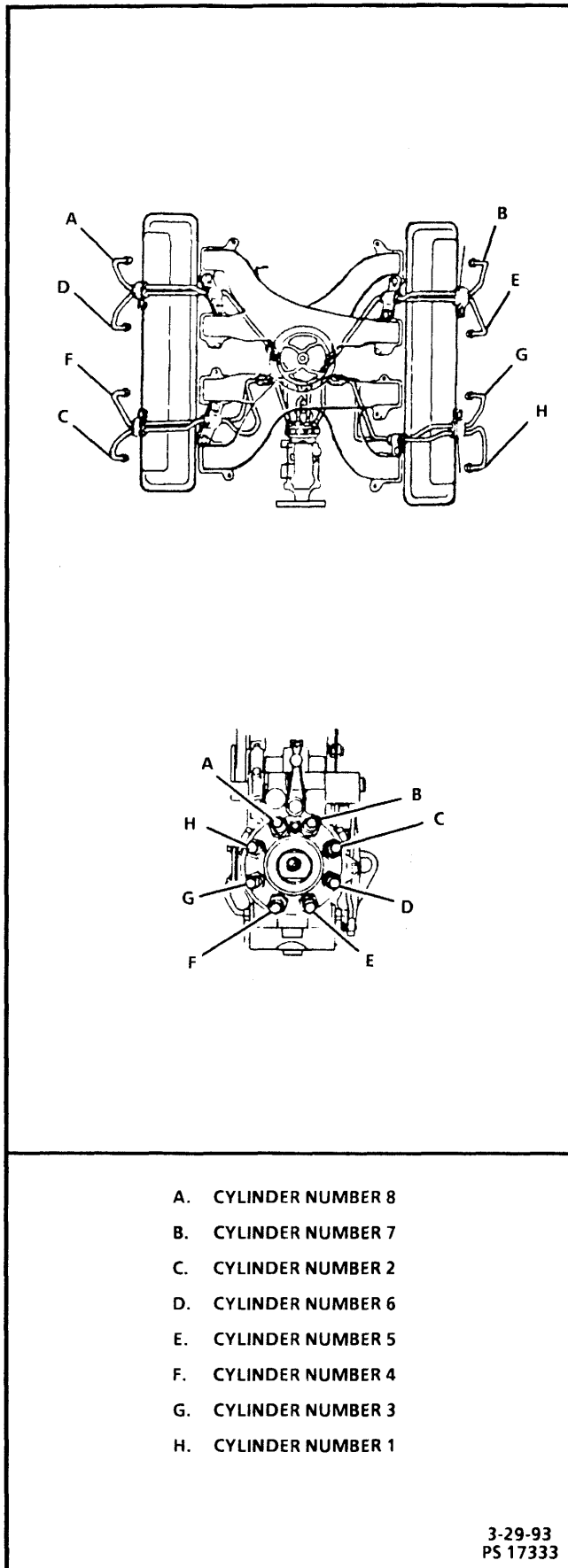


Figure 4-20 - Injection Line Routing

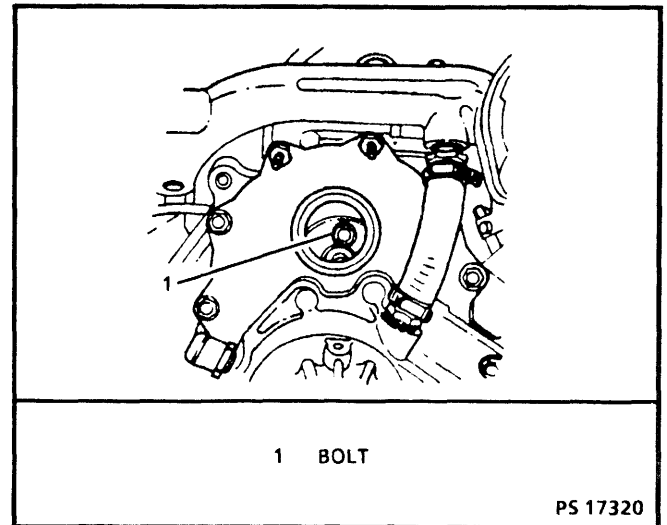


Figure 4-21 - Pump Drive Gear Bolts

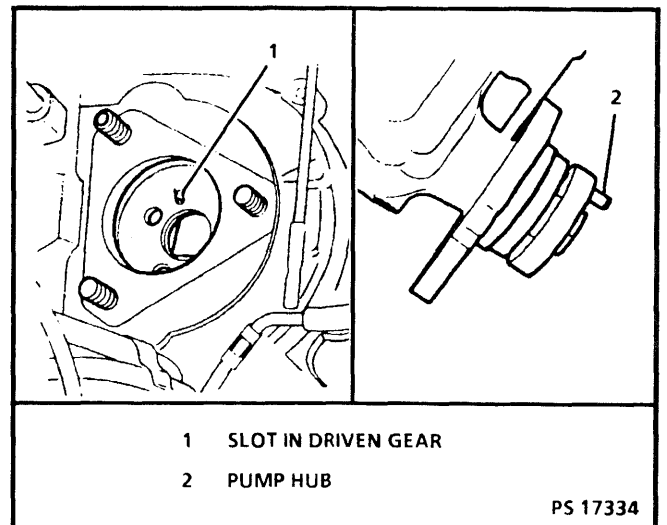


Figure 4-22 - Injection Pump Locating Pin

## Injection Timing

Original factory timing is marked with a static timing mark, which is a circle scribed across both the pump flange and front housing. For the engine to be properly timed, a Tech 1 scan tool must be used. The engine must be "OFF" while the timing is being set.



### Adjust

1. Injection timing.
  - Loosen the three pump retaining nuts.
  - Engine at operating temperature.
  - Connect Tech 1 scan tool.
  - Enter "MISC TEST" and select "INJ PUMP."
  - Enter "TDC TIME SET."
  - Using "MEASURED INJ TIM" set pump to specification with J 29872.

## Tighten

- Pump retaining nuts to 40 N·m (30 lb. ft.).

## Timing Specifications

These are timing specifications which are to be only used with the Tech 1 scan tool.

Timing should be set at RPM listed below. Vehicle should also be at operating temperature.

| ENGINE       | C    | K    | G    | P-MOTORHOME | RPM  |
|--------------|------|------|------|-------------|------|
| 6.5L         | 3.5° | 3.5° | 3.5° | -           | IDLE |
| 6.5L (TURBO) | 3.5° | 3.5° | -    | 3.5°        | IDLE |

### NOTICE:

- All specs are before top dead center unless otherwise stated.
- If timing is not properly set, a DTC 88 will set.

## INJECTION NOZZLE REPLACEMENT

**NOTICE:** When removing an injection nozzle, use J 29873. Remove the nozzle using the 30 mm hex portion (Figure 16). Failure to do so will result in damage to the injection nozzle.

## Remove or Disconnect

### Figures 4-23 and 4-24

1. Negative battery cable(s).
2. Fuel line clip.
3. Fuel return hose.
4. Fuel injection line.
  - Cap the nozzle and lines.
5. Injection nozzle using J 29873.

## Install or Connect

### Figures 4-23 and 4-24

**NOTICE:** When installing an injection nozzle, use J 29873. Install the nozzle using the 30 mm hex portion. Failure to do so will result in damage to the injection nozzle.

1. Injection nozzle using J 29873.

## Tighten

- Nozzle to 70 N·m (50 lb. ft.).
2. Fuel injection line.

## Tighten

- Nut to 25 N·m (20 lb. ft.).
3. Fuel return hose.
  4. Fuel line clip.
  5. Negative battery cables.

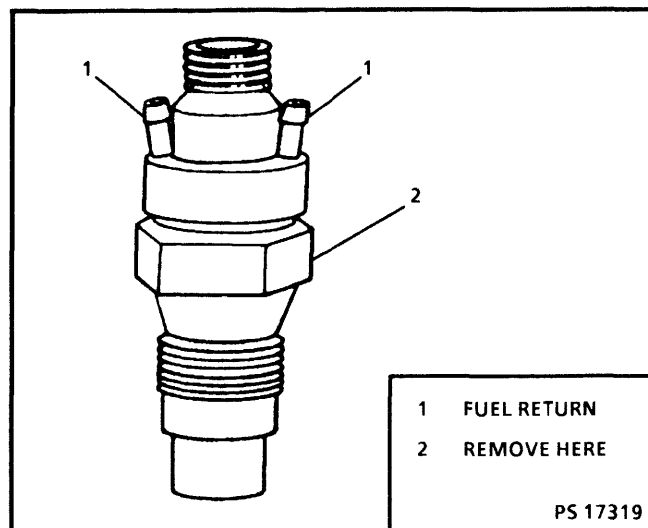


Figure 4-23 - Injection Nozzle

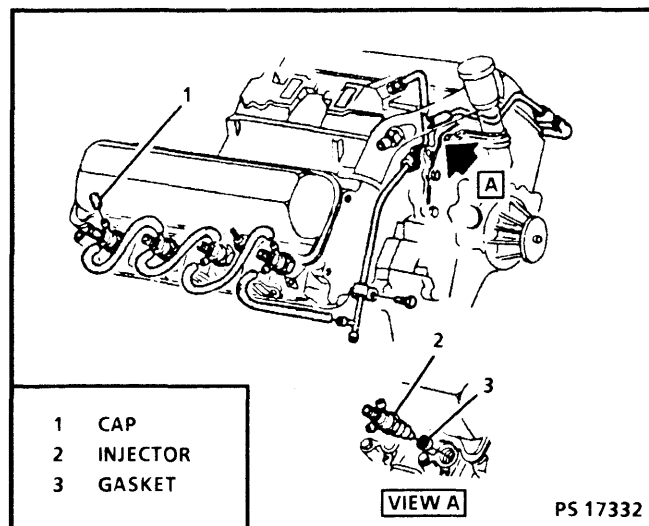


Figure 4-24 - Injection Nozzles

## ACCELERATOR PEDAL POSITION MODULE Figure 4-25

Observe the following when performing service on the accelerator pedal position module:

- The mounting surface between the support and the dash panel, must be free of insulation. The carpet and padding in the pedal and tunnel area must be positioned to lay flat and be free of wrinkles and bunches.

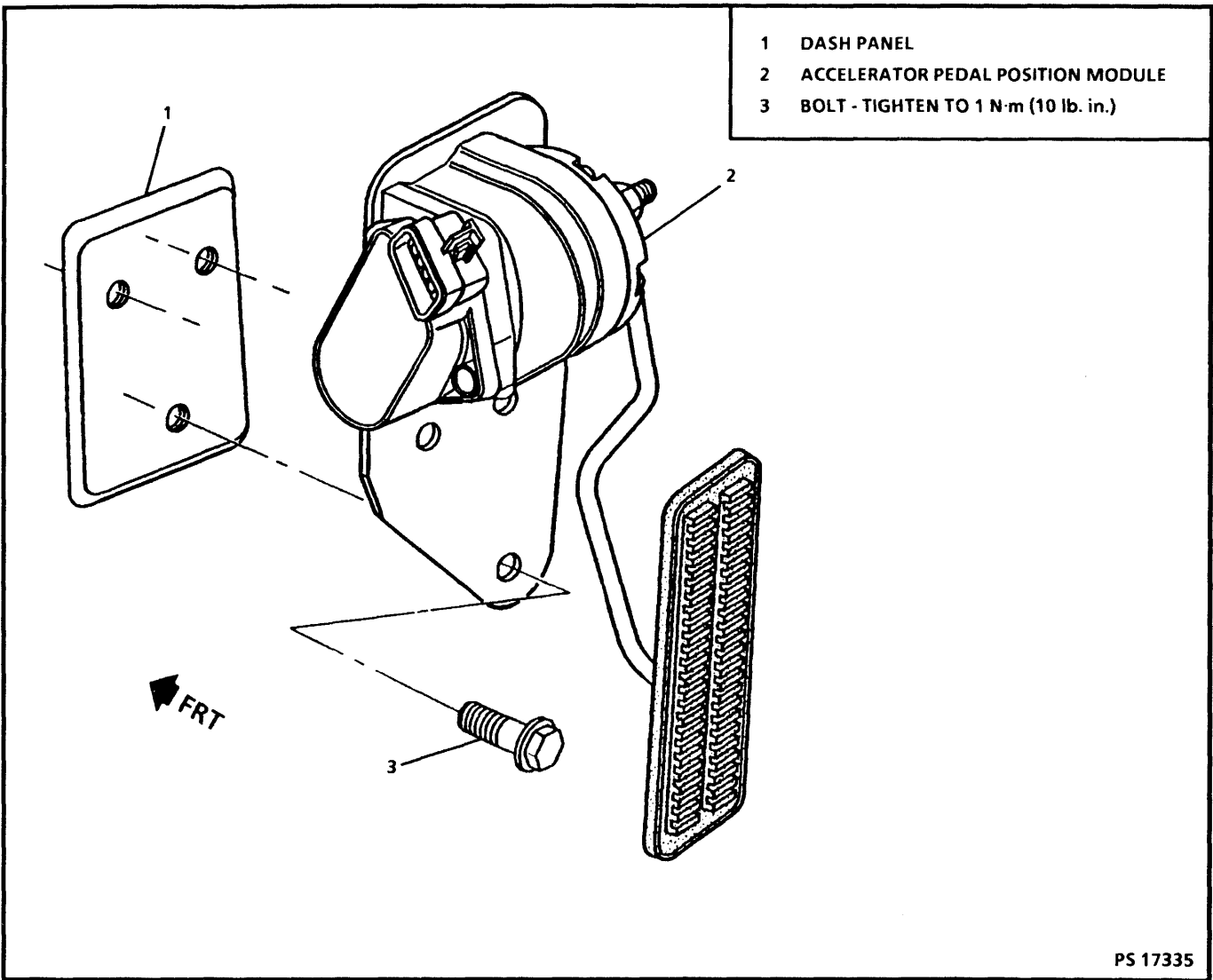
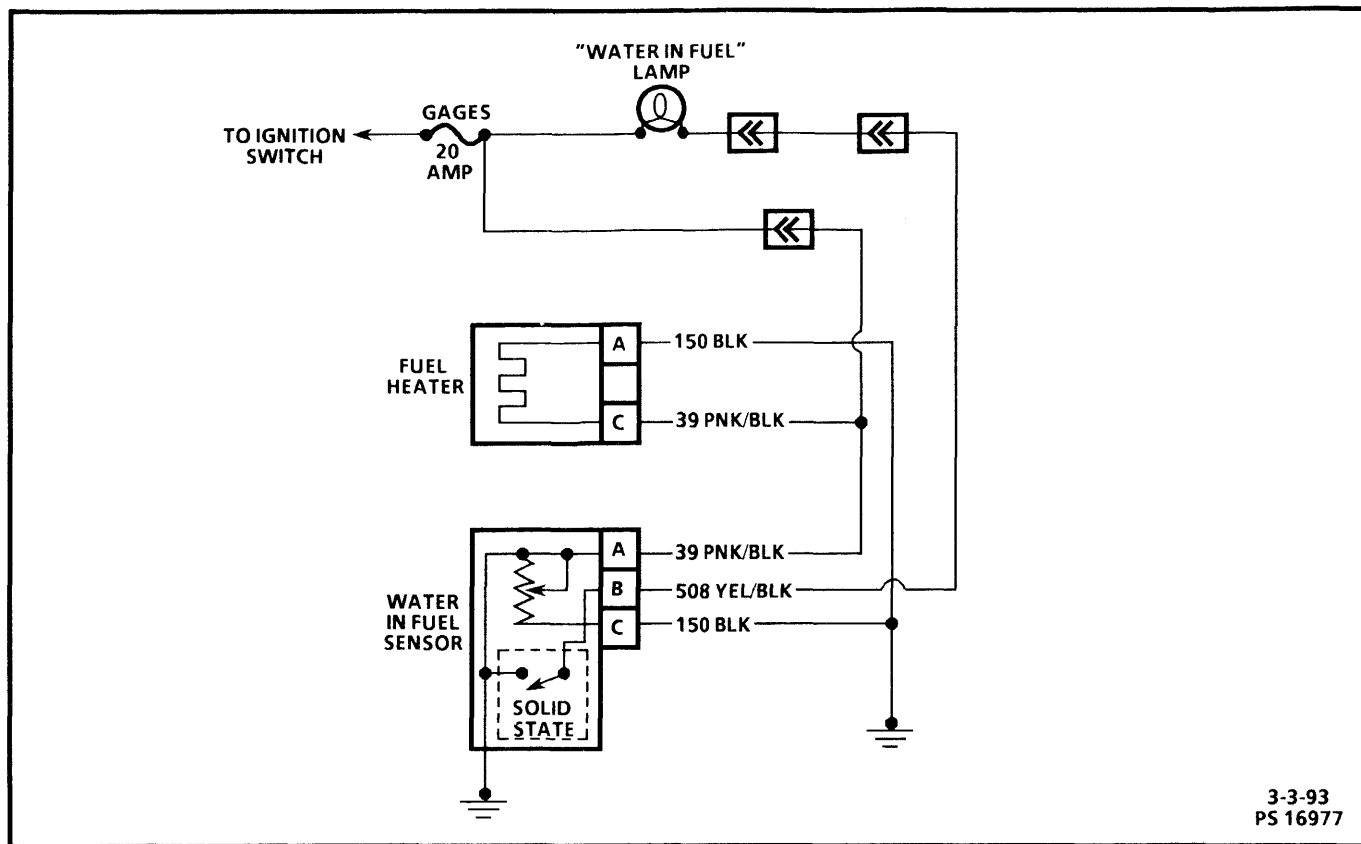


Figure 4-25 - Accelerator Pedal Position Module

PARTS INFORMATION

| PART NAME                                        | GROUP |
|--------------------------------------------------|-------|
| Filter, Fuel . . . . .                           | 3.890 |
| Sensor, WAT Fuel Sentry . . . . .                | 3.890 |
| Heater, Fuel Sentry . . . . .                    | 3.890 |
| Sender, Fuel . . . . .                           | 3.107 |
| Filter, Fuel (In-Tank) . . . . .                 | 3.890 |
| Pump, Fuel . . . . .                             | 3.900 |
| Relay, F/PMP . . . . .                           | 3.900 |
| Switch, F/PMP and ENG OIL<br>PRESS IND . . . . . | 1.800 |
| Lever, Accelerator Pedal . . . . .               | 3.431 |



## "WATER IN FUEL" LAMP CIRCUIT CHECK

### Circuit Description:

The fuel manager/filter assembly consists of the fuel heater, the water in fuel sensor, and a filter. The filter contains the "coalescer" (the device that combines small droplets of water into larger ones) and the filter/separator.

A fuel lift pump delivers diesel fuel from the tank to the fuel filter. As fuel enters the filter, it passes first through the fuel heater. The heater contains a thermostatic switch. The switch opens or closes to turn the heater "OFF" or "ON," depending on the temperature of the fuel.

The fuel then passes through the filter. Next the fuel flows through the water coalescer. Here the droplets of water in the fuel are combined into larger drops, the drops fall to the water reservoir in the filter. When fuel flows from the fuel manager/filter assembly to the injection pump, it is clean and free of water.

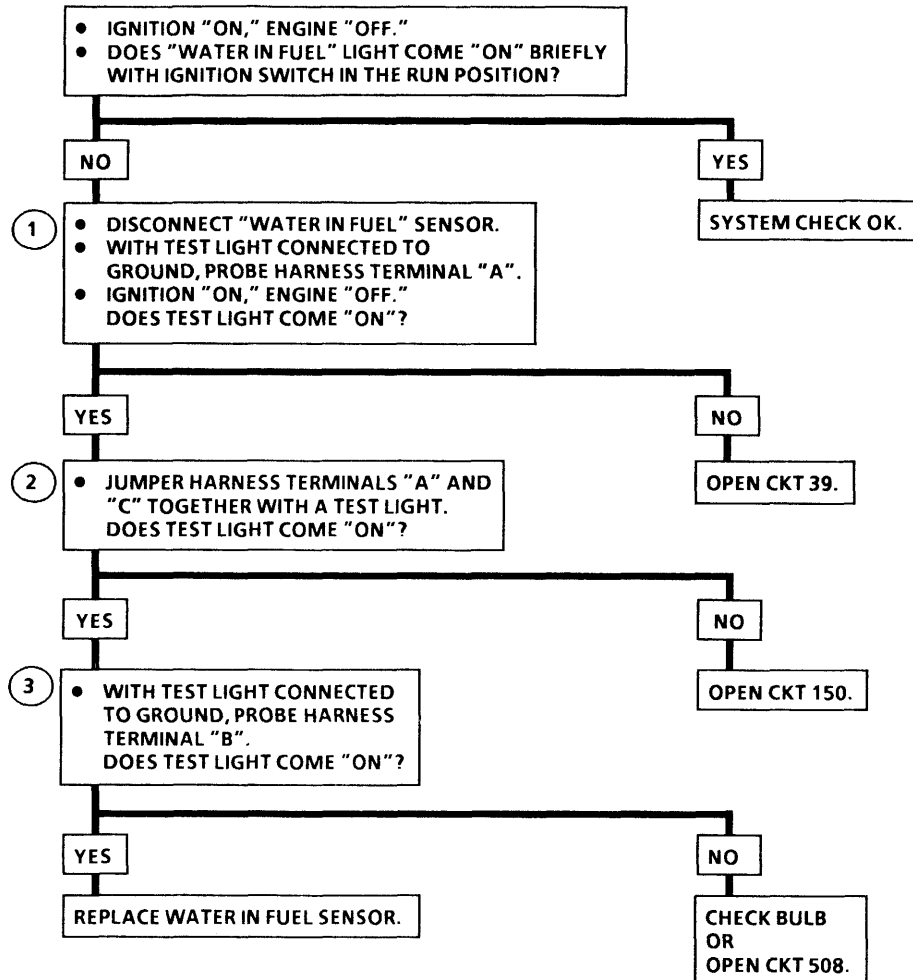
The solid-state water in fuel sensor supplies voltage to a probe. When the probe touches water, the module closes a switch. This completes a circuit to ground to light the "Water in Fuel" lamp.

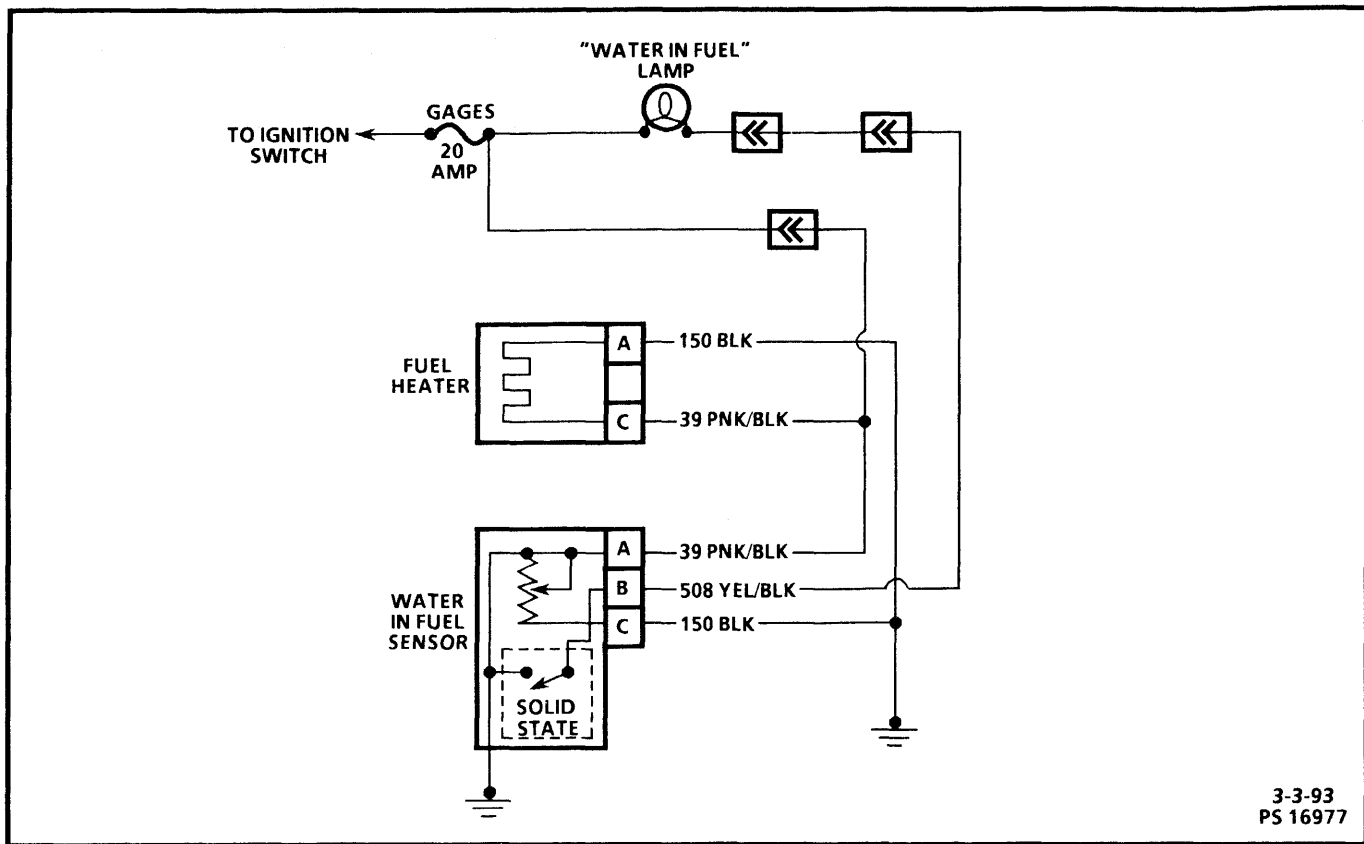
A time delay circuit in the water in fuel module grounds the lamp briefly to test the bulb each time the system is turned "ON."

The fuel heater is operated by a built-in thermostatic switch. When the switch is closed, battery voltage is supplied to the heater.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will determine if CKT 39 is open.
2. This step will determine if the ground CKT 150 is OK.
3. This step will determine if fuse, bulb, and wiring are OK.

**"WATER IN FUEL" LAMP  
CIRCUIT CHECK**



## FUEL HEATER FUNCTIONAL CHECK

### Circuit Description:

The fuel manager/filter assembly consists of the fuel heater, the water in fuel sensor, and a filter. The filter contains the "coalescer" (the device that combines small droplets of water into larger ones) and the filter/separator.

A fuel lift pump delivers diesel fuel from the tank to the fuel filter. As fuel enters the filter, it passes first through the fuel heater. The heater contains a thermostatic switch. The switch opens or closes to turn the heater "OFF" or "ON," depending on the temperature of the fuel.

The fuel then passes through the filter. Next the fuel flows through the water coalescer. Here the droplets of water in the fuel are combined into larger drops, the drops fall to the water reservoir in the filter. When fuel flows from the fuel manager/filter assembly to the injection pump, it is clean and free of water.

The solid-state water in fuel sensor supplies voltage to a probe. When the probe touches water, the module closes a switch. This completes a circuit to ground to light the "Water in Fuel" lamp.

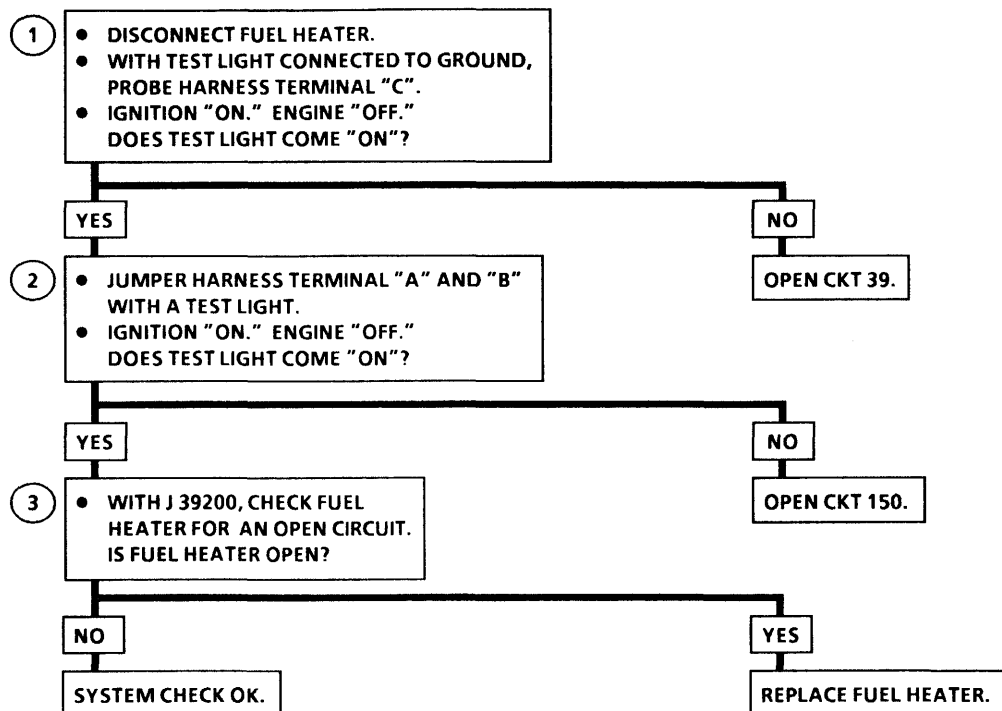
A time delay circuit in the water in fuel module grounds the lamp briefly to test the bulb each time the system is turned "ON."

The fuel heater is operated by a built-in thermostatic switch. When the switch is closed, battery voltage is supplied to the heater.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step checks for an open in CKT 39.
2. This step checks the ground circuit.
3. This step checks the fuel heater for an open.

## FUEL HEATER FUNCTIONAL CHECK





**BLANK**

## SECTION 7

# GLOW PLUG SYSTEM

## CONTENTS

|                             |     |                                   |     |
|-----------------------------|-----|-----------------------------------|-----|
| General Description .....   | 7-1 | Glow Plugs .....                  | 7-2 |
| Glow Plugs .....            | 7-1 | On-Vehicle Service .....          | 7-2 |
| Glow Plug Relay .....       | 7-1 | Glow Plug Relay (Non Turbo) ..... | 7-2 |
| Circuit Operation .....     | 7-1 | Glow Plug Relay (Turbo) .....     | 7-2 |
| Glow Plug After Start ..... | 7-2 | Glow Plugs .....                  | 7-3 |
| Diagnosis .....             | 7-2 | Parts Information .....           | 7-4 |
| Glow Plug Relay .....       | 7-2 | Glow Plug System Check .....      | 7-6 |

## GENERAL DESCRIPTION

In the diesel engine, air alone is compressed in the cylinder; then, after the air has been compressed, a charge of fuel is sprayed into the cylinder and ignition occurs, due to the heat of compression. Eight glow plugs are used to preheat the chamber as an aid to starting (Figure 7-1).

The diesel glow plug system controlled by the PCM consists of a glow plug relay, 6-volt glow plugs, and a glow plug lamp.

### GLOW PLUGS

*Figure 7-1*

These are 6-volt heaters (operated at 12 volts) that turn "ON," when the ignition switch is turned to the run position, prior to starting the engine. They remain pulsing a short time after starting, then are turned "OFF."

A "GLOW PLUGS" lamp, on the instrument panel, provides information on engine starting conditions.

### GLOW PLUG RELAY

The glow plug relay (Figure 7-2) is mounted at the rear of the left cylinder head. It is a solid state device which operates the glow plugs.

The PCM uses a B+ signal to control the solid state circuitry of the glow plug relay.

### CIRCUIT OPERATION

A normal functioning system operates as follows:

A. Key "ON," engine not running and at room temperature.

1. Glow plugs "ON" for 4 to 6 seconds, then "OFF" for about 4.5 seconds.

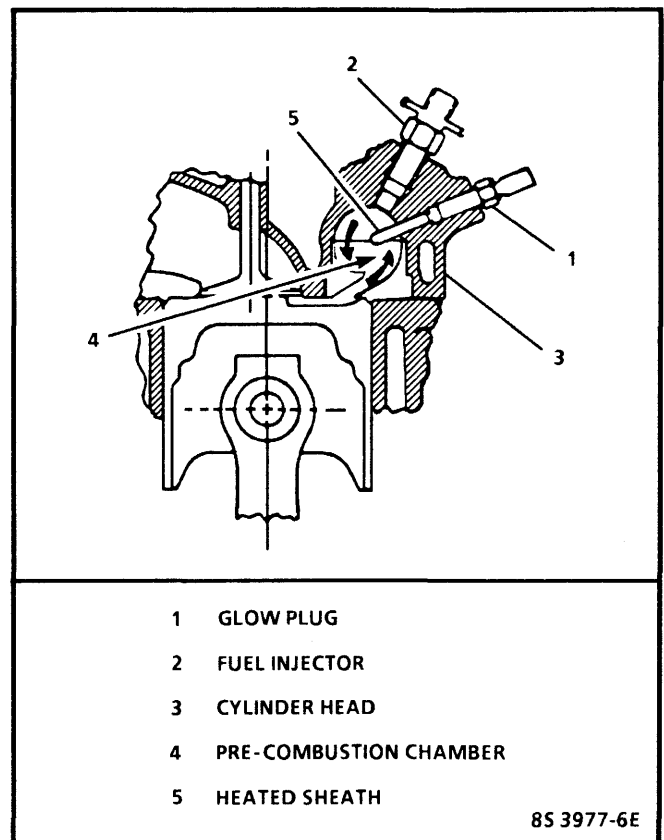


Figure 7-1- Diesel Engine Glow Plug Location

2. Then cycle "ON" for about 1.0 second, "OFF" for about 3.0 seconds, and continue to cycle 1.0 "ON," 3.0 "OFF," for a total duration (including the initial 4 to 6 seconds) of about 16 seconds.
- B. If the engine is cranked during or after the above sequence, the glow plugs will cycle "ON"/"OFF" for a total duration of 16 seconds after the engine control switch is returned from the crank position, whether the engine starts or not. The engine does not have to be running to terminate the glow plug cycling.

## 7-2 DRIVEABILITY AND EMISSIONS (DIESEL)

All the times shown above are approximate, because they vary with initial engine temperature. The initial "ON" time and cycling "ON"/"OFF" times vary also, with system voltage and/or temperature. Lower temperatures cause longer duration of cycling.

### GLOW PLUG AFTER START

The PCM provides glow plug operation after starting a cold engine. This after start operation is initiated when the ignition switch is returned to RUN, from the START position. While loss of this function may not cause a cold start complaint, it may result in excessive white smoking and/or poor idle quality after start.

## DIAGNOSIS

### GLOW PLUG RELAY

The diagnosis of the glow plug relay is part of the "Control Module System" and starts with the "On-Board Diagnostic System Check." This will determine if the system is operating correctly.

If the glow plug system is not working properly, the "On-Board Diagnostic System Check" will direct diagnosis to a Diagnostic Trouble Code (DTC) tree chart or to another system circuit.

### GLOW PLUGS

If the system does not operate as described in "Circuit Operation," perform the "Glow Plug System Check." It provides a fast way to determine if the glow plug system is working properly. Use this procedure, whenever there is doubt about correct system operation.

**NOTICE:** Do not manually bypass the glow plug relay. Do not jump start with more than a 12 volt system. The glow plugs could be damaged.

## ON-VEHICLE SERVICE

### GLOW PLUG RELAY (NON TURBO)

#### Remove or Disconnect

#### Figure 7-2

1. Negative battery cables.
2. Wiring connector to the relay.
3. Relay mounting nuts.
4. Relay from the studs on the engine.

#### Install or Connect

#### Figure 7-2

1. Relay to the studs on the engine.
2. Relay mounting nuts.

#### Tighten

- Nuts to 35 N·m (25 lb. ft.).
3. Wiring connector to the relay.

#### Tighten

- Wiring harness nuts to 5 N·m (44 lb. in.).
4. Negative battery cables.

### GLOW PLUG RELAY (TURBO)

#### Remove or Disconnect

#### Figure 7-2

1. Negative battery cables.
2. Upper intake manifold cover.
3. Wiring connector to the relay.
4. Relay mounting nuts.
5. Relay from the studs on the engine.

#### Install or Connect

#### Figure 7-2

1. Relay to the studs on the engine.
2. Relay mounting nuts.

#### Tighten

- Nuts to 35 N·m (25 lb. ft.).
3. Wiring connectors to the relay.

#### Tighten

- Wiring harness nuts to 5 N·m (44 lb. in.).
4. Upper intake manifold cover.
  5. Negative battery cables.

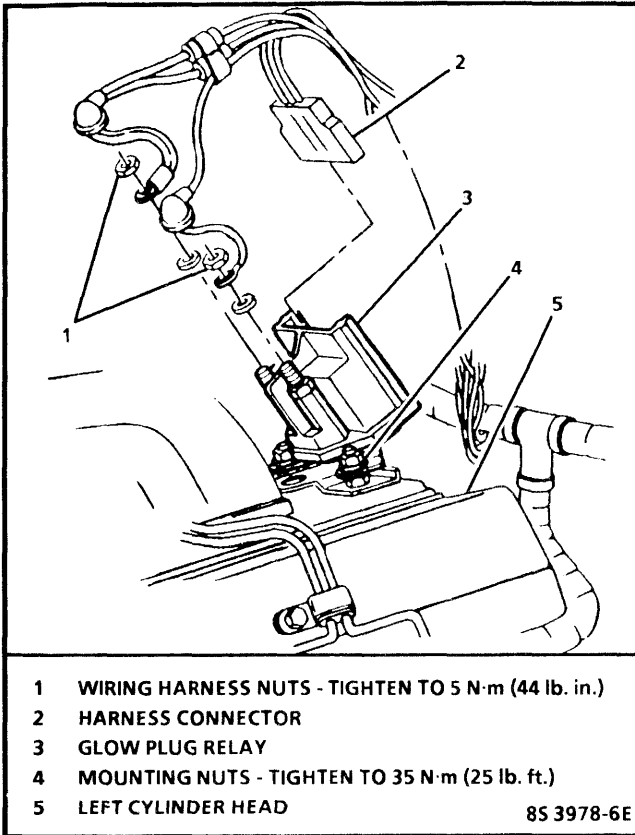


Figure 7-2 - Glow Plug Relay

## GLOW PLUGS

### ↔ Remove or Disconnect

1. Negative battery cable.

#### Both Sides, Non Turbo and Left Side, Turbo:

2. Glow plug lead wires from the glow plugs, using J 39083 glow plug connector remover and installer.
3. Glow plugs from the engine.
  - Use a 3/8-inch deep-well socket to remove the plugs.

#### Right Side, Turbo:

- Raise the vehicle.
4. Right front tire.
  5. Splash shield from the right front wheel well.
  6. Lead wire from the glow plug in the #2 cylinder.
  7. Lead wires for glow plugs in cylinders #4 and #6 at the harness connectors.
  8. Heat shroud for the glow plug in the #4 cylinder.
  9. Heat shroud for the #6 cylinder.
    - Slide the shrouds back far enough to allow access for unplugging the wires at the #4 and #6 glow plugs.
    - Use J 39083 to disconnect the glow plug wires.

10. Glow plugs from cylinders #2, #4, and #6.
11. Lead wire at the glow plug from cylinder #8 by reaching up from underneath the vehicle.
12. Glow plug from cylinder #8.
  - For easier access to cylinders #6 and #8, it may be necessary to remove the exhaust down pipe from turbocharger and muffler inlet pipe.

### ↔ Install or Connect

#### Right Side, Turbo:

1. Glow plug into cylinder #8.

#### ⌚ Tighten

- Glow plug to 17 N·m (13 lb. ft.).
2. Lead wire to #8 glow plug.
  3. Glow plugs into cylinders #2, #4, and #6.
    - Install the glow plugs by reaching through the right wheel well.

#### ⌚ Tighten

- Glow plugs to 17 N·m (13 lb. ft.).
4. Lead wire to glow plug #6.
    - Slide the shroud over the wire lead and fasten to the studs.
    - Repeat Step 4 for the #4 glow plug.

#### ⌚ Tighten

- Heat shroud nuts to 23 N·m (17 lb. ft.).
5. Wires for glow plugs #4 and #6 to connectors at the wire harness.
  6. Lead wire for #2 glow plug.

#### 🔍 Inspect

- Wire routing, making sure the lead wires are not rubbing against the exhaust manifold or any part that may harm the wire insulation.
7. Splash shield in the right front wheel well.
  8. Right front tire.
    - Refer to SECTION 3E of appropriate service manual for lug nut torque.

#### Left Side Turbo and Both Sides Non Turbo:

9. Glow plugs.

#### ⌚ Tighten

- Glow plugs to 23 N·m (17 lb. ft.).
10. Lead wires to the glow plugs.
  11. Negative battery cable.

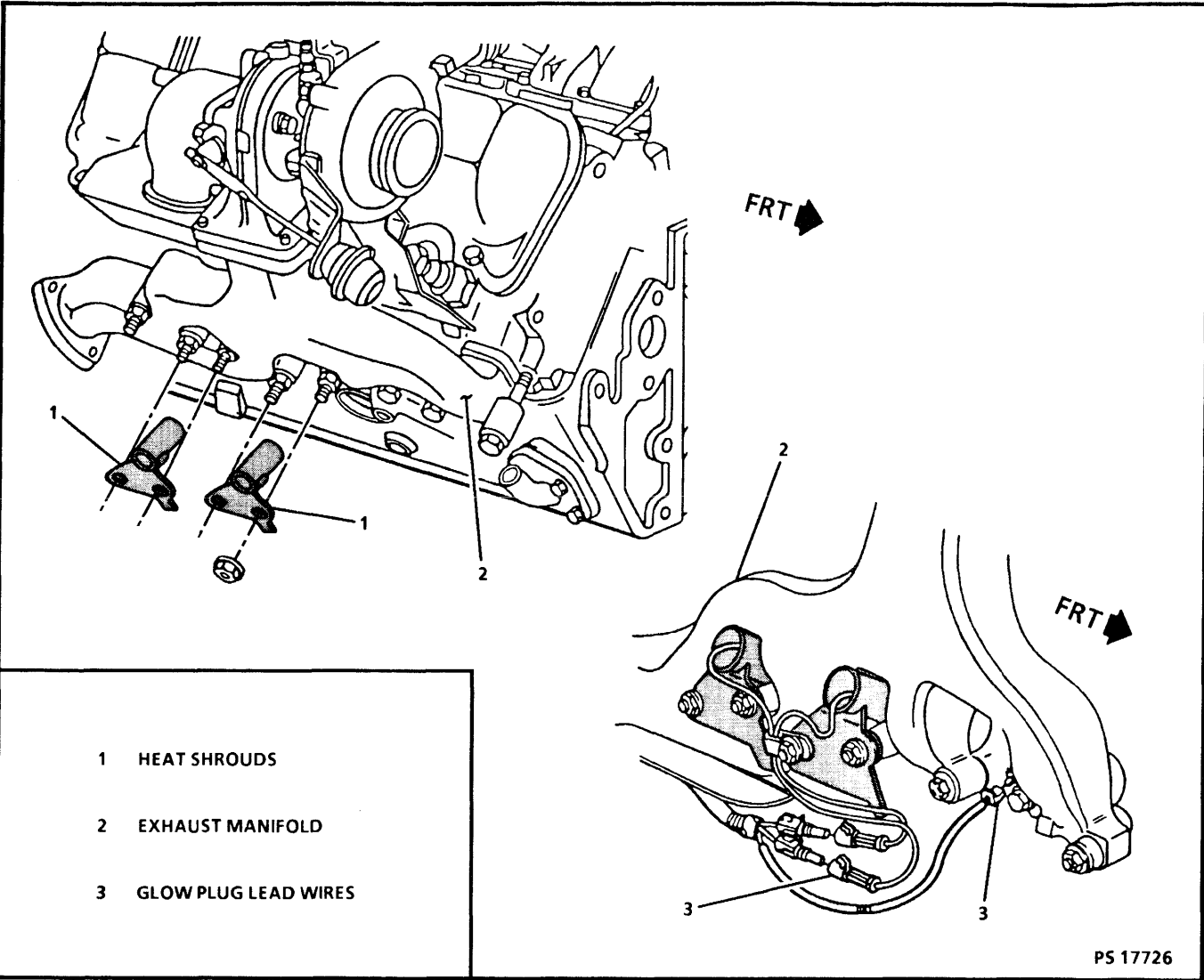


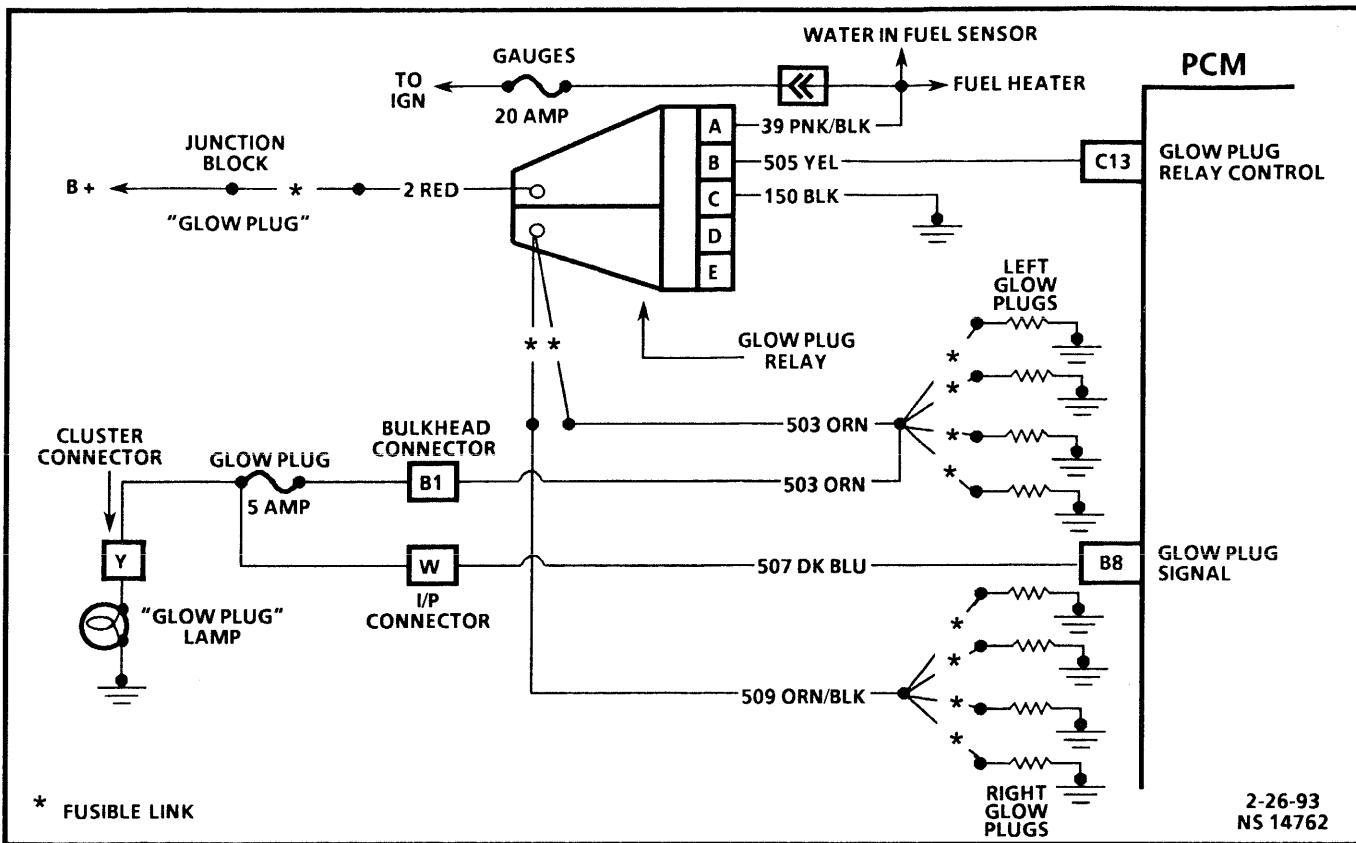
Figure 7-3 - Glow Plugs (Right Side Turbo)

PARTS INFORMATION

| PART NAME                 | GROUP |
|---------------------------|-------|
| Glowplug . . . . .        | 2.270 |
| Glow Plug Relay . . . . . | 2.510 |

**BLANK**

## 7-6 DRIVEABILITY AND EMISSIONS (DIESEL)



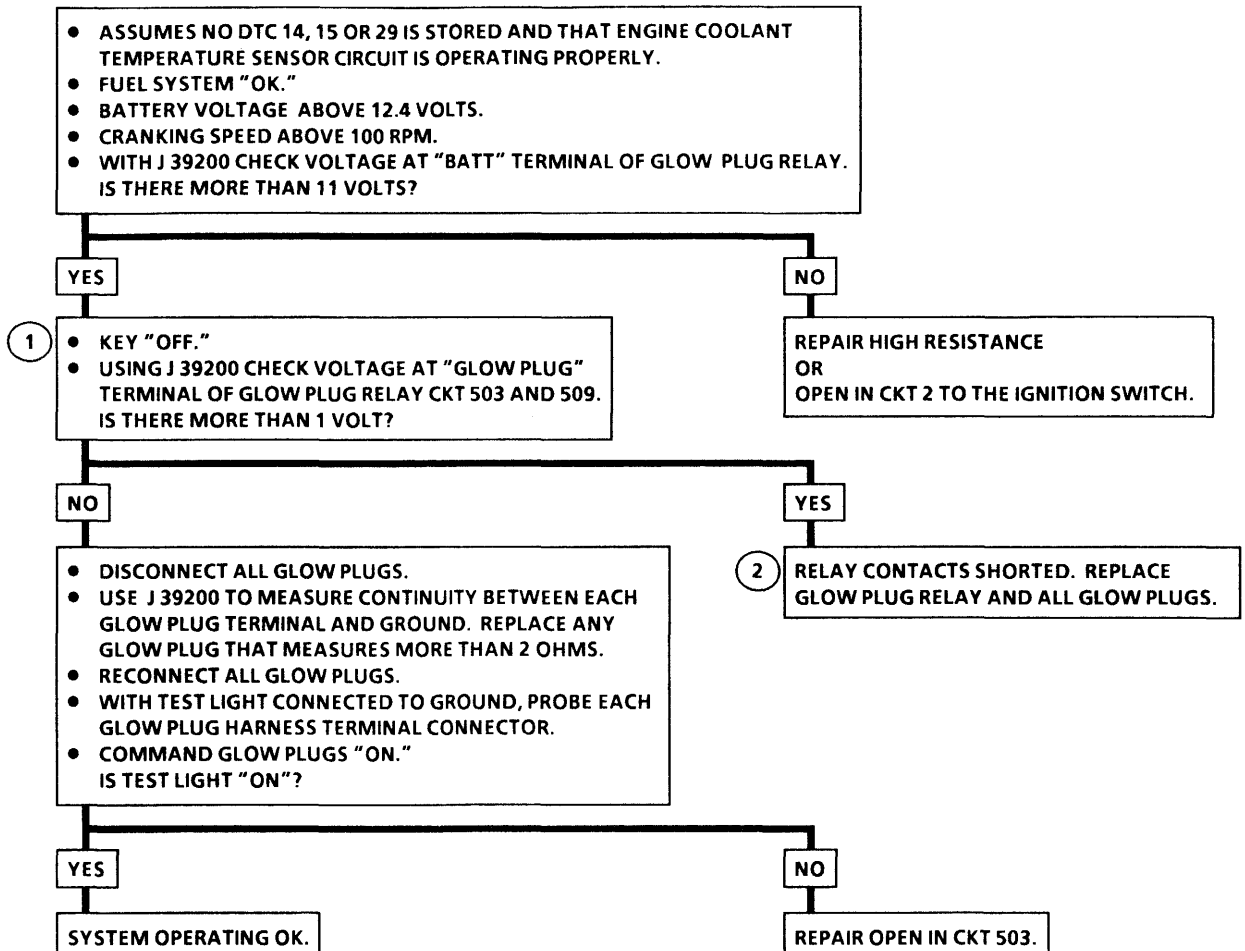
### GLOW PLUG SYSTEM CHECK

#### Circuit Description:

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures. The glow plugs are heated before and during cranking, as well as initial engine operation. A DTC 29 will be set when the glow plug relay output is found to have a fault. This can be found by comparing glow plug feedback voltage to ignition voltage.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if the glow plugs are faulty or if the problem lies in the wiring portion of the circuit.
2. If the relay contacts are shorted together, there will be 12 volts supplied to the glow plugs at all times. Since these are 6 volt glow plugs, they will be damaged by the constant high voltage.

**GLOW PLUG SYSTEM CHECK**



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## SECTION 9

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

### CONTENTS

|                             |     |                                       |     |
|-----------------------------|-----|---------------------------------------|-----|
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| On-Vehicle Service .....    | 9-1 | EGR Solenoid Filter Replacement ..... | 9-2 |
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### GENERAL DESCRIPTION

The EGR system lowers the formation of nitrogen oxides by reducing combustion temperature. This is done by introducing exhaust gases into the cylinders through an EGR valve. The PCM, in the control module system, controls the amount of EGR to meet emission control requirements and maintains good driveability through an EGR solenoid and EGR vent solenoid, which regulates the vacuum to the EGR valve. Two main sensor inputs to the PCM are used to calculate the amount of EGR.

The EGR valve (Figures 9-1 and 9-2), installed on the intake manifold, introduces the exhaust gases to the incoming fresh air at the engine crossover.

A vacuum pump is required to provide a vacuum source to operate the EGR system.

An EGR control pressure/BARO sensor mounted on the right side of the plenum panel is used to measure the amount of absolute pressure in the EGR vacuum line.

#### EGR SOLENOID ASSEMBLY

The EGR solenoid assembly (Figure 9-3) is mounted on top rear of the engine. The PCM controls the EGR solenoid to regulate the vacuum to the EGR valve. By controlling the time the EGR solenoid is "ON" or "OFF" regulates the amount of EGR. The PCM calculates the amount of EGR based on engine speed and accelerator pedal position. The PCM is programmed to vary the "ON" and "OFF" time of the EGR solenoid, based on these two inputs. To monitor the PCM control of EGR, an EGR control pressure/BARO sensor is used to measure the amount of absolute pressure in the EGR vacuum line. If a minor variation is calculated EGR and actual EGR as monitored by the EGR control pressure/BARO sensor exists, the PCM makes a correction. If the variation exceeds an amount in excess of what the PCM can correct for, an error is detected by the PCM and the system will go into default.

When the PCM recognizes the operating range for no EGR, the EGR vent solenoid operates to allow rapid venting of vacuum to the EGR valve.

### DIAGNOSIS

The diagnosis of the EGR system is part of the control module system and starts with the "On-Board Diagnostic System Check." This will determine if the system is operating correctly.

If the EGR system is not working properly, the "On-Board Diagnostic System Check" will direct diagnosis to a Diagnostic Trouble Code (DTC) tree chart or to another system circuit. Refer to SECTION 3.

### ON-VEHICLE SERVICE

#### EGR VALVE (NON TURBO)

*Figure 9-1*

##### Remove or Disconnect

1. Air cleaner cover.
2. Vacuum hose from the EGR valve.
3. Studs.
4. EGR valve.

##### Install or Connect

1. EGR valve.
2. Studs (seal the studs with Loctite 272 or equivalent).

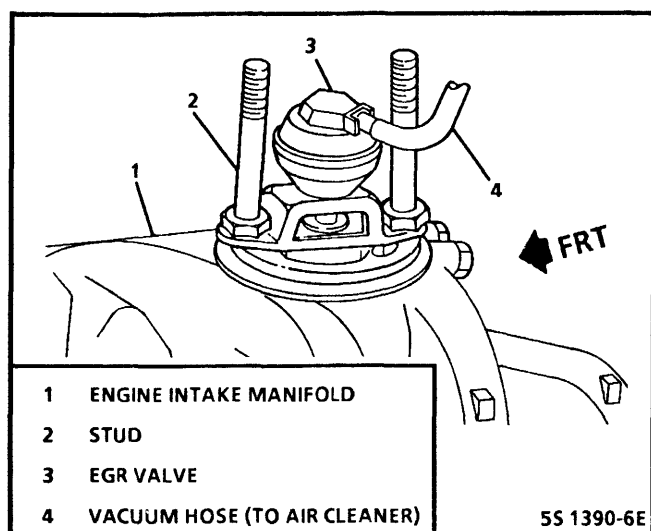


Figure 9-1 - EGR Valve

### EGR VALVE (TURBO) Figure 9-2

#### Remove or Disconnect

1. Upper intake manifold cover.
2. Vacuum hose from the EGR valve.
3. Bolts.
4. EGR valve.

#### Install or Connect

1. EGR valve.
2. Bolts.

#### Tighten

- Bolts to 25 N·m (18 lb. ft.).
3. Vacuum hose.
  4. Upper intake manifold cover.

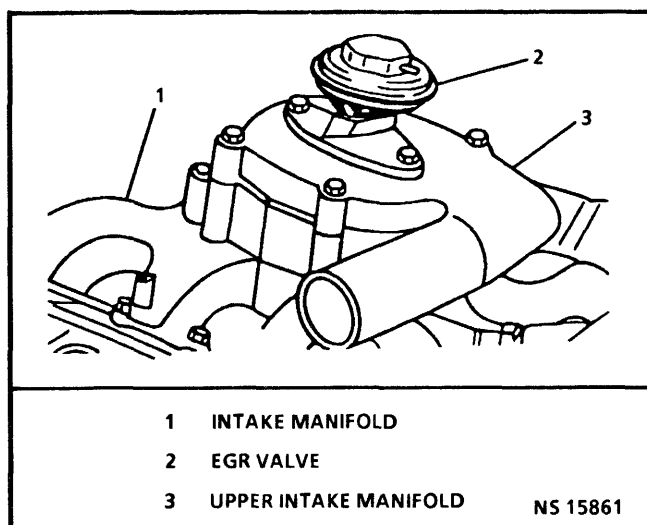


Figure 9-2 - EGR Valve (Turbo)

### EGR SOLENOID Figure 9-3 and 9-4

#### Remove or Disconnect

1. Negative battery cables.
2. Electrical connector from the solenoid.
3. Vacuum hoses.
4. EGR solenoid.

#### Install or Connect

1. EGR solenoid.
2. Vacuum hoses.
3. Electrical connector to the solenoid.
4. Negative battery cables.
5. Perform "On-Board Diagnostic System Check."

### EGR VENT SOLENOID Figure 9-3 and 9-4

#### Remove or Disconnect

1. Negative battery cables.
2. Electrical connector from the solenoid.
3. Vacuum hoses.
4. EGR vent solenoid.

#### Install or Connect

1. EGR vent solenoid.
2. Vacuum hoses.
3. Electrical connector to the solenoid.
4. Negative battery cables.
5. Perform "On-Board Diagnostic System Check."

### EGR SOLENOID FILTER REPLACEMENT Figure 9-3 and 9-4

#### Remove or Disconnect

1. Retainer clip.
2. Filter.

#### Install or Connect

1. Filter.
2. Retainer clip.

## PARTS INFORMATION

| PART NAME                      | GROUP |
|--------------------------------|-------|
| Valve, EGR .....               | 3.670 |
| Valve, EGR Solenoid .....      | 3.670 |
| Valve, EGR Vent Solenoid ..... | 3.670 |

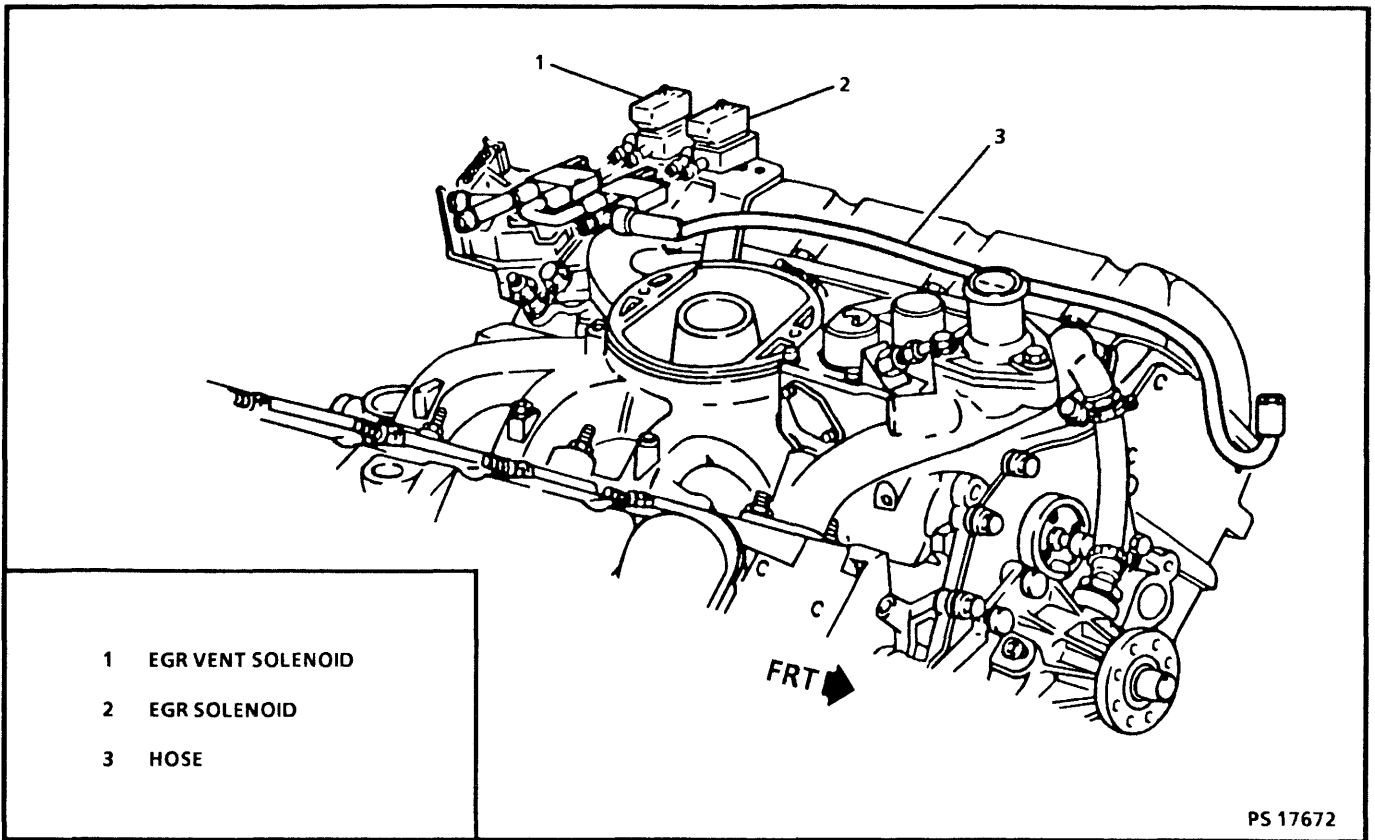


Figure 9-3 - EGR Solenoid Assembly (Non Turbo)

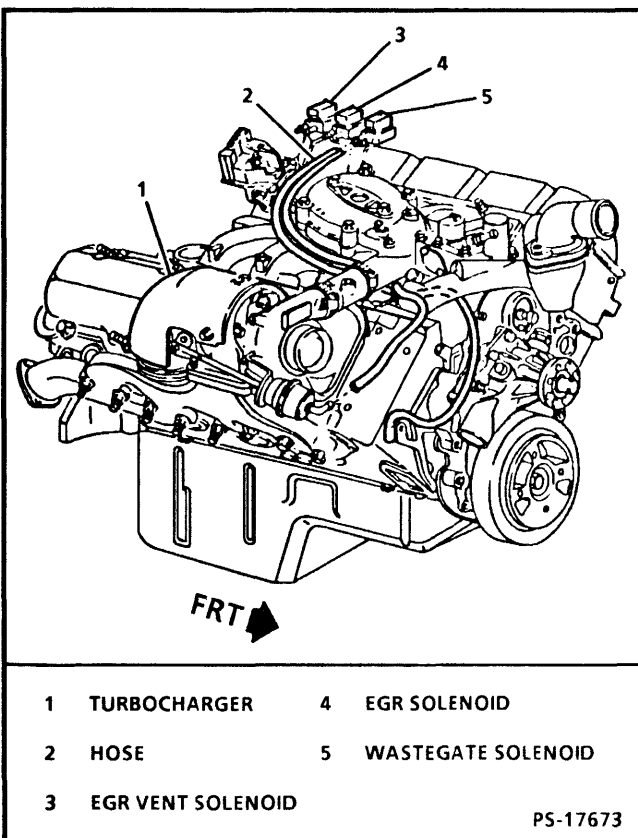


Figure 9-4 - EGR Solenoid Assembly

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## SECTION 10

# TRANSMISSION CONTROLS

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## GENERAL DESCRIPTION

### AUTOMATIC TRANSMISSION

#### 4L60E

All 4L60E Diagnostic Trouble Codes (DTCs) will be in SECTION 10A.

All 4L60E Hydraulic Diagnosis will be in SECTION 7A14A of the appropriate service manual.

All 4L60E Unit Repair will be in SECTION 7A14B of the appropriate unit repair manual.

#### 4L80E

All 4L80E Diagnostic Trouble Codes (DTCs) will be in SECTION 10B.

All 4L80E Hydraulic Diagnosis will be in SECTION 7A17A of the appropriate service manual.

All 4L80E Unit Repair will be in SECTION 7A17B of the appropriate unit repair manual.

### MANUAL TRANSMISSION

All manual transmission controls information will be found in SECTION 10C.

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## SECTION 10A

# 4L60E DIAGNOSTIC TROUBLE CODES

### (WITH TECH 1 SCAN TOOL DIAGNOSTICS)

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## GENERAL DESCRIPTION

## POWERTRAIN CONTROL MODULE (PCM)

The Powertrain Control Module (PCM) is an electronic device which monitors various inputs to control various transmission functions including shift quality and transmission diagnostics. The PCM receives various input information from sensors, switches, and components to process for use within its control program. Based on this input information, the PCM controls various transmission output functions and devices. The PCM is located within the passenger compartment, underneath the right hand side of the dash.

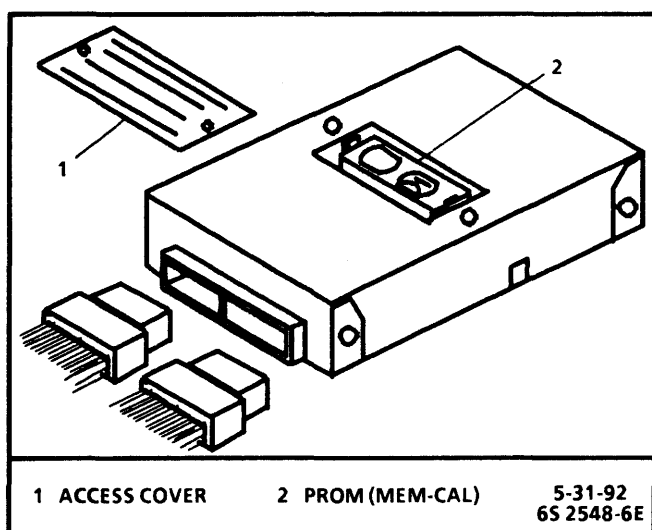


Figure 10A-1 - Powertrain Control Module

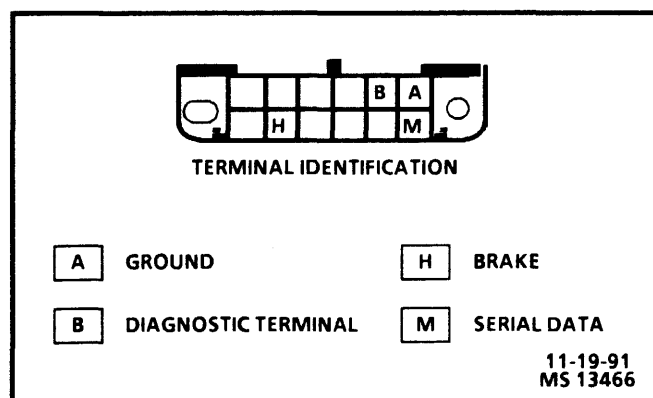


Figure 10A-2 - Data Link Connector (DLC)

## WIRING HARNESS AND CONNECTORS

A wiring harness electrically connects the PCM to various sensors, solenoids, and relays within the system. Many of the connectors used are environmentally protected because of the system low voltages and current levels.

## DATA LINK CONNECTOR (DLC)

This connector is a multiple cavity connector. The DLC provides the technician a means of accessing serial data for aid in diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display DTC(s). The DLC connector is located within the driver's compartment, normally on the left side near the steering column.

## INPUT INFORMATION

## INFORMATION SENSORS AND SWITCHES

The PCM uses the following information sensors to gather data for electronically controlling transmission functions.

- Transmission Fluid Temperature (TFT) sensor.
- Transmission Range (TR) pressure switch assembly.
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Transmission or transfer case Vehicle Speed Sensor (VSS).
- Brake switch.

## TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

The TFT sensor is a thermistor (a device that changes resistance according to changes in temperature) used to indicate transmission fluid temperature. High sensor resistance produces high signal input voltage which corresponds to low fluid temperature. Low sensor resistance produces low signal input voltage which corresponds to high fluid temperature. The PCM uses the TFT sensor signal input to determine the following:

- TCC apply and release schedules.
- Hot mode determination.
- Shift quality.

The TFT sensor is part of the transmission range fluid pressure switch assembly and is attached to the control valve body within the transmission.

## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY

Figure 10A-6

This device is a set of five pressure switches (two normally closed and three normally open), that detect fluid pressure within the valve body passages. The five pressure switches are connected to three signal circuits referred to as range signals A, B, C.

## TRANSMISSION ELECTRICAL CONNECTOR

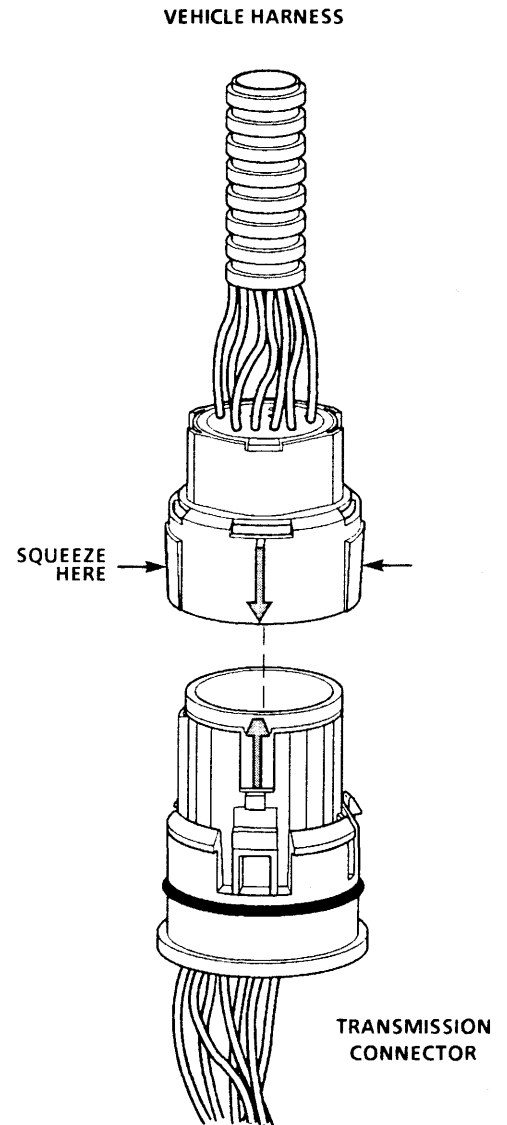
THE TRANSMISSION WIRING CONNECTOR IS A VERY IMPORTANT PART OF THE TRANSMISSION OPERATING SYSTEM. ANY INTERFERENCE WITH THE ELECTRICAL CONNECTION CAN CAUSE THE TRANSMISSION TO SET DIAGNOSTIC TROUBLE CODES (DTC)s AND/OR AFFECT PROPER OPERATION.

THE FOLLOWING ITEMS CAN AFFECT THE ELECTRICAL CONNECTION:

- BENT PINS IN THE CONNECTOR FROM ROUGH HANDLING DURING CONNECTION AND DISCONNECTION.
  - WIRES BACKING AWAY FROM THE PINS OR COMING UNCRIMPED (IN EITHER INTERNAL OR EXTERNAL WIRING HARNESS).
  - DIRT CONTAMINATION ENTERING THE CONNECTOR WHEN DISCONNECTED.
  - PINS IN THE INTERNAL WIRING CONNECTOR BACKING OUT OF THE CONNECTOR OR PUSHED OUT DURING RECONNECTION.
  - EXCESSIVE TRANSMISSION FLUID LEAKING INTO THE CONNECTOR, WICKING UP INTO THE EXTERNAL WIRING HARNESS, AND DEGRADING OF THE WIRE INSULATION. \*
  - WATER/MOISTURE INTRUSION IN THE CONNECTOR.
  - LOW PIN RETENTION IN THE EXTERNAL CONNECTOR FROM EXCESSIVE CONNECTION AND DISCONNECTION OF THE WIRING CONNECTOR ASSEMBLY.
  - PIN CORROSION FROM CONTAMINATION.
- \* THE PRESENCE OF TRANSMISSION FLUID IN THE TRANSMISSION CONNECTOR IS NOT HARMFUL IN ITSELF. THE FLUID ONLY AFFECTS THE EXTERNAL HARNESS WIRING INSULATION IF THE FLUID WICKS UP TO THE HARNESS.

POINTS TO REMEMBER WHEN WORKING WITH THE TRANSMISSION WIRING CONNECTOR ASSEMBLY:

- TO REMOVE THE CONNECTOR, SQUEEZE THE TWO TABS TOWARDS EACH OTHER AND PULL STRAIGHT UP (REFER TO THE ILLUSTRATION).
- CAREFULLY LIMIT TWISTING OR WIGGLING THE CONNECTOR DURING REMOVAL. BENT PINS CAN OCCUR.
- **DO NOT** PRY THE CONNECTOR OFF WITH A SCREWDRIVER OR OTHER TOOL.
- TO REINSTALL THE EXTERNAL WIRING CONNECTOR, FIRST ORIENT THE PINS BY LINING UP THE ARROWS ON EACH HALF OF THE CONNECTOR. PUSH THE CONNECTOR STRAIGHT DOWN INTO THE TRANSMISSION WITHOUT TWISTING OR ANGLING THE MATING PARTS.
- THE CONNECTOR SHOULD CLICK INTO PLACE WITH A POSITIVE FEEL AND/OR NOISE.
- WHENEVER THE TRANSMISSION EXTERNAL WIRING CONNECTOR IS DISCONNECTED FROM THE INTERNAL HARNESS AND THE ENGINE IS OPERATING DTC(s) WILL SET. CLEAR THESE DTC(s) AFTER RECONNECTING THE EXTERNAL CONNECTOR.



1-6-93  
NS 15891

Figure 10A-3 - Transmission Electrical Connector

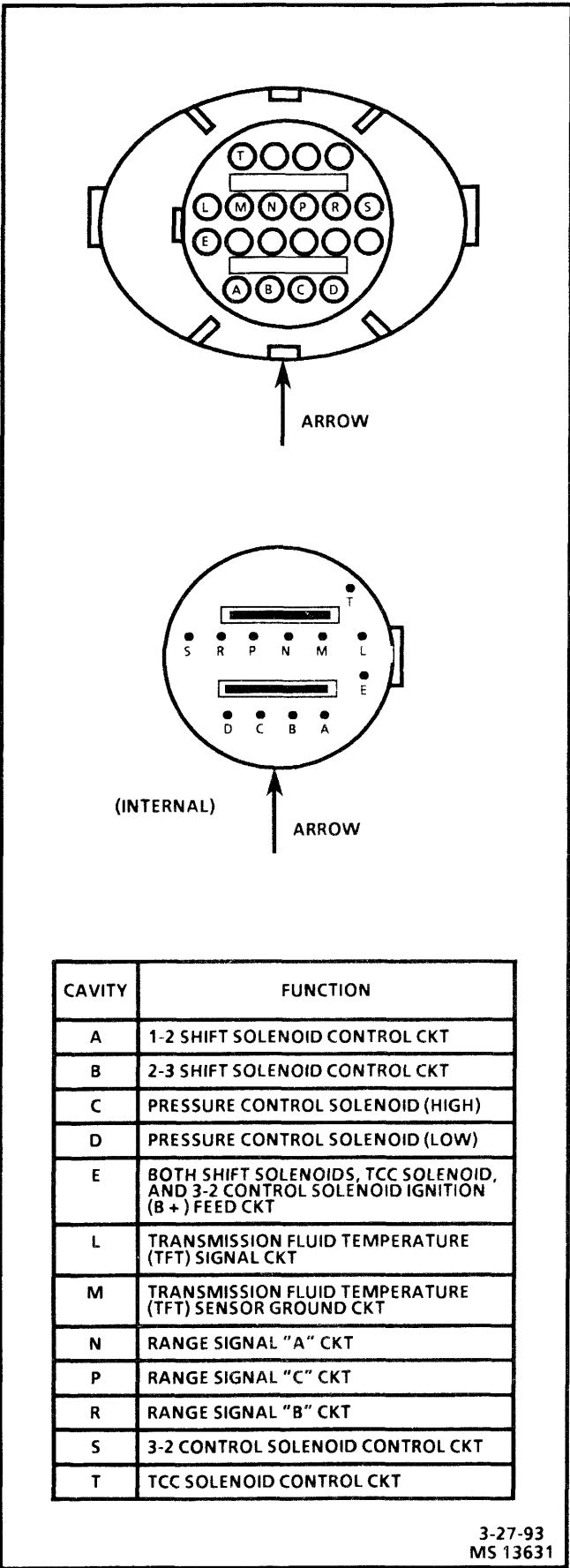


Figure 10A-4 - Harness Connector

Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

The combination of pressure switch states determine the voltage signal (B+ or 0) on each range signal to the PCM. These three range signals are then interpreted by the PCM to indicate the transmission range selected. The transmission range fluid pressure switch assembly contains the trans fluid temperature sensor and attached to the control valve body within the transmission.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR  
Figure 10A-5

The Engine Coolant Temperature (ECT) sensor is a thermistor (a device that changes resistance according to change in temperature) used to indicate engine coolant temperature. High sensor resistance produces signal input voltage which corresponds to low engine temperature. Low sensor resistance produces low signal input voltage which corresponds to high engine coolant temperature. The PCM uses the ECT sensor signal to determine the TCC apply and release schedules. The ECT sensor is attached to the engine assembly.

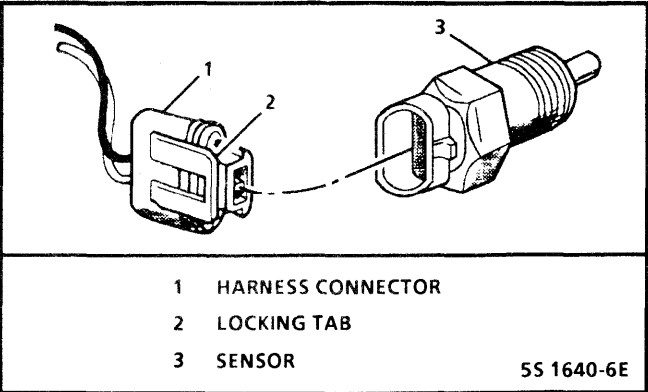


Figure 10A-5 - Engine Coolant Temperature (ECT) Sensor

## THROTTLE POSITION (TP) SENSOR

The Throttle Position (TP) sensor is a potentiometer (a device for measuring an unknown voltage or potential difference by comparison to a standard voltage). The TP sensor sends a voltage to the control module, varying from (approximately .5 volt) to (approximately 5 volts). This voltage signal to the control module represents throttle shaft angle. At closed throttle, the signal voltage to the control module is approximately .5 volt as the throttle shaft angle increases the signal voltage increases to greater than 4.5 volts at wide open throttle. The TP sensor is attached to the throttle body assembly.

## TRANSFER CASE SWITCH ASSEMBLY

This switch assembly is used to indicate the position of the transfer case select lever. When four wheel drive (4WD) low is selected a ground path is provided, changing 4WD low input signal from B+ to

0 voltage. The 4WD low signal input is used to correct the transmission output speed signal from the VSS buffer module to the PCM, to compensate for the transfer case gear reduction. This switch is attached to the transfer case.

## VEHICLE SPEED SENSOR (VSS) Figure 10A-7 (2WD) 10A-8 (4WD)

This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth pressed on an output shaft. As the rotor interrupts the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an output shaft speed signal to the control module. The control module uses the vehicle speed sensor signal input to:

- Calculate vehicle speed, trans output speed, TCC slip speed.
- Control shift quality.

The VSS is attached to the output shaft housing.

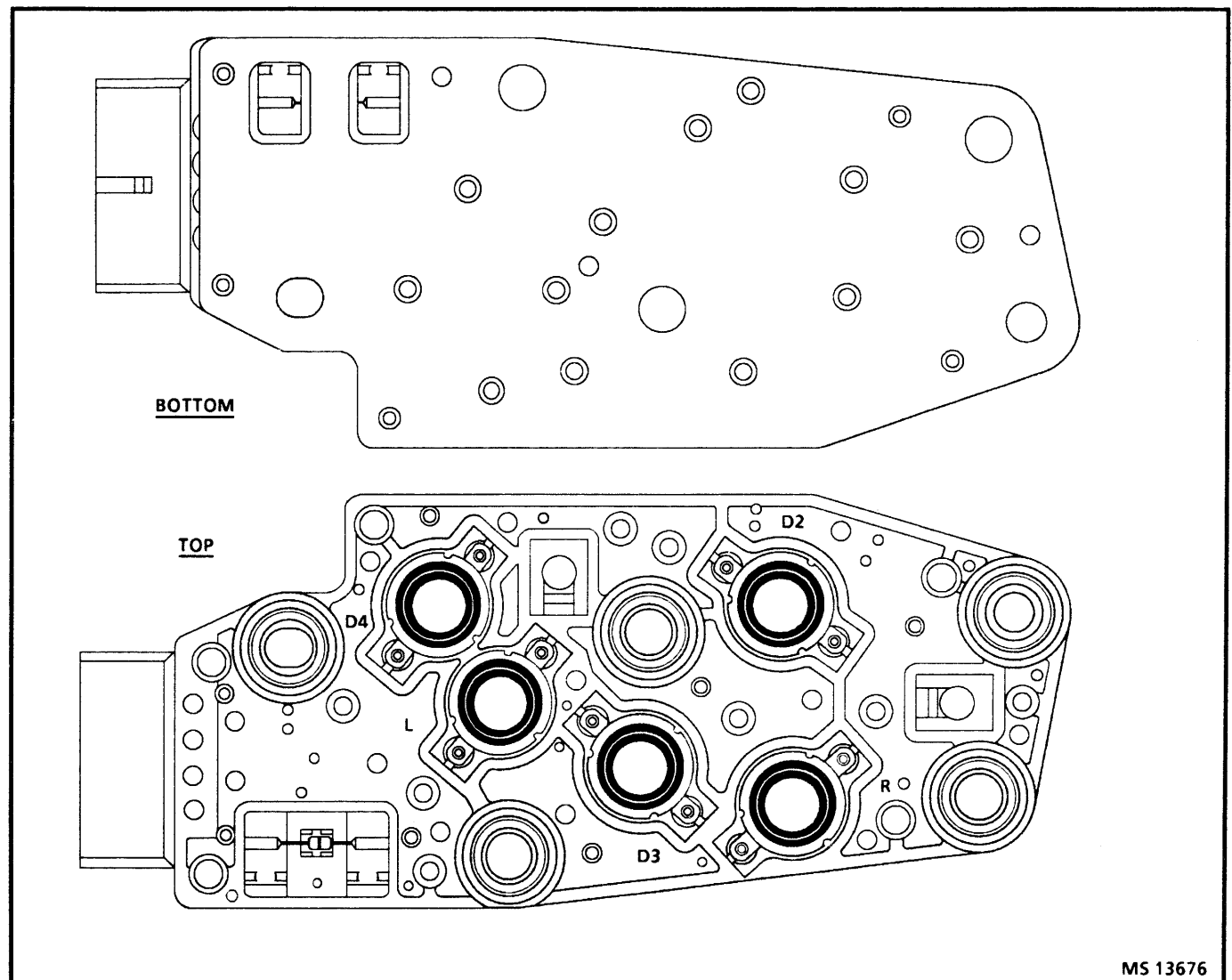


Figure 10A-6 - Transmission Range (TR) Pressure Switch Assembly

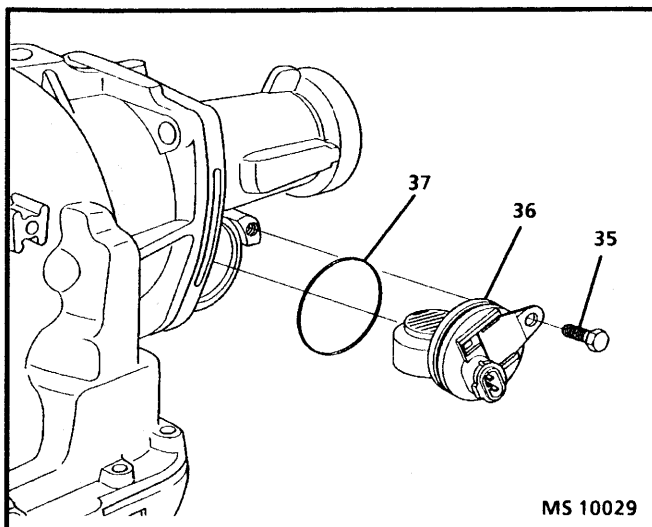


Figure 10A-7 - Vehicle Speed Sensor (2WD)

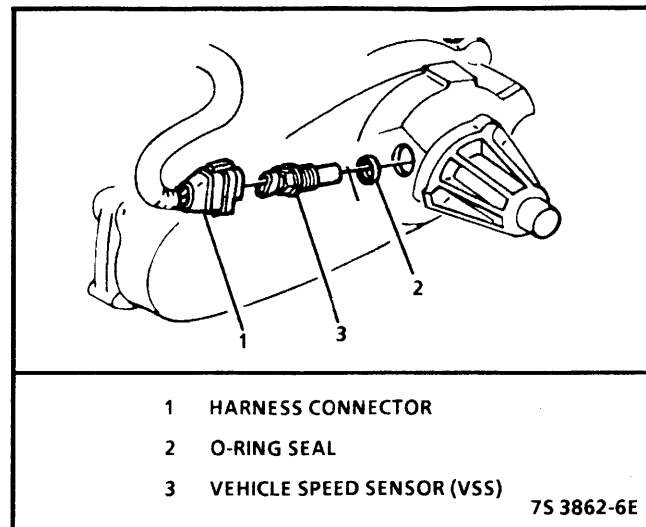


Figure 10A-8 - Vehicle Speed Sensor (4WD)

The PCM uses this signal to de-energize the TCC solenoid when brake pedal is applied. The brake switch is located on the brake pedal mounting bracket.

| CHART |                    |                    |
|-------|--------------------|--------------------|
| Gear  | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1     | ON                 | ON                 |
| 2     | OFF                | ON                 |
| 3     | OFF                | OFF                |
| 4     | ON                 | OFF                |

## OUTPUT INFORMATION

Based on input information, the PCM controls various transmission output functions and devices.

- 1-2 Shift Solenoid.
- 2-3 Shift Solenoid.
- 3-2 Control Solenoid.
- Pressure Control Solenoid (PCS).
- Torque Converter Clutch (TCC) Solenoid.

## VEHICLE SPEED SIGNAL (VSS) BUFFER MODULE

The vehicle speed signal buffer module (VSS buffer module) is an electronic device. The VSS buffer module processes inputs from the vehicle speed sensor and outputs various signals. The VSS buffer module outputs a 40 Pulse Per Revolution (PPR) signal. This 40 ppr signal is used by the control module to determine transmission output speed. The VSS buffer module also outputs a 2002 pulses per mile signal to the control module to control various other functions. The VSS buffer module is matched to the vehicle based on transmission, final drive ratio and tire size. The VSS buffer module is located on the right hand side of the instrument panel attached to the PCM bracket.

## BRAKE SWITCH

This electrical switch is used to indicate brake pedal status. This switch is normally closed when the brake pedal is not applied. When the brake pedal is applied the switch will open, changing the signal to the PCM.

## 1-2 SHIFT SOLENOID

Figure 10A-9

This electrical device is used to control fluid flow acting on the 1-2 and 3-4 shift valves. The solenoid is a normally open exhaust valve that is used with the 2-3 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

## 2-3 SHIFT SOLENOID

Figure 10A-9

This electrical device is used to control fluid flow acting on the 2-3 shift valves. The solenoid is a normally open exhaust valve that is used with the 1-2 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

## 3-2 CONTROL SOLENOID

Figure 10A-10

This electrical device is used to control fluid flow acting on the 3-2 shift valve, which then controls the 2-4 band apply rate and 3-4 clutch release rate.

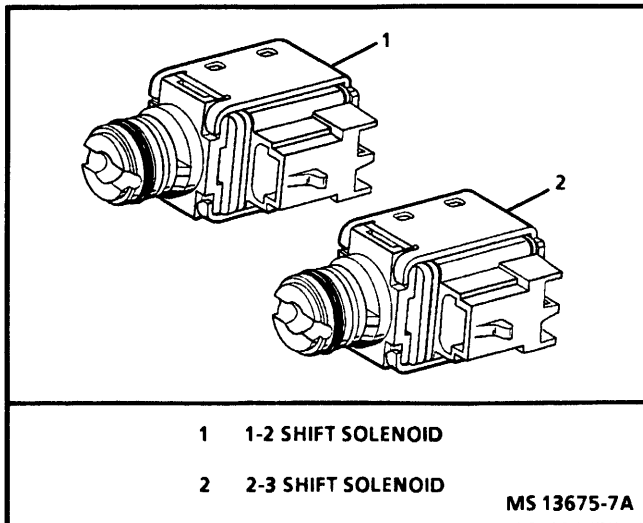


Figure 10A-9 - 1-2 Shift Solenoid or 2-3 Shift Solenoid

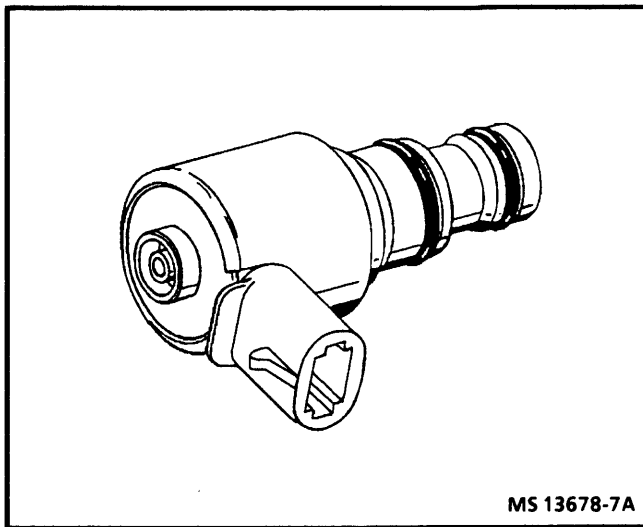


Figure 10A-10 - 3-2 Control Solenoid

It is a pulse width modulated solenoid that operates on a negative duty cycle. This solenoid controls the 3-2 downshift feel and is attached to the control valve body within the transmission.

### PRESSURE CONTROL SOLENOID (PCS) Figure 10A-11

This electrical device is used to control fluid line pressure by controlling actuator feed limit fluid flow acting on an internal spool valve and spring pressure. The solenoid is a normally closed solenoid valve that controls fluid pressure when operating on a duty cycle. The solenoid is attached to the control valve body within the transmission.

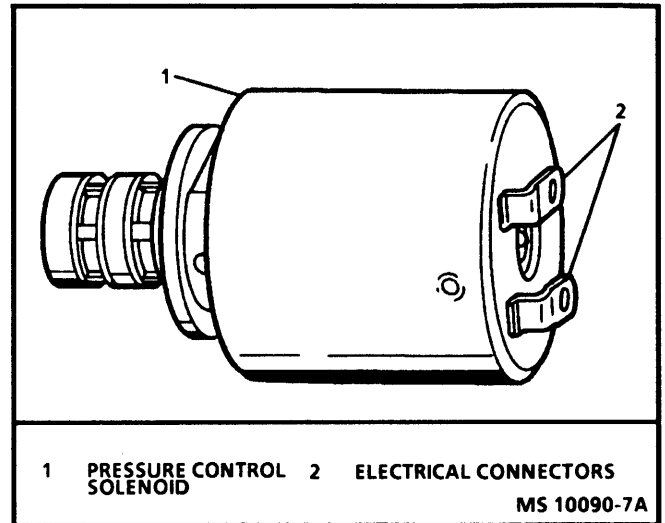


Figure 10A-11 - Pressure Control Solenoid (PCS)

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID Figure 10A-12

This electrical device is used to control fluid acting on the TCC converter clutch valve, which then controls TCC apply and release. This solenoid is attached to the transmission case assembly extending into the pump cover.

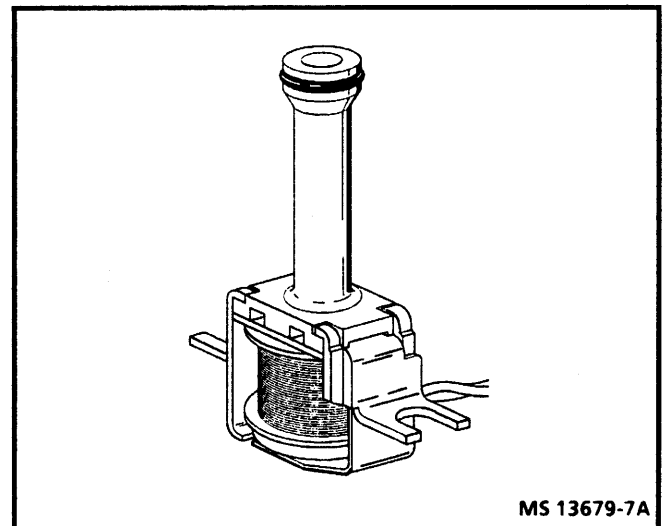


Figure 10A-12 - Torque Converter Clutch (TCC) Solenoid

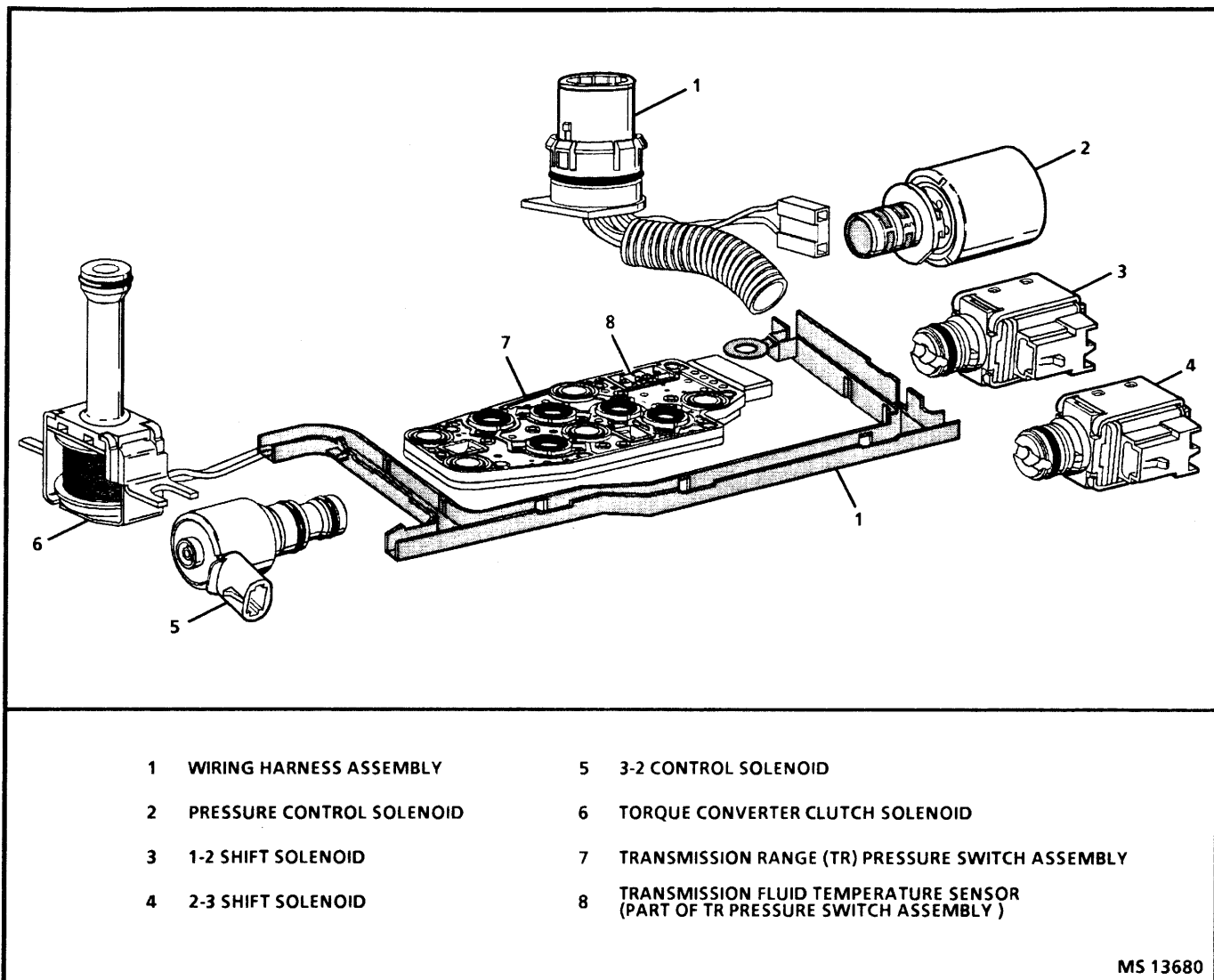


Figure 10A-13 - Electrical Components

## DIAGNOSIS

The PCM is equipped with a self diagnostic feature that detects system failures and aids the technician in locating a faulty circuit. The PCM has memory for comparing the various input information to programmed information. These conditions are described on the facing page of each Diagnostic Trouble Code (DTC) chart. If a value is not within the PCM parameters, a DTC will set and default values will be used.

The PCM will continually perform a self diagnosis check. The PCM can be requested to display any stored DTC by using a scan tool or manually grounding the diagnostic test terminal. When the diagnostic test terminal of the Data Link Connector (DLC) is grounded, the PCM will check the engine speed circuit input, if the voltage is zero, the PCM will flash DTC 12 and any other DTC(s) stored. If DTC 12 will not flash, refer to CHART A-1 or CHART A-2 in SECTION 3 for further diagnostic information.

### Important

- Always refer to the "On-Board Diagnosis (OBD) System Check" before proceeding to diagnose the system.

The scan tool will display all stored DTC(s) in current or history status. A DTC 12 is not a fault condition with the ignition "ON," engine "OFF." When the manual grounding procedure is used, the MIL will flash all DTCs stored in the PCM memory (current and history). The DTC charts assume the DTC is in current status. If the DTC is in history status, the fault may be an intermittent. An "intermittent" DTC is one which will not reset during the current ignition cycle. The facing page of a DTC chart will contain "DIAGNOSTIC AIDS" to help locate intermittent conditions.

If a visual (physical) check does not locate the cause of the fault, J 39200 DVM can be used to test the suspected circuit. The J 39200 DVM can be used to check for opens or shorts:

- **SHORT TO VOLTAGE** - Connect J 39200 to a known good ground on the DC voltage scale.
- **SHORT TO GROUND** - Connect J 39200 to a known good B+ on the DC voltage scale.
- **OPEN CIRCUIT** - Connect J 39200 to each end of the circuit on the ohms scale with voltage removed from the circuit.

## PCM INTERMITTENT DIAGNOSTIC TROUBLE CODES OR PERFORMANCE

The DTC charts in this section determine if there is a fault within the circuit. The fault must be present to locate the problem. If an intermittent condition occurs, a DTC will be stored in history status, but the circuit check will indicate a normal condition. Most intermittent conditions are usually a faulty connection or component. When diagnosing intermittents, thoroughly check the suspected circuits for:

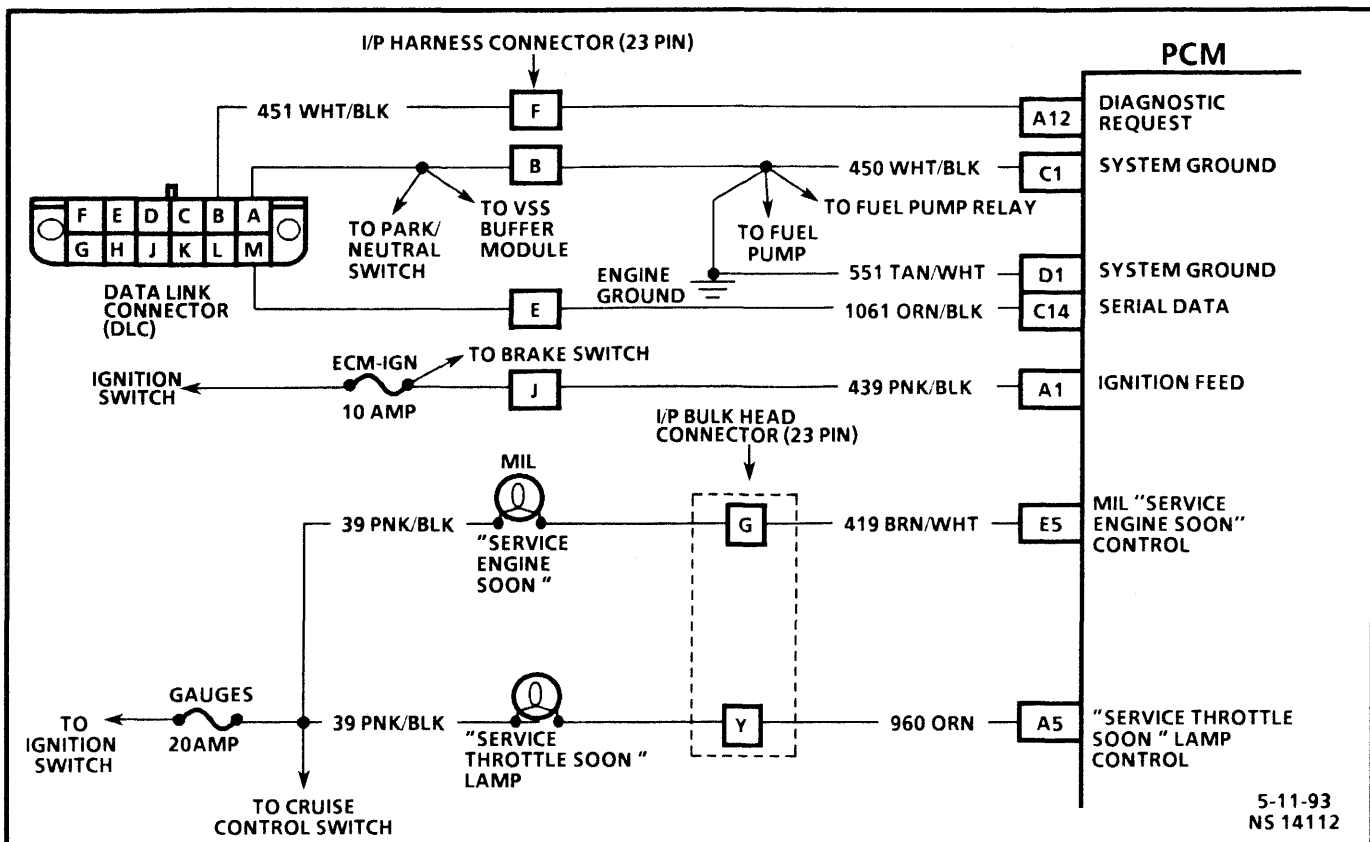
- Poor terminal tension.
- Poor seating of connector halves.
- Poor terminal to wire connection.
- Improperly formed or damaged terminals.
- Improperly installed electrical options.
- Faulty PCM power or ground connection.
- Intermittent short or open.
- Electrical system surges caused by a defective relay, solenoid, or switch. Normally these conditions will occur when the faulty component is operated.

## CLEARING HISTORY DTC(s)

All history DTC(s) can be cleared after all repairs have been completed in the following ways:

1. With a scan tool.
2. By removing voltage from the PCM.
3. Fifty ignition cycles with fault removed.





## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)

### Circuit Description:

The "On-Board Diagnostic (OBD) System Check" is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, this will direct the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it properly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

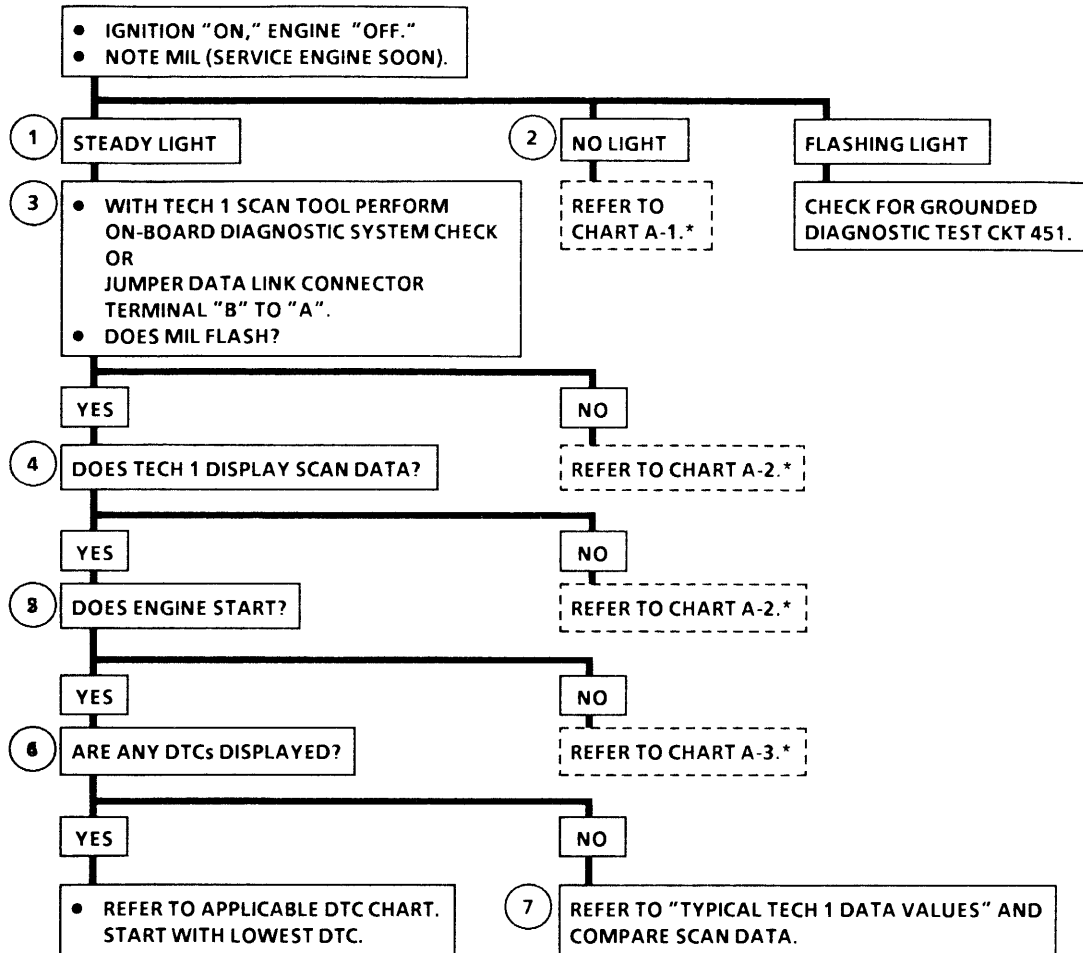
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

- When the ignition switch is cycled to "ON," the MIL should turn "ON" briefly, then "OFF" briefly, then remain "ON" steady. This sequence will determine that the vehicle diagnostics are operational.
- This step will isolate if the customer complaint is a MIL or driveability problem.
- Although the control module is powered up, a symptom could exist because of a system fault.
- Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
- Although the PCM is powered up, a "Cranks But Will Not Run" symptom could exist because of a PCM or system problem.

- This step will isolate if the customer complaint is a MIL or driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM or PCM.
- Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. A base engine problem (i.e., advanced cam timing may substantially alter sensor values).

**NOTICE:** The PCM utilizes a 24 pin "Pink" connector, a 32 pin "Pink" connector and a 32 pin "Blue" connector. The 24 pin "Pink" connector is labeled "A" and "B", the 32 pin "Pink" connector is labeled "C" and "D" and the 32 pin "Blue" connector is a labeled "C" and "D". When referencing PCM connector pinouts, the "Blue" PCM connector will be referred to as the "E" and "F" connector.

## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

\* IN SECTION 3.

5-5-93  
PS 17310

## 10A-12 DRIVEABILITY AND EMISSIONS (DIESEL)

If after completing the On-Board Diagnostic (OBD) system check and finding the Tech 1 diagnostics functioning properly and no DTC(s) displayed, the "Transmission Tech 1 Values" may be used for comparison with values obtained on the vehicle being diagnosed. The "Transmission Tech 1 Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosing. For further description on the values and use of the Tech 1 to diagnosis PCM inputs, refer to "General Description." If all values are within the range illustrated, refer to SECTION 7A14A (4L60E) or 7A17A (4L80E) "Functional Test Procedure."

### TRANSMISSION TECH 1 DATA

Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Closed Loop / Accessories Off

| SCAN Position          | Units Displayed                                      | Typical Data Value           | Refer To Section |
|------------------------|------------------------------------------------------|------------------------------|------------------|
| Engine Speed           | RPM                                                  | ± 50 RPM From desired        | 3                |
| Trans Output Spd       | RPM                                                  | 0 RPM                        | 10A/10B          |
| Eng Cool Temp          | C°/F°                                                | 85°C - 105°C (185°F - 221°F) | 3                |
| Trans Fluid Temp       | C°/F°                                                | 82°C - 94°C (180°F - 200°F)  | 10A/10B          |
| Throt Position         | Volts                                                | 0.3 - 0.9V                   | 3                |
| Throttle Angle         | Percentage                                           | 0%                           | 3                |
| # A/B/C RNG            | Off/On                                               | Off/On/Off                   | 10A              |
| * A/B/C RNG            | Off/On                                               | On/Off/On                    | 10B              |
| Trans Range Sw         | Invalid, Rev,<br>Drive 4, 3,<br>2, Low,<br>Park/Neut | Park/Neut                    | 10A/10B          |
| Commanded Gear         | 1-4                                                  | 1                            | 10A/10B          |
| Adaptable Shift        | No, Yes                                              | No                           | 10A/10B          |
| 1-2 Sol 2-3 Sol        | Off/On                                               | On/On                        | 10A/10B          |
| CTR FDBK 1/2 2/3       | Off/On                                               | On/On                        | 10A/10B          |
| * Trans Input Speed    | RPM                                                  | ± 50 RPM of Engine Speed     | 10B              |
| # 3-2 Control Sol      | Percentage                                           | 0%                           | 10A/10B          |
| # 3-2 Control FDBK     | Off/On                                               | Off                          | 10A              |
| Hot Mode               | No, Yes                                              | No                           | 10A/10B          |
| * TCC PWM Solenoid     | Percentage                                           | 0%                           | 10B              |
| TCC Slip Speed         | RPM                                                  | ± 50 RPM From Engine Speed   | 10A/10B          |
| # TCC Solenoid         | Off/On                                               | Off                          | 10A              |
| # CTR FDBK TCC Sol     | Off/On                                               | Off                          |                  |
| Desired PCS            | Amps                                                 | 1.01 Amps                    | 10A/10B          |
| Actual PCS             | Amps                                                 | 1.01 Amps                    | 10A/10B          |
| PCS Duty Cycle         | Percentage                                           | 40% - 60%                    | 10A/10B          |
| MPH Km/h               | 0-255                                                | 0                            | 10A/10B          |
| 4WD Low Switch         | No, Yes                                              | No                           | 10A/10B          |
| Cruise Engaged         | No, Yes                                              | No                           | 9B               |
| TCC Brake Switch       | Open/Closed                                          | Closed                       | 10A/10B          |
| Kickdown Enabled       | No, Yes                                              | No                           | 10A/10B          |
| * Trans Gear Ratio     | Ratio                                                | 0.00                         | 10B              |
| * Turbine Speed        | RPM                                                  | ± 50 RPM Of Engine Speed     | 10B              |
| 1-2 Shift Time         | Seconds                                              | 0                            | 10A/10B          |
| 2-3 Shift Time         | Seconds                                              | 0                            | 10A/10B          |
| # 1-2 Shift Time Error | Seconds                                              | 0                            | 10A              |
| # Curr Adapt Cell      | % TP                                                 | Not Used                     | 10A              |
| Trans Calib ID         | 0-65535                                              | Internal ID                  | 10A/10B          |
| System Voltage         | Volts                                                | 12.0 - 14.5V                 | 10A/10B          |

# 4L60E Only

\* 4L80E Only

## TRANSMISSION TECH 1 DATA DEFINITIONS

**ENGINE SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

**TRANS OUTPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

**ENGINE (ENG) COOLANT (COOL) TEMPERATURE (TEMP)** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the engine coolant temperature sensor. Engine coolant temperature is high (151°C) when signal voltage is low (0 volt), and engine coolant temperature is low (-40°C) when signal voltage is high (5 volts).

**TRANS FLUID TEMP** - Scan tool displays a range of -40°C to 151°C, -40°F to 304°F. - This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high (151°C) when signal voltage is low (0 volt), and transmission fluid temperature is low (-40°C) when signal voltage is high (5 volts).

**THROTTLE (THROT) POSITION** - Scan tool displays a range of 0.00 volt to 5.10 volts. - This parameter indicates the signal input of the throttle position sensor circuit. Low voltage (approximately .3V to 1.3V) indicates closed throttle, high voltage (approximately greater than 4.5V) indicates wide open throttle.

**THROTTLE ANGLE** - Scan tool displays a range of 0% to 100%. - This parameter indicates the signal input of the throttle position sensor circuit. 0% throttle angle (low voltage) indicates closed throttle, 100% throttle angle (high voltage) indicates wide open throttle.

**A/B/C RANGE (RNG)** - Scan tool displays "ON"/"OFF," "ON"/"OFF," "ON"/"OFF." - These parameters are the three inputs from the transmission range pressure switch assembly. "ON" represents a B+ voltage signal, "OFF" represents a 0 voltage signal.

**TRANS RANGE SWITCH (SW)** - Scan tool displays a range of invalid, Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, and Low. - This parameter is the decoded status of the three A/B/C range inputs from the transmission range pressure switch assembly and represents the position of the transmission manual valve.

**COMMANDED GEAR** - Scan tool displays a range of 1, 2, 3, or 4. - This parameter is the decoded commanded state of the 1-2 and 2-3 shift solenoids.

Gear 1 = "ON," "ON." Gear 2 = "OFF," "ON." Gear 3 = "OFF," "OFF." Gear 4 = "ON," "OFF."

**ADAPTABLE SHIFT** - This value indicates if the current shift will update the 1-2 adapt tables. The adapt tables are used to modify line pressure. The following items cause a shift not to be adaptable:

- Braking pressure (manual gear ranges).
- Long shift delay (shift delay is the time the solenoid changes state until the shift starts).
- Long shift time.
- Throttle range.
- Significant throttle angle change.
- Hot mode.
- Transmission fluid temperature range.
- Manual gear ranges (D1, D2).
- If shift starts too soon after the solenoid state change.
- Diagnostic failures - 21, 22, 24, 28, 53, 58, 59, 72, 73, 75, 79, 81, or 82.
- Time since last shift.
- Time since the last range change.
- Significant vehicle speed change.

**1-2 SOLENOID (SOL)/2-3 SOLENOID (SOL)** - Scan tool displays "ON"/"OFF." - These parameters are the commanded status of the 1-2 and 2-3 shift solenoids. "ON" represents a commanded energized state (current flowing through solenoid). "OFF" represents a commanded non-energized state (current not flowing through solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) 1/2 2/3** - Scan tool displays "ON"/"OFF." - These parameters are the actual states of the 1-2 and 2-3 shift solenoid driver control circuits. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage.

**3-2 CONTROL SOLENOID (SOL)** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded percentage of "ON" time of the 3-2 control solenoid. 0% represents a completely "OFF" (non-energized) commanded state. 100% represents an "ON" (energized) commanded state.

**3-2 CONTROL (CTR) FEEDBACK (FDBK)** - Scan tool displays "ON/OFF." - This parameter is the actual state of the 3-2 control solenoid driver control circuit. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage. The 3-2 control solenoid feedback will normally vary "ON"/"OFF" under normal operating conditions.

## 10A-14 DRIVEABILITY AND EMISSIONS (DIESEL)

**HOT MODE** - The scan tool will display this value either "ON" or "OFF." When displayed "ON," the transmission fluid temperature has become greater than 135°C and the following actions will occur:

1. The TCC will engage in fourth gear, except when the brakes are applied, low TP signal, or a DTC is stored.
2. When the fluid temperature obtains 150°C but, less than 154°C for 15 minutes, DTC 79 will set. When DTC 79 is set, TCC application will still occur in the same criteria as when hot mode started.
3. When fluid temperature increases from 150°C for 1 second, in a time period less than 15 minutes, DTC 79 will not set. DTC 58 will set when transmission fluid temperature is greater than 154°C for 1 second.
4. When DTC 58 is set and in hot mode, the vehicle will retain hot mode criteria until the next ignition cycle.
5. If fluid temperature cools from 135°C down to less than 125°C, hot mode criteria will discontinue.

**TCC SLIP SPEED** - Scan tool displays a range of -4096 RPM to +4095 RPM. - This parameter is the difference between transmission input speed (derived from the distributor reference pulses, or crankshaft/camshaft position sensors) and transmission output speed (derived from the vehicle speed sensor). A negative value indicates input speed is less than output speed (deceleration). A positive value indicates input speed is greater than output speed (acceleration). A value of zero indicates input speed is equal to output speed (TCC applied).

**TCC SOLENOID** - Scan tool displays "ON"/"OFF." - This parameter is the commanded state of the TCC solenoid. "ON" indicates a commanded energized state (current flowing through the solenoid). "OFF" indicates a commanded non-energized state (current not flowing through the solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) TCC SOL** - Scan tool displays "ON"/"OFF." - This parameter is the actual state of the TCC solenoid driver control circuit. "ON" indicates a driver control signal at 0 voltage. "OFF" indicates a driver control signal at B+ voltage.

**DESIRED PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the commanded current of the pressure control solenoid circuit. 0.00 amps (no current flow) indicates commanded higher line pressure. 1.10 amps (high current flow) indicates commanded lower line pressure.

**ACTUAL PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the actual current of the pressure control solenoid circuit at the control module. 0.00 amps (no current flow) indicates actual lower line pressure.

**PRESSURE CONTROL SOLENOID (PCS) DUTY CYCLE** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded state of the pressure control solenoid expressed as a percent of energized on-time. 0% indicates zero on-time (non-energized) or no current flow. 100% indicates maximum on-time (energized) or high current flow. Normal operations range is 0%-60%.

**MPH Km/h** - Scan tool displays a range of 0 mph to 255 mph. - This parameter is input signal from the vehicle speed sensor.

**FOUR WHEEL DRIVE (4WD) LOW SWITCH** - Scan tool displays NO/YES. - This parameter is the signal state of the four wheel drive low circuit. NO indicates a B+ voltage signal (4WD low not requested), YES indicates a 0 voltage signal (4WD low requested).

**CRUISE ENGAGED** - Scan tool displays NO/YES. - This parameter is the signal state of the cruise control "ON"/"OFF" switch. NO indicates a 0 voltage signal (cruise control not requested). YES indicates a B+ voltage (cruise control requested).

**TCC BRAKE SWITCH** - Scan tool displays OPEN/CLOSED. - This parameter indicates the state of the TCC brake switch circuit input. Open indicates a 0 voltage input (brake switch open, brake pedal applied). Closed indicates a B+ voltage input (brake switch closed, brake pedal released).

**KICKDOWN ENABLED** - (Above approximately 75% TPS) Scan tool displays NO/YES. - This parameter indicates whether enabling conditions exist for an acceleration mode downshift. NO indicates enabling conditions (throttle position, vehicle speed, input speed, etc.) do not exist for an acceleration mode downshift. YES indicates enabling conditions exist for an acceleration mode downshift.

**1-2 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 1-2 shift. These are accurate unless adaptable indicates YES.

**2-3 SHIFT TIME** - Scan tool displays a range of 0.00 seconds to 6.38 seconds. - This parameter is the actual time of the last 2-3 shift. Please refer to road test procedure in section 7A14A to achieve accurate 2-3 shift time. 2-3 shift time is normally between 0.3 sec and 1.35 sec.

**1-2 SHIFT ERROR** - Scan tool displays a range of **0.00 seconds to 6.38 seconds**. - This parameter is the difference between the desired 1-2 shift time and the actual 1-2 shift time.

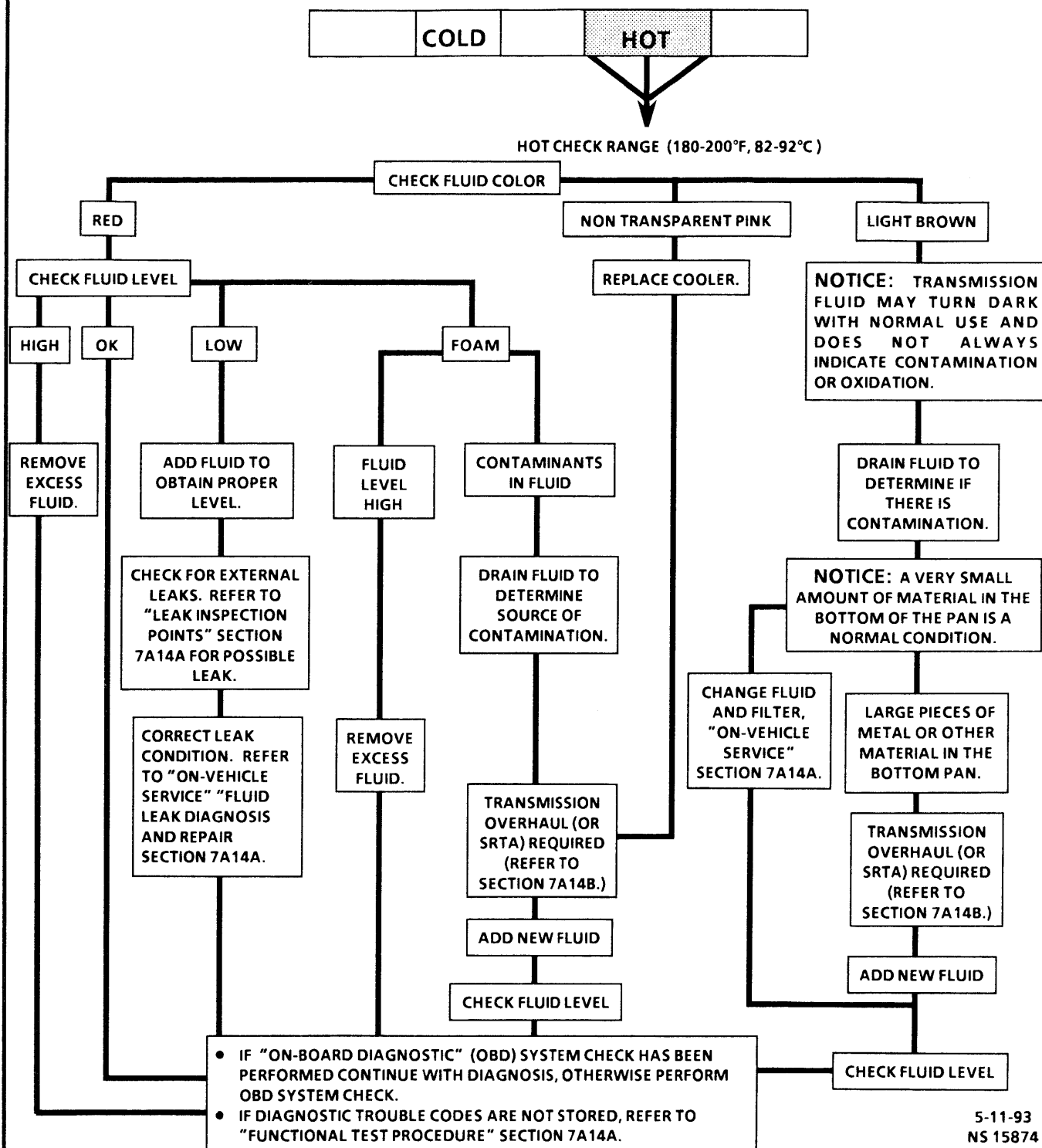
**CURRENT (CURR) ADAPT CELL** - Scan tool displays a range of **NOT USED, 25% TP CELL, 40% TP CELL and 70% TP CELL**. - This parameter indicates the current throttle position cell used for fluid line pressure modification (adaptation). N/A represents 0% to 25% throttle angle. 25% TP CELL represents 25% to 39% throttle cell. 40% TP CELL represents 40% to 70% throttle angle. 70% TP CELL represents 70% to 100% throttle angle.

**TRANS CALIBRATION (CALIB) ID** - Scan tool displays a range of **0000 to 9999**. - This parameter is the four digit identification of the transmission software calibration. ”

**SYSTEM VOLTAGE** - Scan tool displays **0.00 volt to 25.5 volts**. - This parameter is the battery ignition voltage input to the control module.

## 4L60E TRANSMISSION FLUID CHECKING PROCEDURE

1. Warm the transmission to normal operating temperature by driving the vehicle about 15 miles (24 km). Operating temperature is 180-200°F (82-94°C).
  2. Park vehicle on a level surface, place shift lever in "P" park and apply the parking brake.
  3. Check fluid level on the dipstick (read the lower level).
  4. If fluid level is low, add only enough DEXRON®-IIE to bring the fluid level into the hot area.
- \* It is important to check fluid level when the transmission has reached operating temperature. The hot range is calibrated correspond to the correct fluid level range for fluid between 180 and 200°F (82-94°C).



## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A. Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION | DTC NUMBER AND NAME                                                        | SECTION |
|-------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------|---------|
| DTC 13 - Oxygen O2S Sensor Circuit (Open Circuit)                                         | 3A      | *DTC 28 - Transmission Range (TR) Pressure Switch Assembly                 | 10A     |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3A      | DTC 32 - Exhaust Gas Recirculation (EGR) System                            | 3A      |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3A      | DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit High (Low Vacuum) | 3A      |
| DTC 16 - Vehicle Speed Signal (VSS) Buffer Fault (Vehicle Speed Signal)                   | 3A      | DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit Low (High Vacuum) | 3A      |
| DTC 21 - Throttle Position (TP) Sensor Circuit High (Signal Voltage High)                 | 3A      | DTC 35 - IAC Error                                                         | 3A      |
| DTC 22 - Throttle Position (TP) Sensor Circuit Low (Signal Voltage Low)                   | 3A      | *DTC 37 - Brake Switch Stuck "ON"                                          | 10A     |
| DTC 23 - Intake Air Temperature (IAT) Sensor Circuit High (Low Temperature Indicated)     | 3A      | *DTC 38 - Brake Switch Stuck "OFF"                                         | 10A     |
| *DTC 24 - Vehicle Speed Sensor (VSS) Circuit Low (Trans Output Speed Signal)              | 10A     | DTC 41 - 1X Signal Error                                                   | 3A      |
| DTC 25 - Intake Air Temperature (IAT) Sensor Circuit Low (High Temperature Indicated)     | 3A      | DTC 42 - Ignition Control (IC) Error                                       | 3A      |
|                                                                                           |         | DTC 43 - Knock Sensor (KS) Circuit                                         | 3A      |
|                                                                                           |         | DTC 44 - Lean Exhaust                                                      | 3A      |
|                                                                                           |         | DTC 45 - Rich Exhaust                                                      | 3A      |



## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A. **Remember**, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                            | SECTION | DTC NUMBER AND NAME                                                           | SECTION |
|------------------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------|---------|
| DTC 51 - PROM Error (MEM-CAL)                                                                  | 3A      | *DTC 69 - Torque Converter Clutch (TCC) Stuck "ON"                            | 10A     |
| *DTC 52 - System Voltage High Long                                                             | 10A     | *DTC 72 - Vehicle Speed Sensor (VSS) Circuit Loss (Trans Output Speed Signal) | 10A     |
| *DTC 53 - System Voltage High                                                                  | 10A     | *DTC 73 - Pressure Control Solenoid (PCS) Fault (Current Error)               | 10A     |
| DTC 54 - Fuel Pump Relay Circuit (Low Voltage)                                                 | 3A      | *DTC 75 - System Voltage Low                                                  | 10A     |
| DTC 55 - Faulty PCM                                                                            | 3A      | *DTC 79 - Transmission Fluid Over Temp                                        | 10A     |
| *DTC 58 - Transmission Fluid Temperature (TFT) Sensor Circuit Low (High Temperature Indicated) | 10A     | *DTC 81 - 2-3 Shift Solenoid Circuit Fault                                    | 10A     |
| *DTC 59 - Transmission Fluid Temperature (TFT) Sensor Circuit High (Low Temperature Indicated) | 10A     | *DTC 82 - 1-2 Shift Solenoid Circuit Fault                                    | 10A     |
| *DTC 66 - 3-2 Control Solenoid Circuit Fault                                                   | 10A     |                                                                               |         |
| *DTC 67 Torque Converter Clutch (TCC) Solenoid Circuit Fault                                   | 10A     |                                                                               |         |

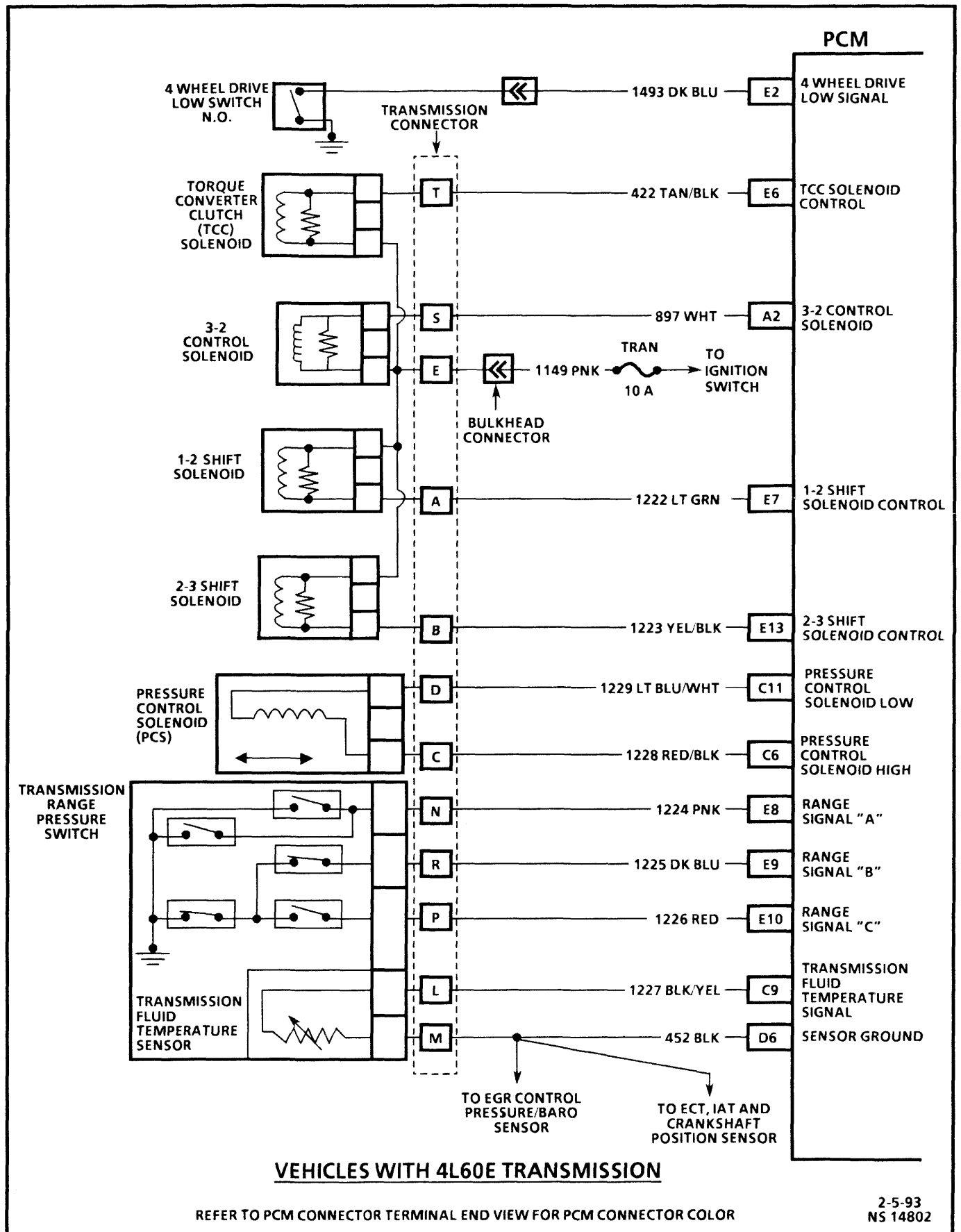
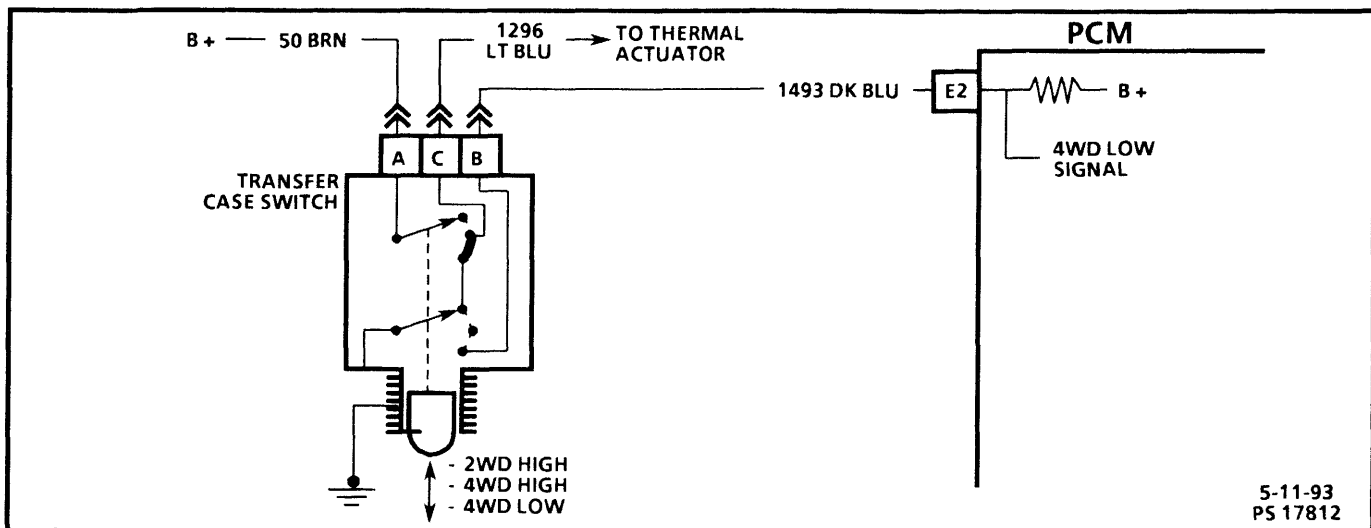


Figure 10A-14 - PCM Wiring Diagram 4L60E Transmission



## 4WD LOW SWITCH SIGNAL CHECK

### Circuit Description:

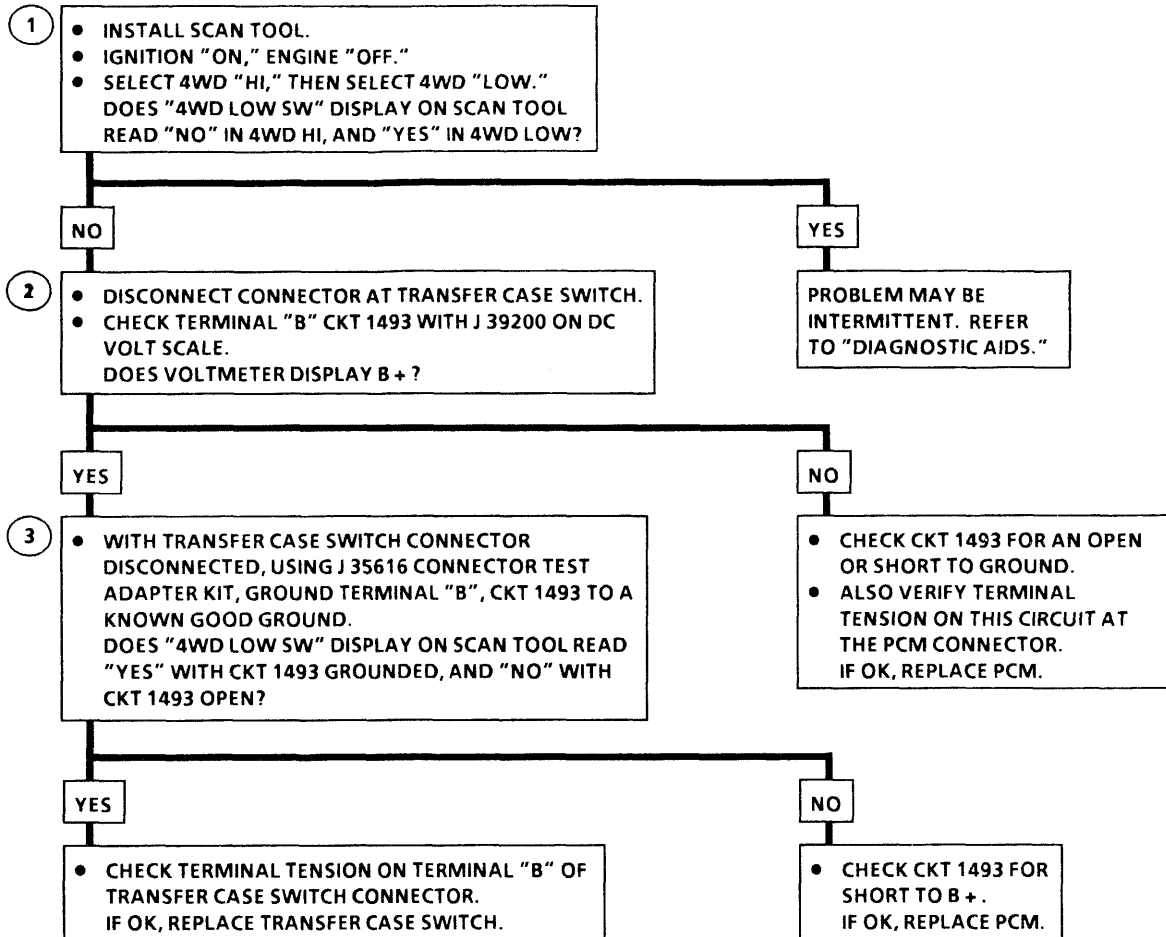
The 4WD low circuit consists of a transfer case switch, front axle actuator, and wiring. The PCM supplies a B+ voltage signal to the transfer case switch on CKT 1493. With 2WD or 4WD HI selected, no ground path is provided for CKT 1493, and the voltage signal at the PCM will be B+. When 4WD low is selected the transfer case switch provides a ground for CKT 1493 and the PCM 4WD low signal CKT 1493 will change from B+ to zero volt. The transfer case switch also completes CKT 50 (B+) to CKT 1296 to provide B+ to the front axle actuator.

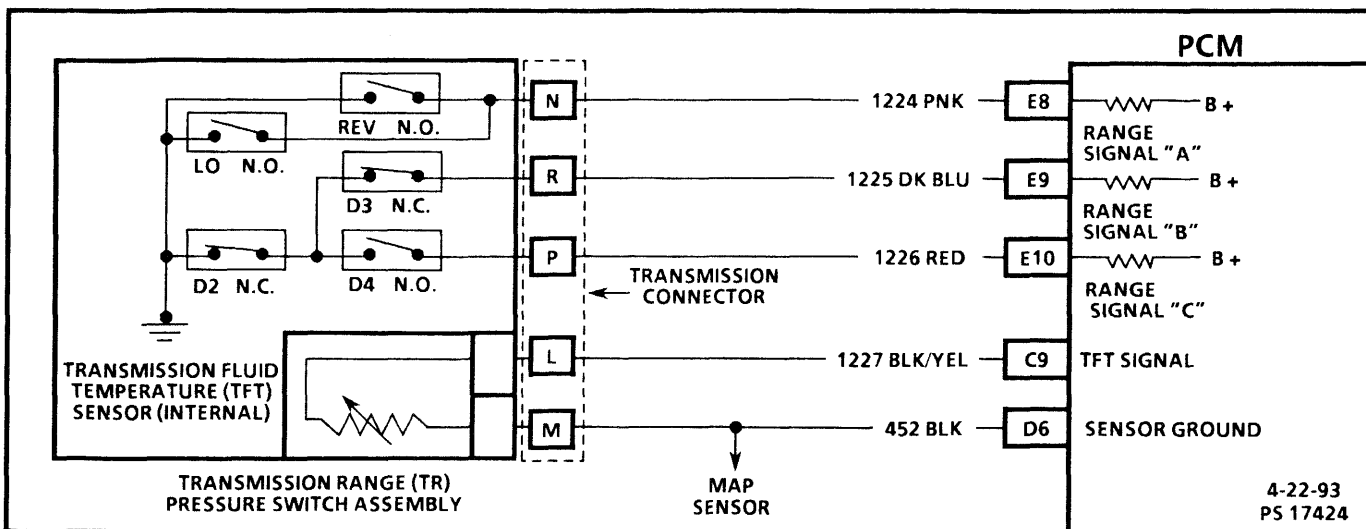
**Action Taken (PCM will default to):** No DTC(s) will be set, however, failures of the 4WD low circuit can cause many types of complaints such as: early/late shifts, erratic shifts.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for proper circuit operation.
2. This test checks for a proper reference signal from the PCM.
3. This test checks the ability of the transfer case switch to ground the reference signal from the PCM.

**Diagnostic Aids:** For further information, refer to SECTION 7D of the appropriate service manual.

**4WD LOW SWITCH SIGNAL CHECK**



## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

### Circuit Description:

The Transmission Range (TR) switch assembly consists of five pressure switches (two normally closed and three normally open), and a TFT sensor combined into one unit and mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** Refer to accompanying chart for various A/B/C range combinations. Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A of the appropriate service manual for further information.

"ON" = 0 volts/"OFF" = B +

### Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Part         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings

## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

- 1
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO

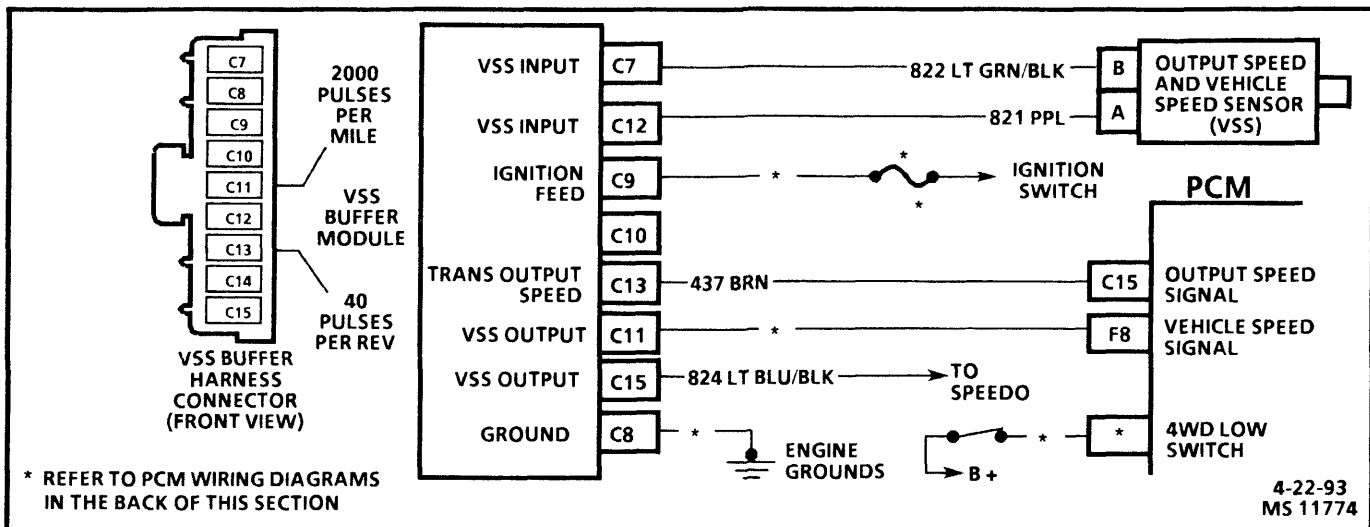
- 3
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

YES

- 2
- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.



## DTC 24

## VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW (TRANS OUTPUT SPEED SIGNAL)

### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

### DTC 24 Will Set When:

- No DTC(s) 21, 22, 28, 33, or 34.
- Not in P/N.
- CKT 437 voltage is constant.
- Engine speed is greater than 3000 RPM.
- Output speed is less than 250 RPM.
- MAP is greater than 100 kPa.
- TP is between 10% and 100%.
- All conditions met for 3 seconds.

**Action Taken (PCM will default to):**

- Maximum line pressure.
- Second gear only.

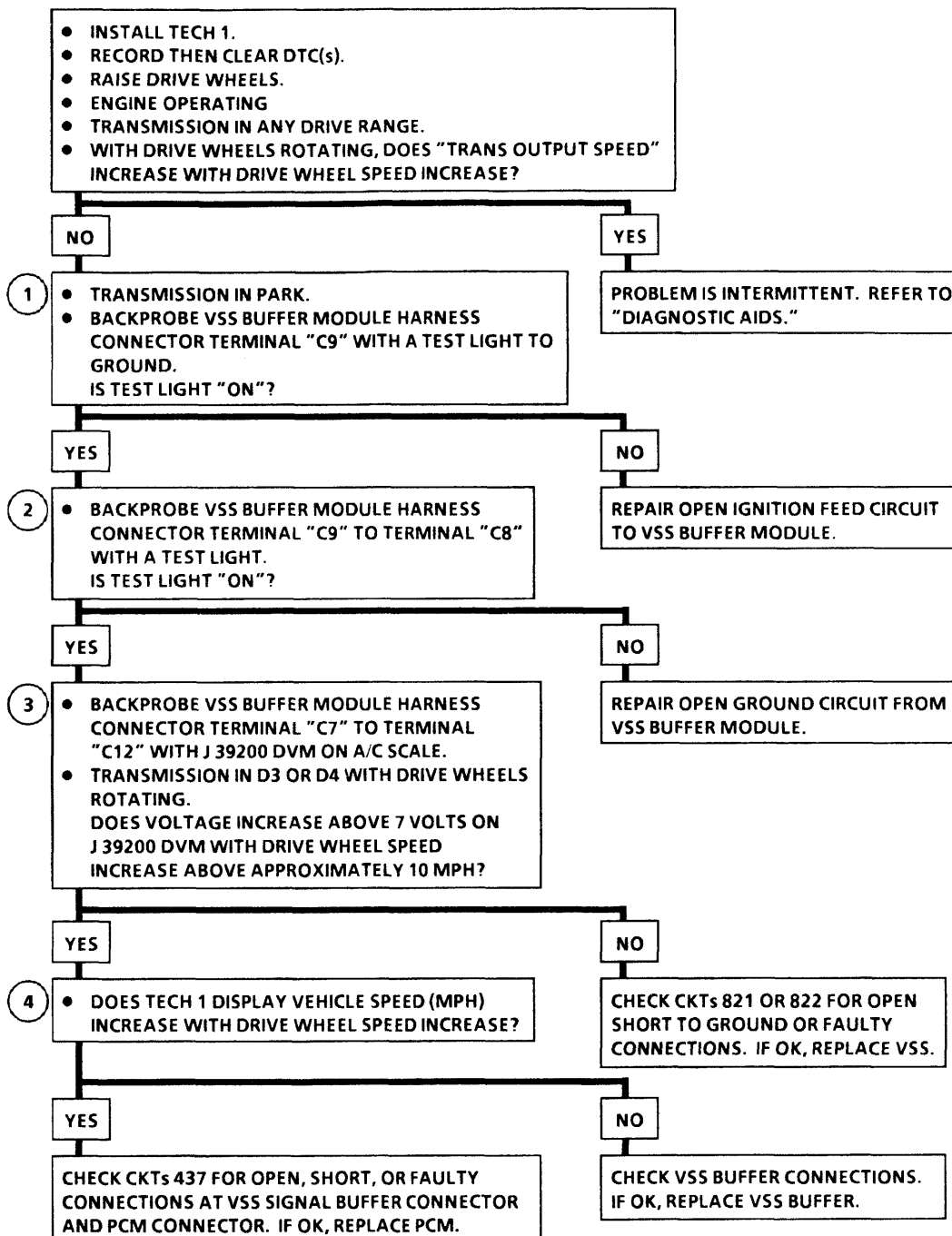
**DTC 24 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

### Diagnostic Aids:

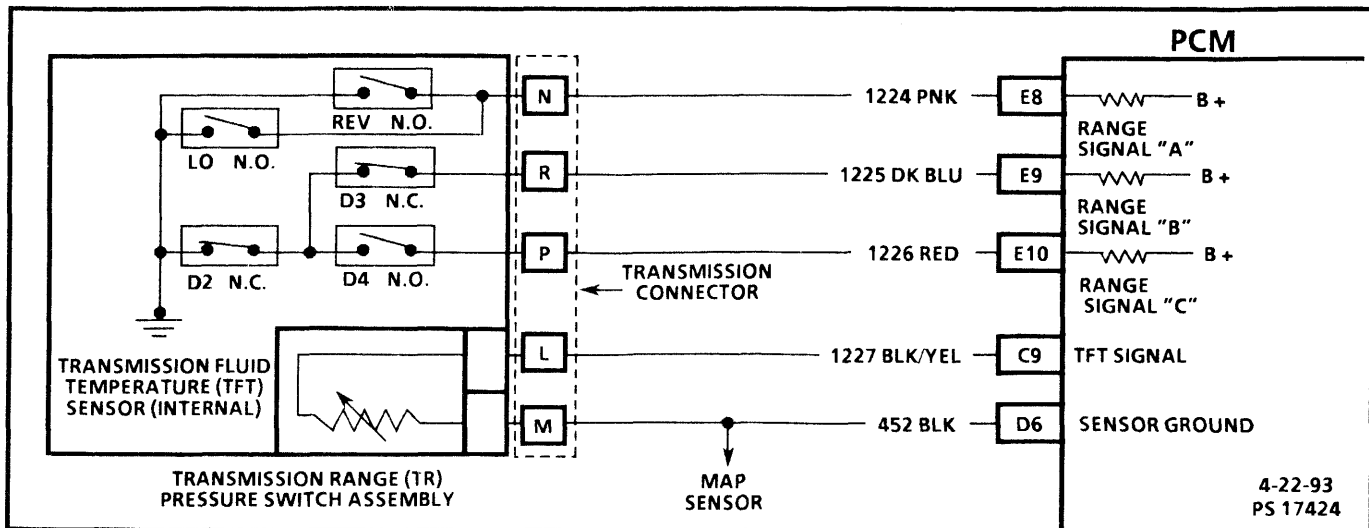
- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

**DTC 24****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697





## DTC 28

### TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT

#### Circuit Description:

The Transmission Range (TR) switch assembly consists of five pressure switches (two normally closed and three normally open), and a TFT sensor combined into one unit and mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

#### DTC 28 Will Set When:

- Range signals "A" and "C" are both zero volts "ON."
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Drive four shift pattern control.
- No fourth gear in hot mode.
- No TCC.

**DTC 28 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled from "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage form the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** DTC 28 will set if the PCM detects one of two "Illegal" combinations.

Refer to accompanying chart for various A/B/C range combinations.

Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A of the appropriate service manual for further information.

"ON" = 0 volts/"OFF" = B +

#### Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Part         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings

**DTC 28****TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT**

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

①

- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO

③

- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

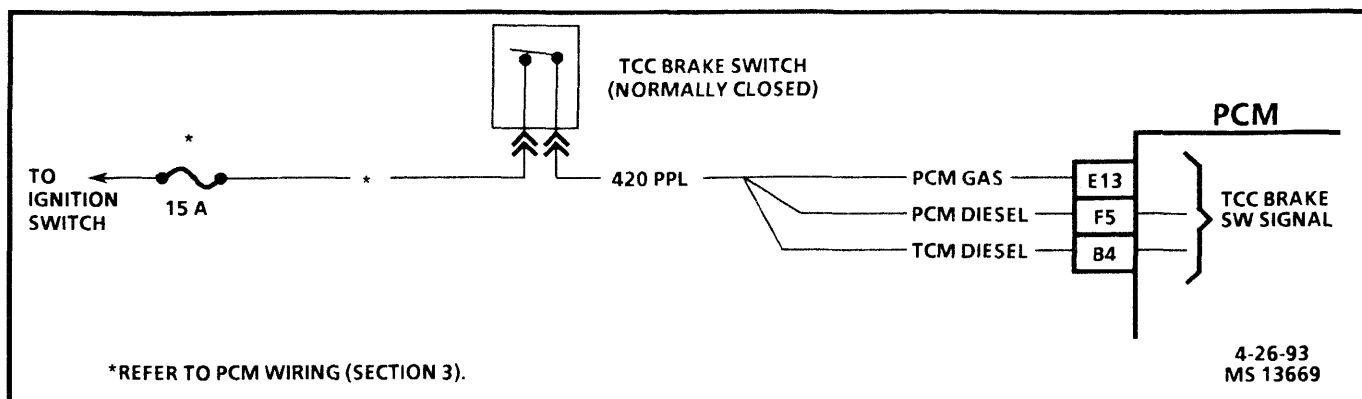
YES

②

- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-27-93  
PS 17065



## DTC 37

### BRAKE SWITCH STUCK "ON"

#### Circuit Description:

The normally closed brake switch supplies a B + signal on CKT 420 to the PCM. The signal voltage is opened when the brakes are applied.

#### DTC 37 Will Set When:

- CKT 420 is open.
  - Vehicle speed is less than 5 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - Then vehicle speed is greater than 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

**Action Taken (PCM will default to):** No fourth gear operation, if in hot mode.

**DTC 37 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

# **DTC 37** **BRAKE SWITCH STUCK "ON"**

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

①

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

②

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

YES

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

YES

③

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

YES

ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

YES

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

NO

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

NO

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

NO

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

NO

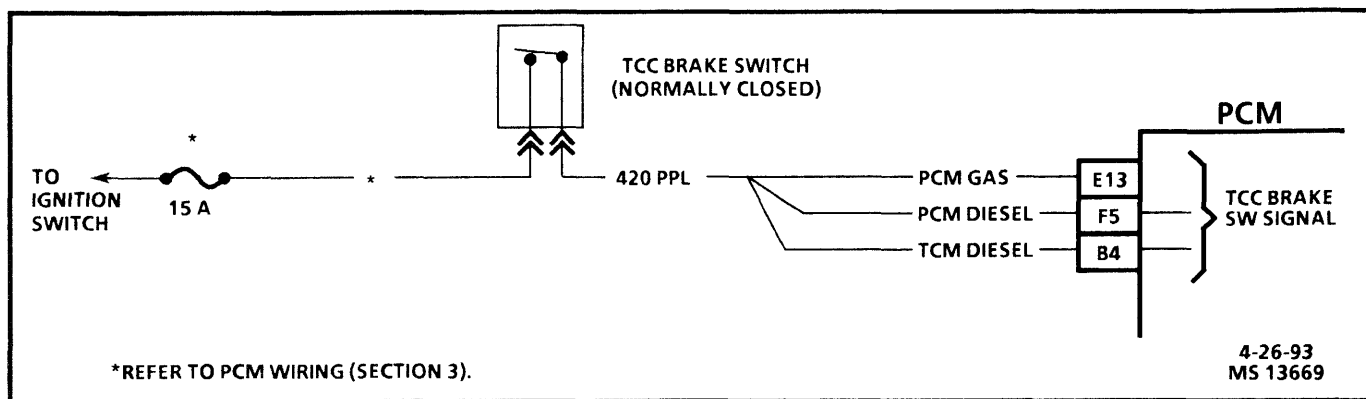
REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

NO

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

## 10A-30 DRIVEABILITY AND EMISSIONS (DIESEL)



### DTC 38

#### BRAKE SWITCH STUCK "OFF"

##### Circuit Description:

The normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The signal voltage is opened when the brakes are applied.

##### DTC 38 Will Set When:

- CKT 420 has constant voltage.
  - Vehicle speed is greater than 20 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

**Action Taken (PCM will default to):** No fourth gear operation, if in hot mode.

**DTC 38 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

##### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

## DTC 38

### BRAKE SWITCH STUCK "OFF"

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

YES

①

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

YES

NO

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

YES

NO

②

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

YES

NO

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

YES

NO

③

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

YES

NO

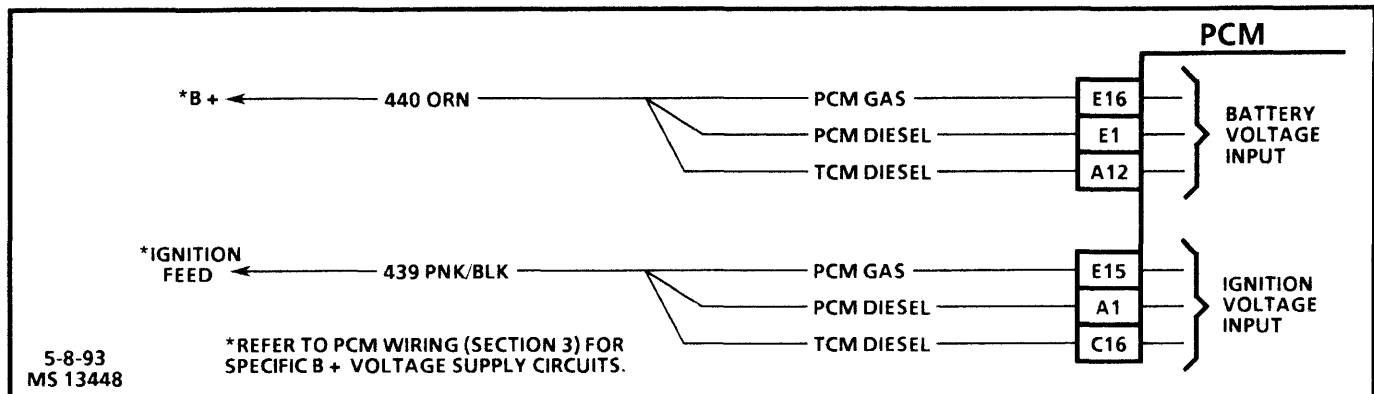
ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-3-93  
PS 17053

## 10A-32 DRIVEABILITY AND EMISSIONS (DIESEL)



### DTC 52

#### SYSTEM VOLTAGE HIGH LONG

##### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

##### DTC 52 Will Set When:

- The ignition is "ON" and the PCM ignition feed voltage is greater than 16 volts.
- All conditions are met for 109 minutes.

##### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Third gear only.

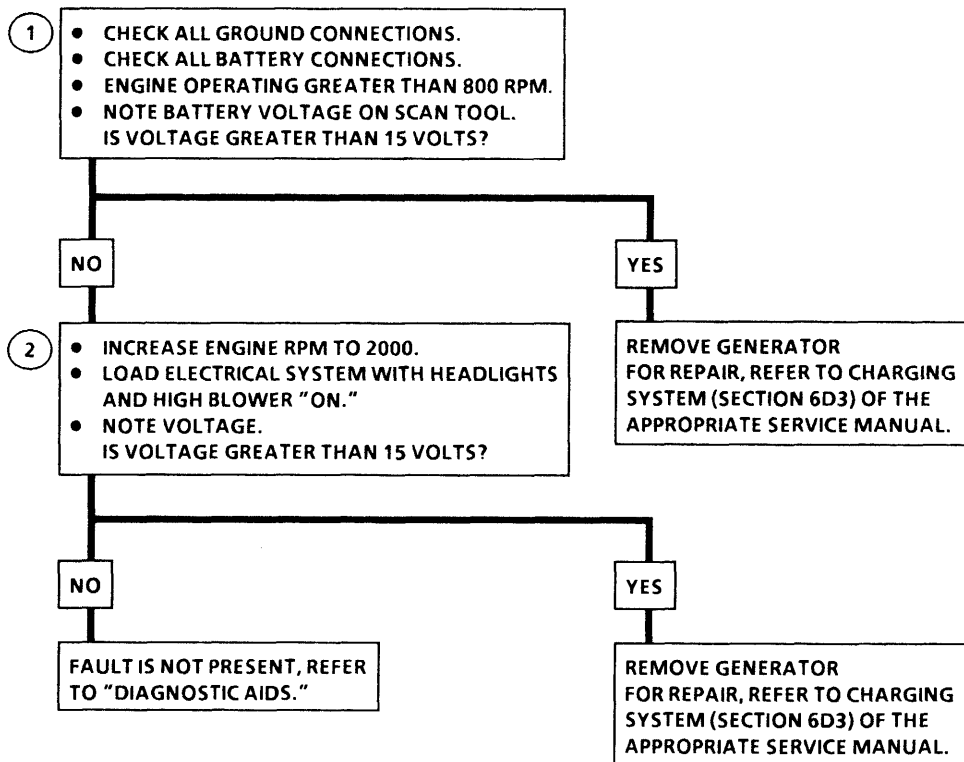
**DTC 52 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

##### Diagnostic Aids:

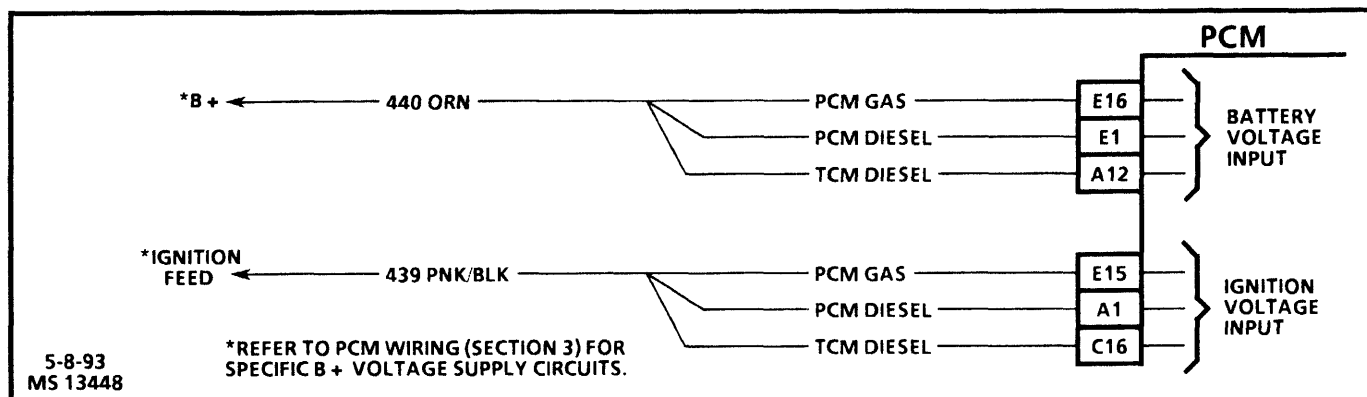
- CKT 440 supplies battery voltage to the PCM.
- Charging the battery with a battery charger and jump-starting an engine may set DTC 52. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 52**  
**SYSTEM VOLTAGE HIGH LONG**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067





## DTC 53

### SYSTEM VOLTAGE HIGH

#### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

#### DTC 53 Will Set When:

- The ignition is "ON" and the PCM ignition feed voltage is greater than 19.5 volts.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Third gear only.

**DTC 53 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

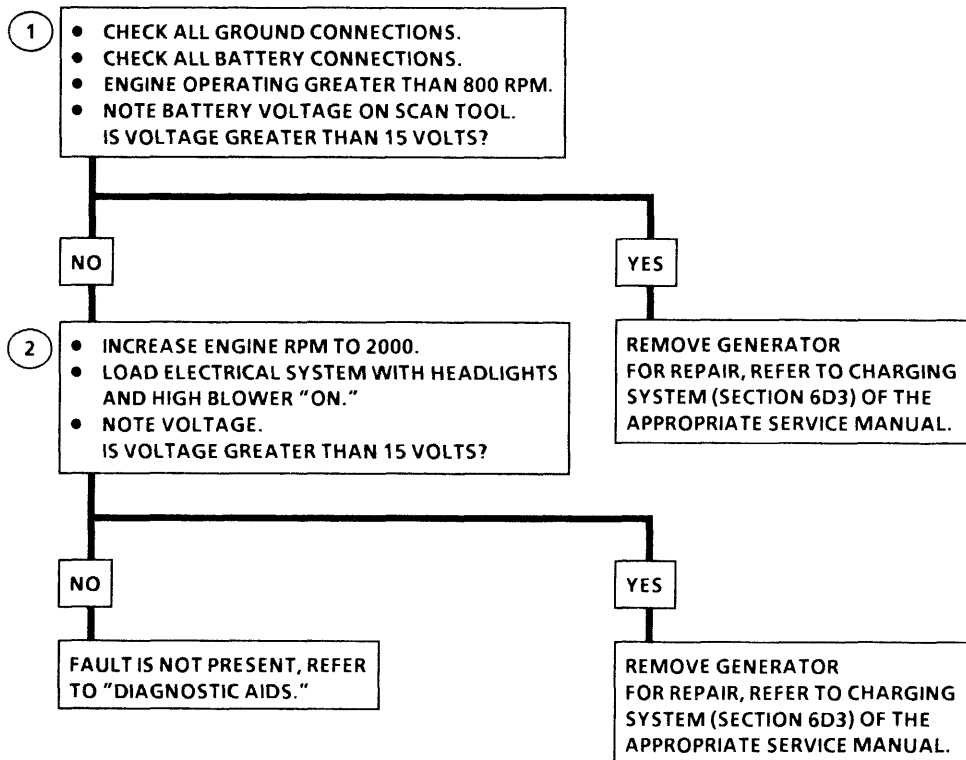
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

#### Diagnostic Aids:

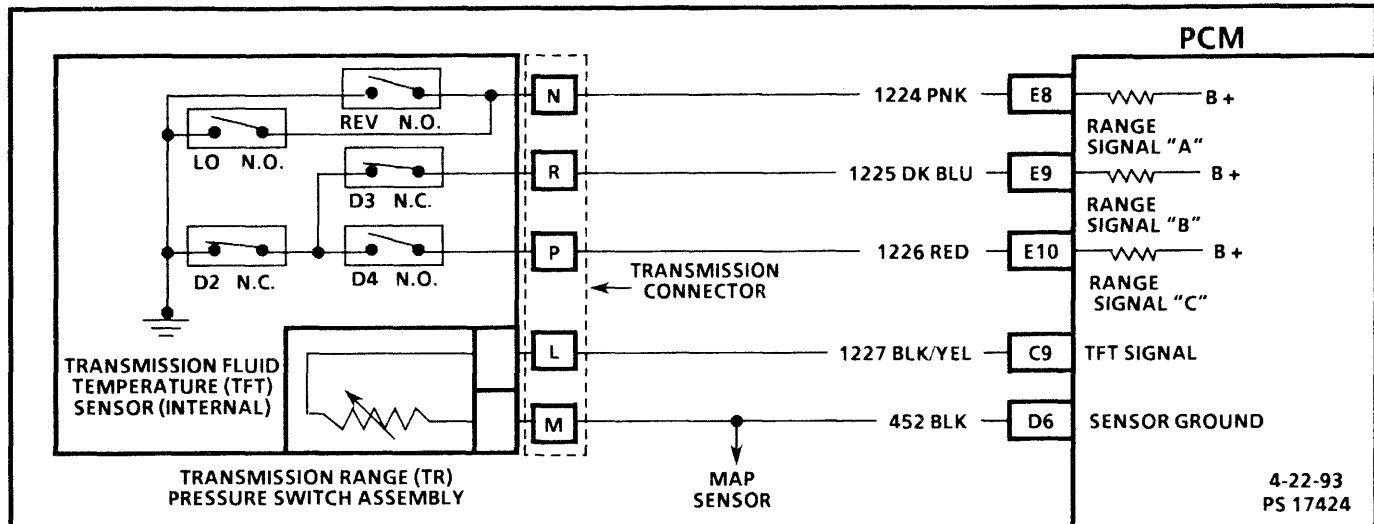
- CKT 440 supplies battery voltage to the PCM.
- Charging the battery with a battery charger and jump-starting an engine may set DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

# **DTC 53** **SYSTEM VOLTAGE HIGH**



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067



## DTC 58

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts. With a DTC 79 also set, check the transmission cooling system.

#### DTC 58 Will Set When:

- Signal voltage indicates TFT greater than 151°C (306°F).
- All conditions are met for 1 second.

**Action Taken (PCM will default to):** The transmission will use a warm value for operation, but the scan tool will display the actual fluid temperature

**DTC 58 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

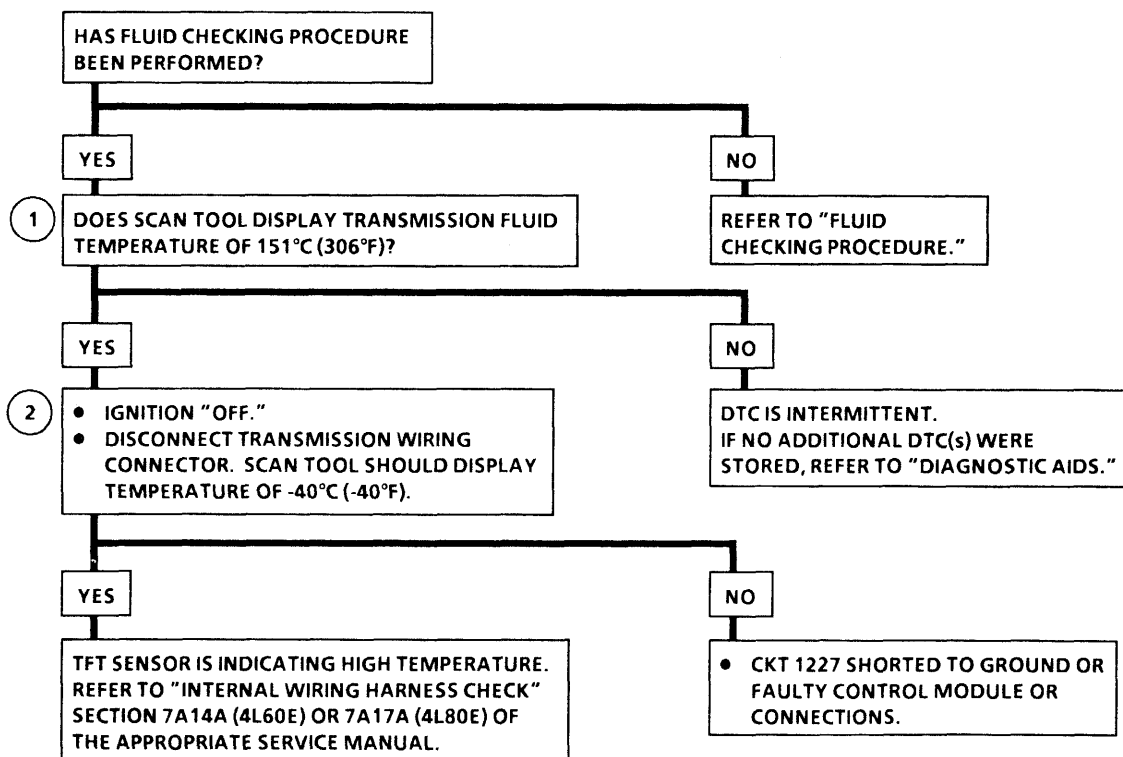
1. This test checks for a short to ground or a skewed sensor.
2. This test checks for an internal fault within the transmission by creating an open.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C (212°F) then stabilize.

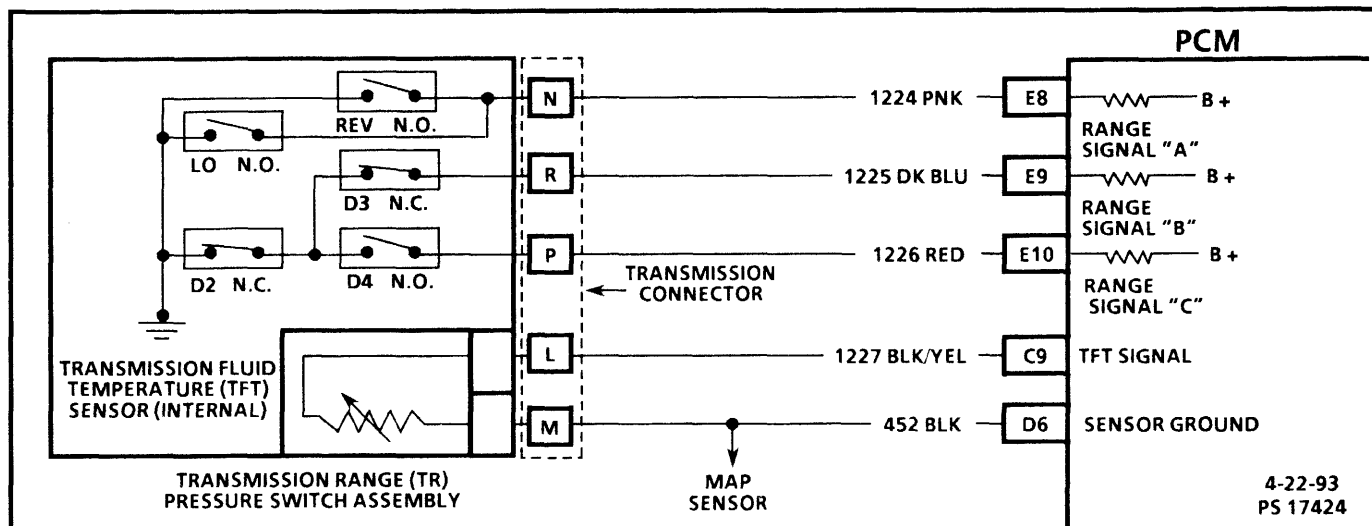
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A14A may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" (mis-scaled) sensor could result in delayed garage shifts or TCC complaints.

**DTC 58****TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-29-93  
MS 13671



## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies 5 volts to the sensor on CKT 1227. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases at about 1.5 to 2.0 volts.

#### DTC 59 Will Set When:

- Signal voltage indicates TFT less than -40°C (-40°F).
- All conditions are met for 1 second.

**Action Taken (PCM will default to):** The transmission will use a warm value for operation, but, the scan tool will display the actual fluid temperature.

**DTC 59 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for a skewed sensor.
2. This test simulates a DTC 58. If the PCM recognizes the low signal voltage (high temperature), and the scan displays 146°C (295°F) or greater, the PCM and wiring are OK.
3. This test checks if CKT 1227 is open. There should be 5 volts present at the sensor connector if measured with J 39200.

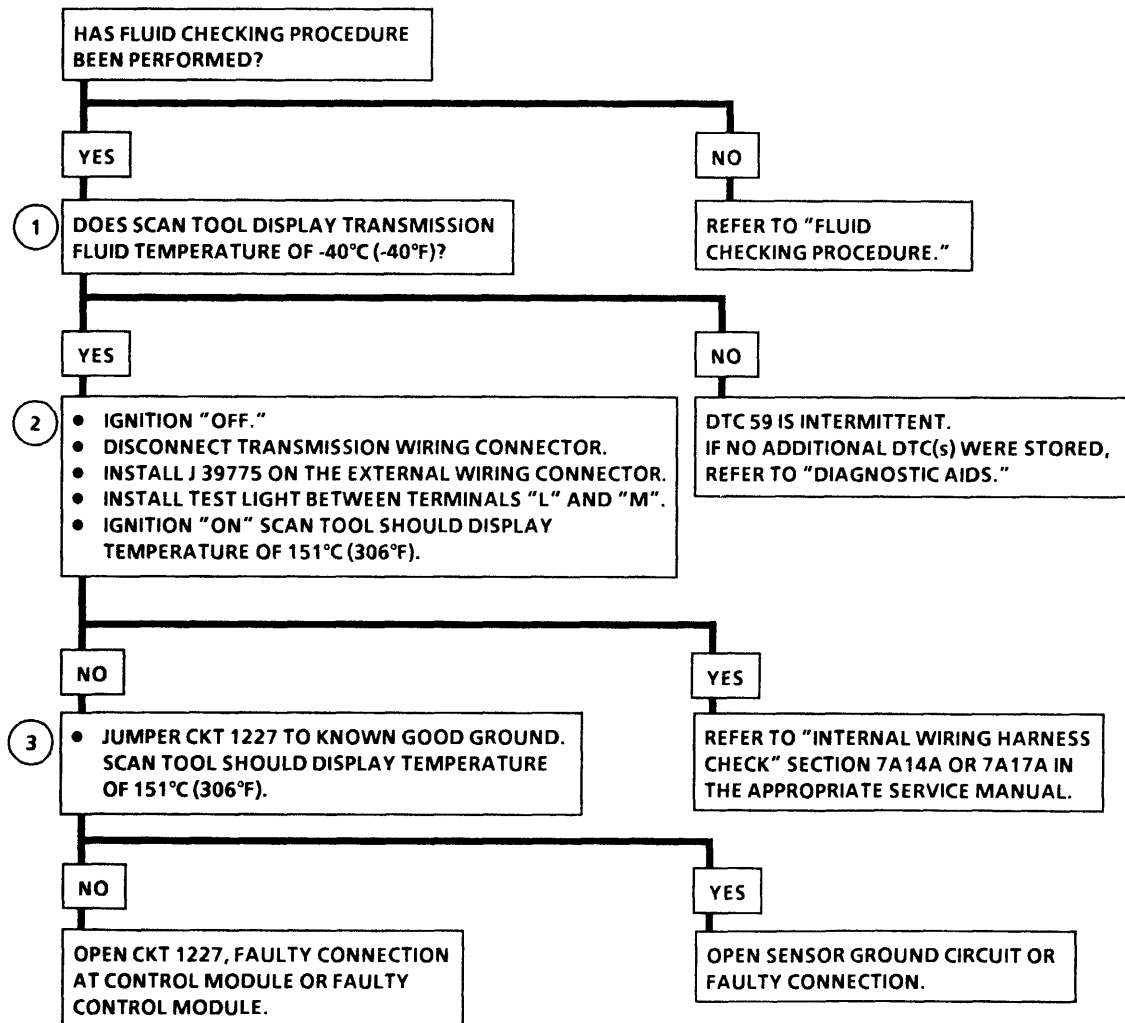
**Diagnostic Aids:** Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100°C (212°F) then stabilize.

A faulty connection or an open in CKT 455 or CKT 1227 can result in a DTC 59.

The "Temperature to Resistance Value" scale in SECTION 7A14A may be used to check the TFT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor can result in firm shifts, or TCC complaints.

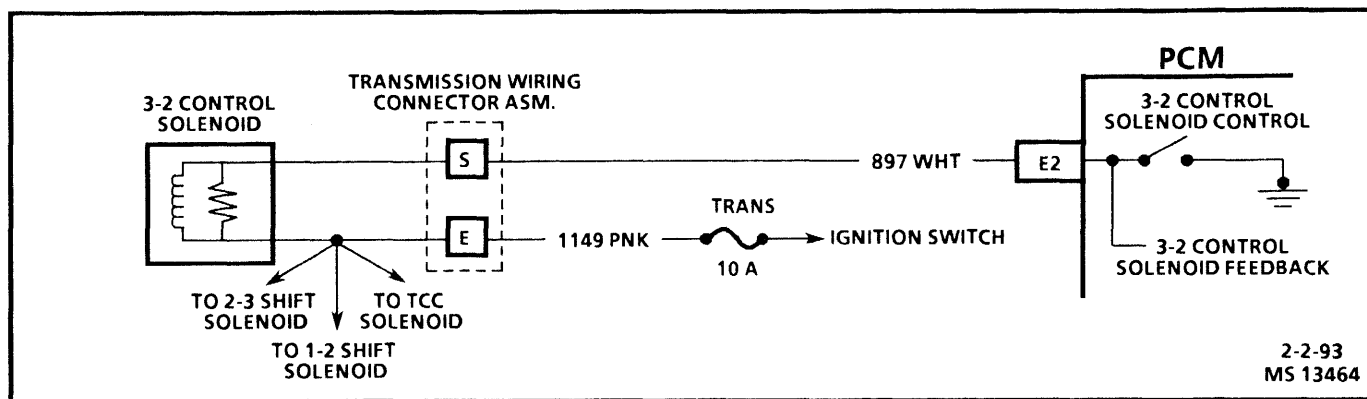
## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13451



## DTC 66

### 3-2 CONTROL SOLENOID CIRCUIT FAULT

#### Circuit Description:

Hydraulically, the 3-2 control solenoid coordinates the apply rate of the 2-4 band with hydraulic release, of the 3-4 clutch during a 3-2 downshift.

The PCM continually monitors the 3-2 circuit duty cycle depending on the commanded state of the circuit. When the transmission is in first gear the duty cycle of the solenoid is equal to 0. When the transmission is in second gear or higher the duty cycle of the solenoid will be about 90%. When the transmission downshifts, 3-2, the duty cycle of the solenoid will drop.

#### DTC 66 Will Set When:

- The PCM commands the solenoid "ON," and the voltage at the PCM remains high.
- The PCM commands the solenoid "OFF," and the voltage at the PCM remains low.
- All conditions are met for 4 seconds.

#### Action Taken (PCM will default to):

- A delayed (soft) landing to third gear.
- Third gear starts.

**DTC 66 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the function of the 3-2 control solenoid and the internal transmission harness.
2. This test checks for power to the 3-2 control solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections at the transmission connector.

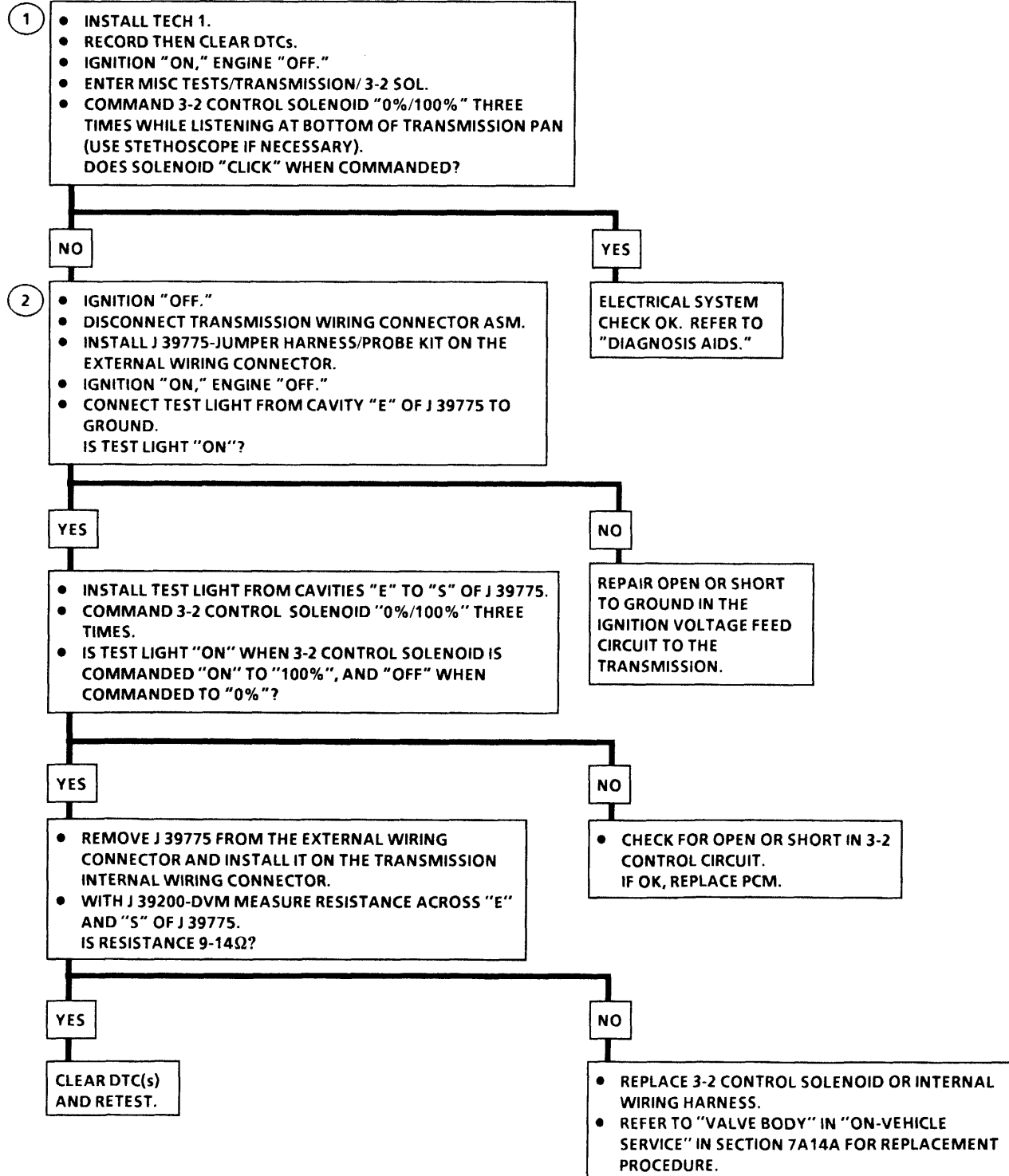
If OK, refer to "PCM Intermittent Diagnostic Trouble Codes or Performance" or "Symptom Diagnosis" in SECTION 7A14A.

The 3-2 control solenoid feedback normally oscillate "ON"/"OFF" when the duty cycle is applied.

An open in the ignition feed circuit will cause multiple DTC(s) to set.

# DTC 66

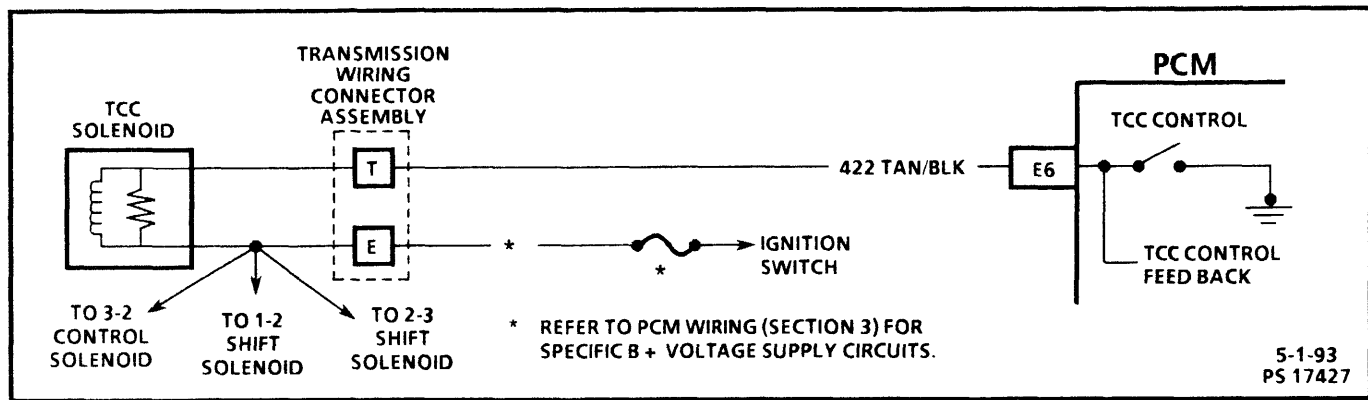
## 3-2 CONTROL SOLENOID CIRCUIT FAULT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
MS 13465





## DTC 67

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the TCC solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 422.

#### DTC 67 Will Set When:

- The PCM commands the TCC solenoid "ON," and the voltage stays high (B+).
- The PCM commands the solenoid "OFF," and the voltage drops to zero volts.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- No fourth gear in hot mode.

**DTC 67 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the PCM's ability to control the solenoid.
2. This test checks power supply to the TCC solenoid.

**Diagnostic Aids:** Check all connections at the transmission wiring connector ASM.

If OK refer to "PCM Intermittent Diagnostic Trouble Codes or Performance" or "Symptom Diagnosis" in SECTION 7A14A.

Some slight TCC slip is normal.

An open in the ignition feed circuit will cause multiple DTC(s) to set.

A short to ground in the TCC circuit may also cause a DTC 69 to set. If the TCC circuit is shorted to ground, the TCC will hydraulically engage in D2.

**DTC 67****TORQUE CONVERTER CLUTCH (TCC)  
SOLENOID CIRCUIT FAULT****1**

- INSTALL TECH 1.
- RECORD THEN CLEAR DTCs.
- IGNITION "ON," ENGINE "OFF."
- ENTER MISC TESTS/TRANSMISSION/TCC SOLENOID.
- COMMAND TCC SOLENOID "ON"/"OFF" THREE TIMES WHILE LISTENING AT BOTTOM OF TRANSMISSION PAN (USE STETHESCOPE IF NECESSARY).
- DOES SOLENOID "CLICK" WHEN COMMANDED?

**NO****YES**

ELECTRICAL SYSTEM  
CHECK OK. REFER TO  
"DIAGNOSTIC AIDS."

**2**

- IGNITION "OFF."
- DISCONNECT TRANSMISSION WIRING CONNECTOR ASM. (ADDITIONAL DTCs WILL SET.)
- INSTALL J 39775 JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
- IGNITION "ON," ENGINE "OFF."
- CONNECT TEST LIGHT FROM CAVITY "E" OF J 39775 TO GROUND.  
IS TEST LIGHT "ON"?

**YES****NO**

- INSTALL TEST LIGHT FROM CAVITIES "E" TO "T" (4L60E) OR "E" TO "S" (4L80E) OF J 39775.
- COMMAND TCC SOLENOID "ON"/"OFF" THREE TIMES.
- IS TEST LIGHT "ON" WHEN COMMANDED "ON" AND "OFF" WHEN COMMANDED "OFF"?

REPAIR OPEN OR SHORT TO GROUND IN THE  
IGNITION VOLTAGE FEED CIRCUIT TO THE  
TRANSMISSION. IF THE FUSE IS OPEN, CHECK  
THE TRANSMISSION INTERNAL WIRING HARNESS  
OR SOLENOID FOR SHORT TO GROUND.

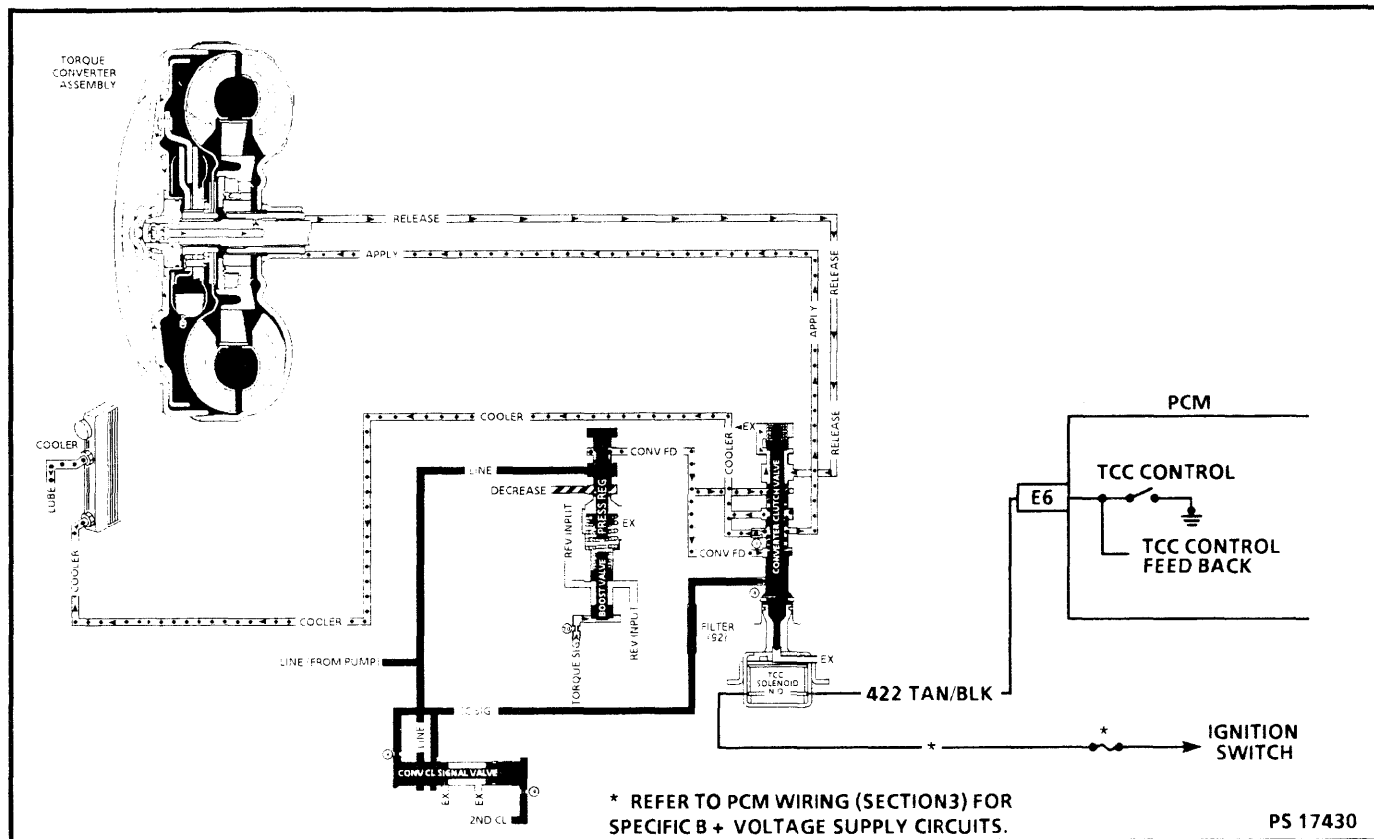
**NO****YES**

- CHECK CKT 422 (4L60E) OR CKT 1350 (4L80E) FOR AN OPEN OR SHORT FROM THE CONTROL MODULE TO THE TRANSMISSION WIRING CONNECTOR. IF OKAY, REPLACE CONTROL MODULE.

EXTERNAL TRANSMISSION WIRING  
CHECKS OKAY. REFER TO "INTERNAL  
WIRING HARNESS CHECK" IN  
SECTION 7A14A (4L60E) OR 7A17A (4L80E).

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17530



## DTC 69

### TORQUE CONVERTER CLUTCH (TCC) SOLENOID STUCK "ON"

#### Circuit Description:

The PCM energizes the Torque Converter Clutch (TCC) solenoid by grounding CKT 422 with an internal quad-driver. The TCC solenoid allows converter release fluid to exhaust past the #9 check ball, applying the TCC. The TCC solenoid will de-energize when the quad-driver no longer provides a ground. When the TCC solenoid is de-energized, this will block exhaust fluid, and release the TCC.

#### DTC 69 Will Set When:

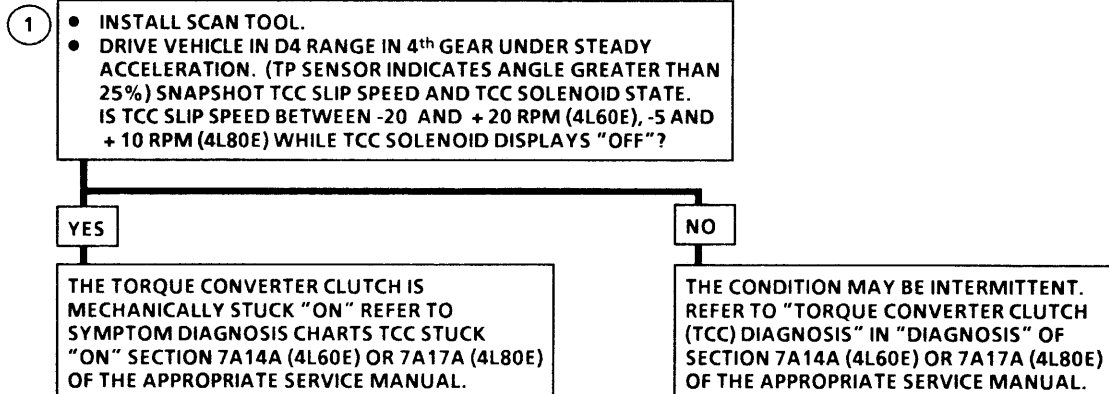
- No DTC(s) 21, 22, or 28 are set.
- TCC slip speed RPM indicates between -20 and +20.
- TCC solenoid is commanded "OFF."
- TP sensor signal is greater than 25%.
- Trans range switch indicates D3 or D4.
- Commanded gear indicates 3<sup>rd</sup> or 4<sup>th</sup> gear.
- Engine speed is greater than 300 RPM.
- All conditions are met for 4 seconds.

**DTC 69 Will Clear When:** Fault condition no longer exists and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

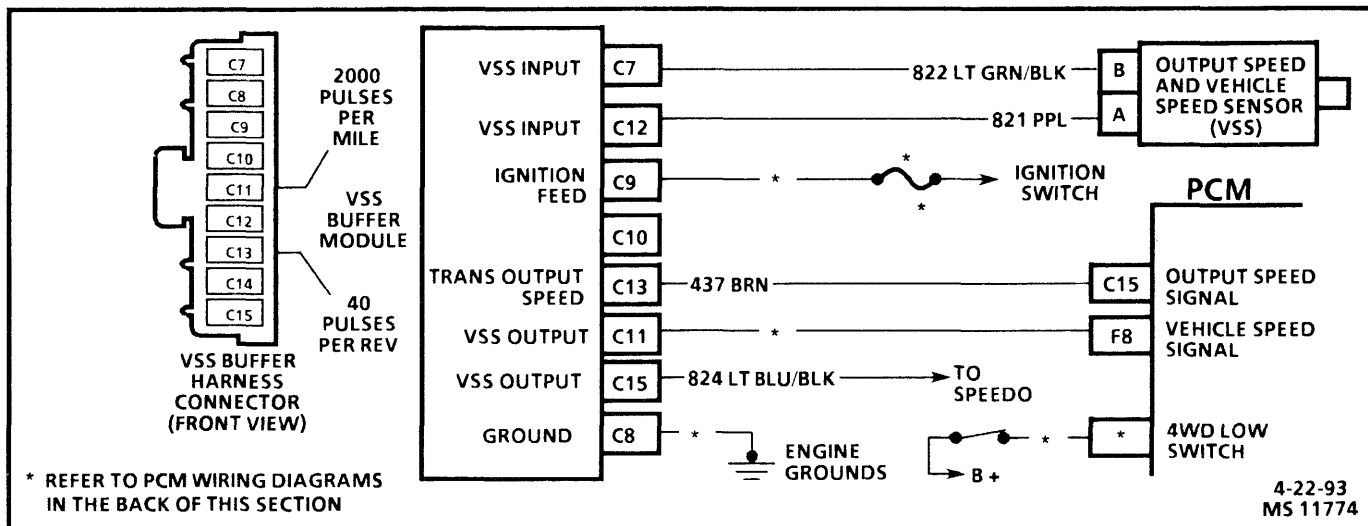
1. This test checks the mechanical state of the TCC. When the PCM commands the TCC solenoid "OFF," TCC slip speed should increase.

**Diagnostic Aids:** If the TCC is mechanically stuck "ON," vehicle speed is zero, brakes are applied, and D2 is selected, the TCC fluid will mechanically apply the TCC causing an engine stall.

**DTC 69****TORQUE CONVERTER CLUTCH (TCC) SOLENOID STUCK "ON"**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17052



## DTC 72

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

#### DTC 72 Will Set When:

- Not in P/N.
  - No DTC 28 set.
  - Transmission output speed change is greater than 1000 RPM.
  - Engine speed is greater than 200 RPM.
  - All conditions met for 2 seconds.
- In P/N.
  - No DTC 28 set.
  - Transmission output speed change is greater than 2050 RPM.
  - Engine speed is greater than 200 RPM.
  - All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- A (soft) delayed landing to second gear.
- Maximum line pressure.

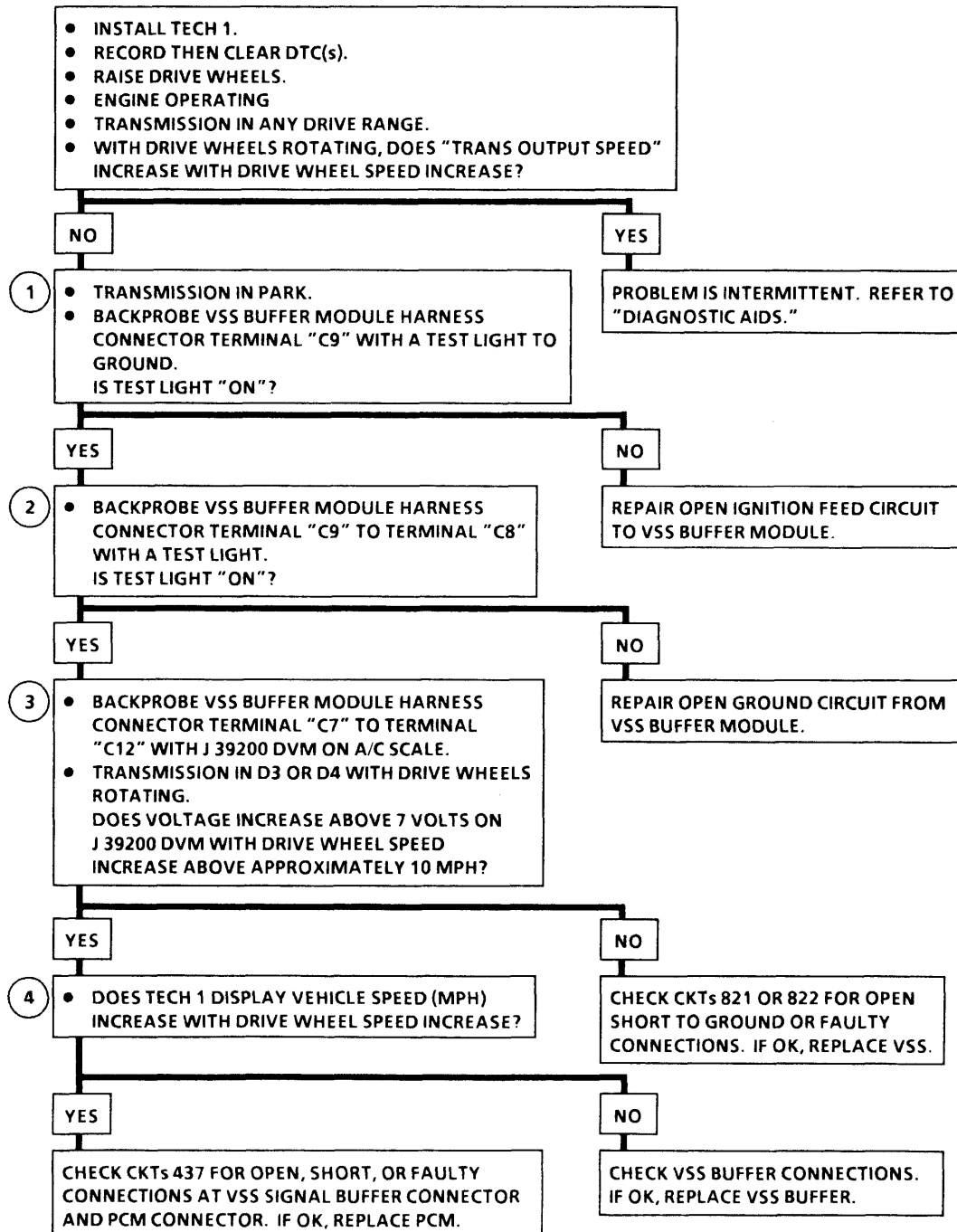
**DTC 72 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

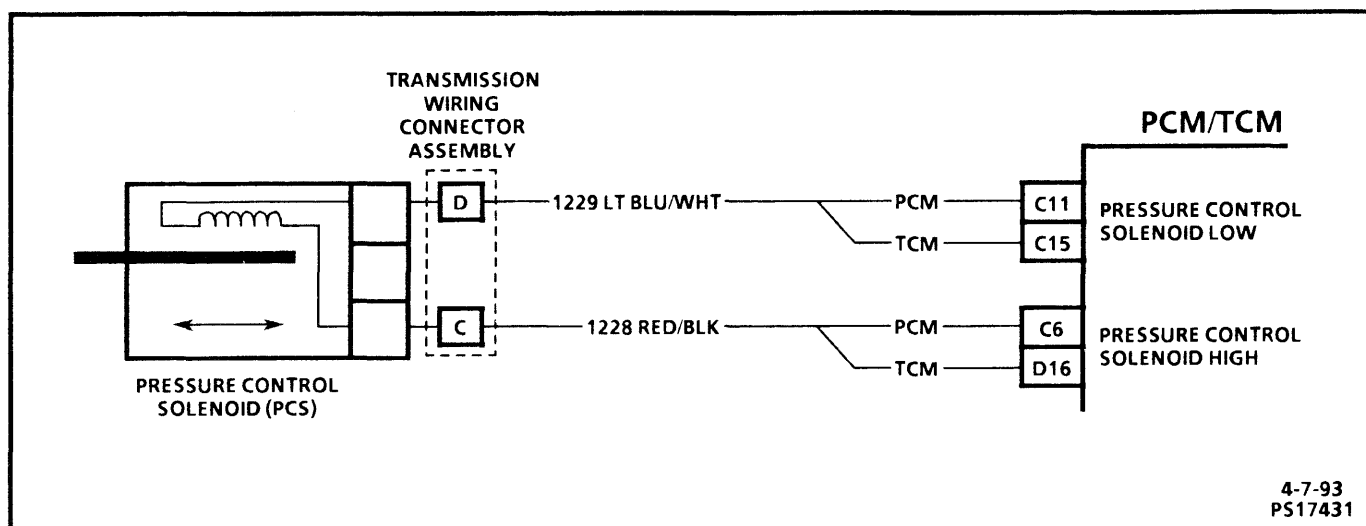
#### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

**DTC 72****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697



## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)

#### Circuit Description:

The pressure control solenoid is a PCM controlled device used to regulate transmission line pressure. The PCM compares TP voltage, engine RPM and other inputs to determine the line pressure appropriate for a given load. The PCM will regulate the pressure by applying a varying amperage to the pressure control solenoid. The applied amperage can vary from 0.1 to 1.1 amp. The PCM then monitors the amperage at the return line.

#### DTC 73 Will Set When:

- No DTC 75.
- The return amperage varies greater than 0.16 amp from the commanded amperage.
- All conditions met for 1 second.

**Action Taken (PCM will default to):** Maximum line pressure.

**DTC 73 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the pressure control solenoid.
2. This test checks internal transmission harness and the pressure control solenoid for incorrect resistance.

**Diagnostic Aids:** Check for poor connections at PCM and at transmission connector.

**DTC 73****PRESSURE CONTROL SOLENOID (PCS) CIRCUIT  
(CURRENT ERROR)****1**

- INSTALL TECH 1.
  - RECORD THEN CLEAR DTC(s).
  - ENGINE OPERATING, TRANSMISSION IN PARK.
  - ENTER MISC TESTS/TRANSMISSION/PCS CONTROL.
  - USING TECH 1, APPLY 1.0 AMPS THRU 0.1 AMPS WHILE OBSERVING DESIRED PCS AND ACTUAL PCS.
- IS ACTUAL PCS READING ALWAYS WITHIN 0.16 AMPS OF DESIRED PCS?

NO

YES

**2**

- IGNITION "OFF."
- DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
- INSTALL J 39775 JUMPER HARNESS/PROBE KIT ON THE TRANSMISSION EXTERNAL WIRING HARNESS CONNECTOR.
- JUMPER J 39775 CAVITIES "M" AND "R".
- USING J 39200 DVM ON 10 AMP SCALE, CONNECT (IN SERIES) TO CAVITIES "C" AND "D."
- ENGINE OPERATING, TRANSMISSION IN PARK.
- USING TECH 1, APPLY 1.0 AMPS THRU 0.1 AMPS WHILE OBSERVING DESIRED PCS AND J 39200 DVM READING.
- IS DESIRED PCS ALWAYS WITHIN 0.16 AMPS OF J 39200 DVM READING?

PROBLEM IS INTERMITTENT REFER TO "DIAGNOSTIC AIDS."

YES

NO

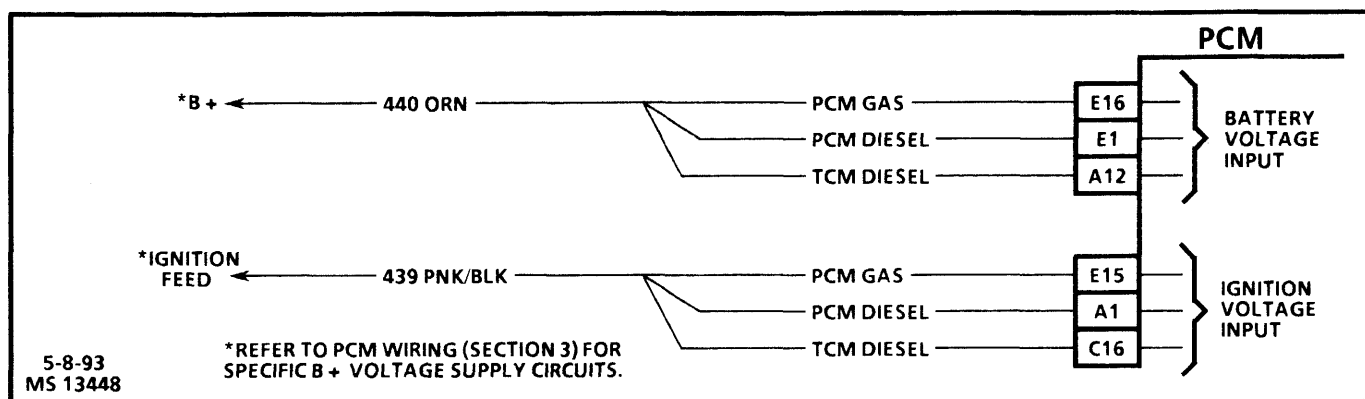
- IGNITION "OFF."
- CK TRANS WIRING CONNECTOR TERMINAL TENSION ON THE PCS CIRCUITS. IF OK, REFER TO SECTION 7A14A (4L60E) OR 7A17A (4L80E) "INTERNAL WIRING HARNESS CHECK" FOR INTERNAL PCS CIRCUIT DIAGNOSIS.

VERIFY CKTs 1228 AND 1229 ARE NOT OPEN OR SHORTED. ALSO VERIFY TERMINAL TENSION ON THESE CIRCUITS AT THE PCM CONNECTOR. IF OK, REPLACE PCM.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
PS 16751





## DTC 75

### SYSTEM VOLTAGE LOW

#### Circuit Description:

CKT 439 is the ignition voltage feed for the PCM. CKT 440 is the battery feed for the PCM.

#### DTC 75 Will Set When:

- The ignition is "ON."
- PCM ignition feed voltage is less than the graduated scale of:  $-40^{\circ}\text{C} (-40^{\circ}\text{F}) = 7.3$  volts,  $90^{\circ}\text{C} (194^{\circ}\text{F}) = 10.3$  volts, or  $150^{\circ}\text{C} (304^{\circ}\text{F}) = 11.7$  volts.
- Engine speed greater than 1000 RPM.
- All conditions are met for 4 seconds.

#### Action Taken (PCM will default to):

- No TCC.
- Maximum line pressure.
- Third gear only.

**DTC 75 Will Clear When:** The fault condition(s) no longer exist.

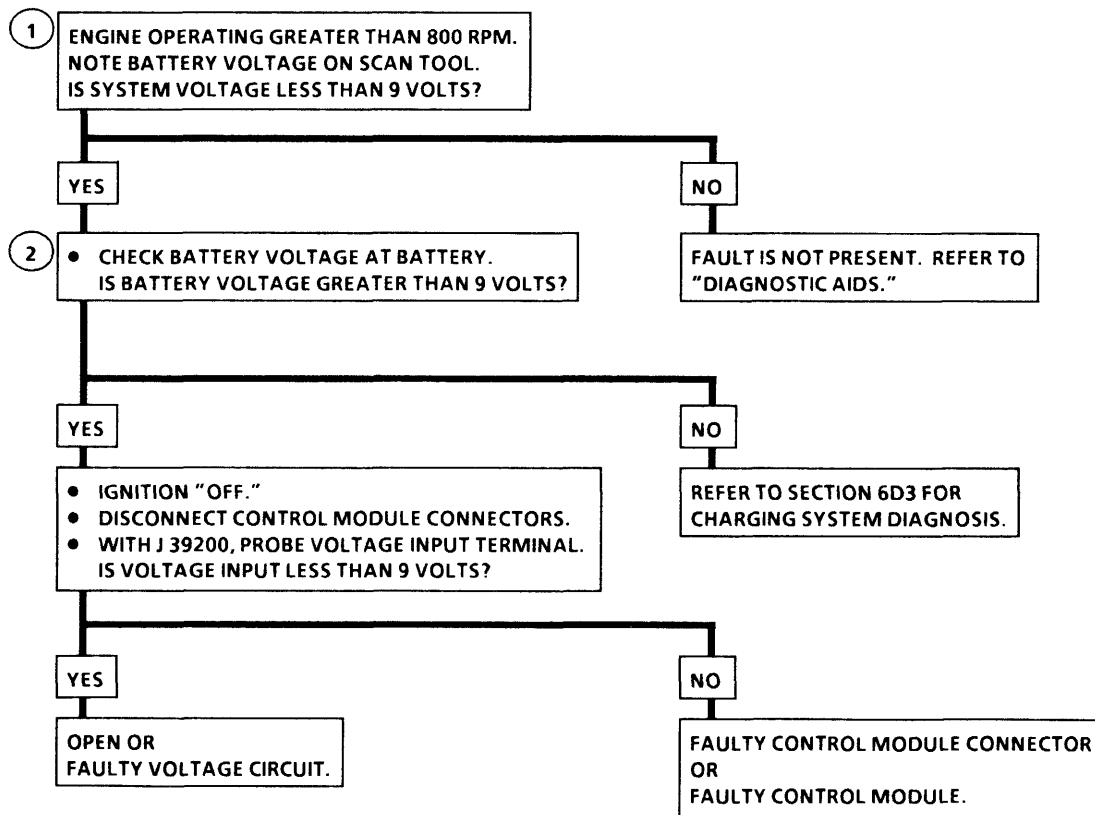
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for normal battery voltage between 9-15 volts.
2. This test checks if the low voltage display is due to the generator, CKT 439 or PCM, with engine operating checks voltage at the battery. If the voltage is less than 8.6 volts, the PCM is OK.

**Diagnostic Aids:** CKT 440 supplies battery voltage to the PCM.

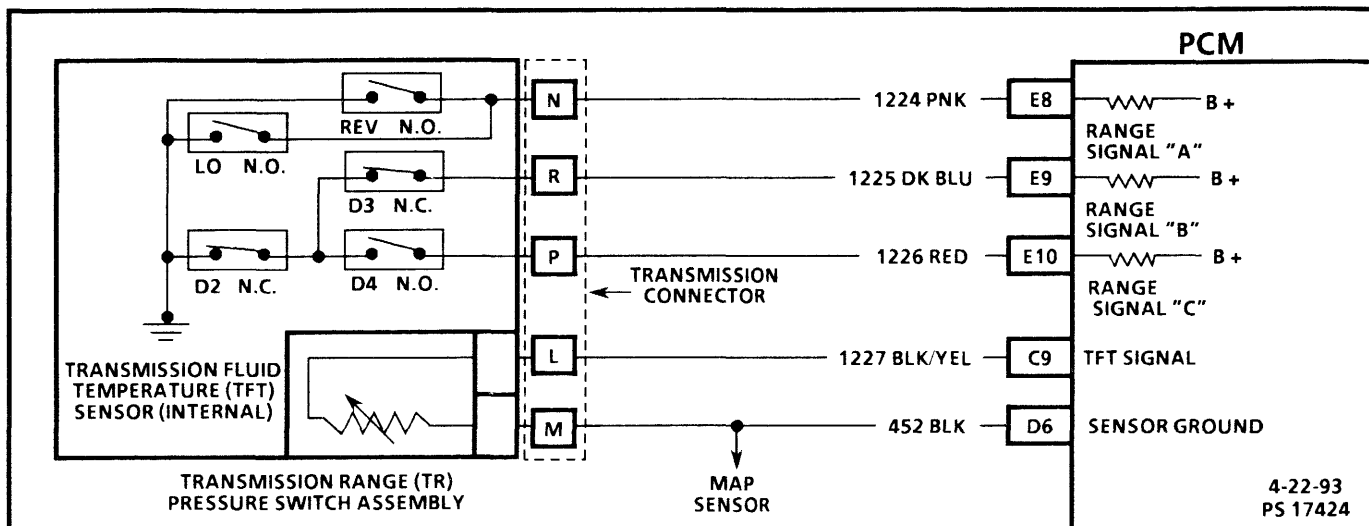
Charging battery with a battery charger and jump-starting engine may set DTC 53. If diagnostic trouble code sets when an accessory is operated, check for poor connections or excessive current draw. Refer to SECTION 6D3 of appropriate service manual for circuit details. Also, check for poor connections at starter solenoid or fusible link.

- 4660E transmission default gear is 3<sup>rd</sup>.
- 4680E transmission default gear is 2<sup>nd</sup>.

**DTC 75**  
**SYSTEM VOLTAGE LOW**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17066



## DTC 79

### TRANSMISSION FLUID OVERTEMP

#### Circuit Description:

The Transmission Fluid Temperature (TFT) sensor is a thermistor within the TR pressure switch assembly, that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.

#### DTC 79 Will Set When:

- No DTC(s) 58 or 59.
- Signal voltage indicates a transmission fluid temperature greater than 146°C (295°F) and has not cooled to less than 137°C (295°F).
- All conditions are met for 30 minutes.

**DTC 79 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for skewed sensor or shorted circuit.
2. This test simulates a DTC 59.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

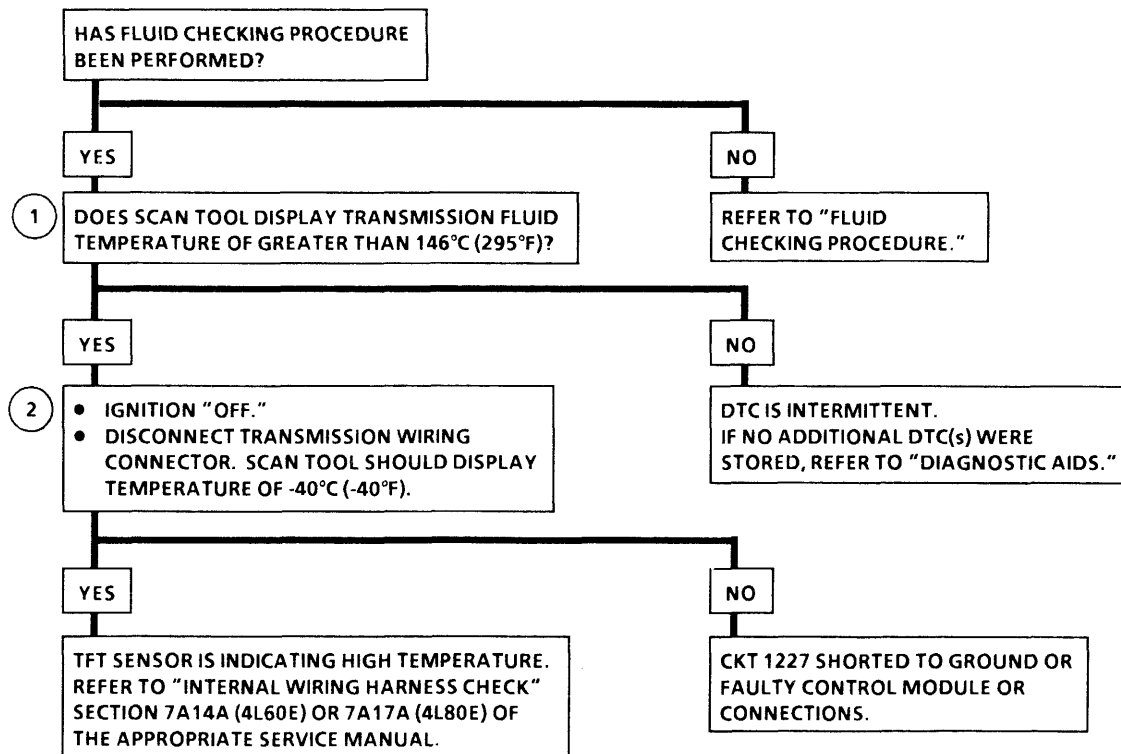
Scan tool TFT displays should rise steadily to about 100°C then stabilize.

Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A14A may be used to test the transmission sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" sensor could result in delayed garage shifts or TCC complaints.

Check transmission fluid. Refer to "Fluid Checking Procedure."

## DTC 79 TRANSMISSION FLUID OVERTEMP



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
PS 17931

## 2-3 SHIFT SOLENOID CIRCUIT FAULT

Ignition voltage is supplied directly to the 2-3 shift solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1223.

- The PCM commands the solenoid "ON" and voltage remains high.
- The PCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

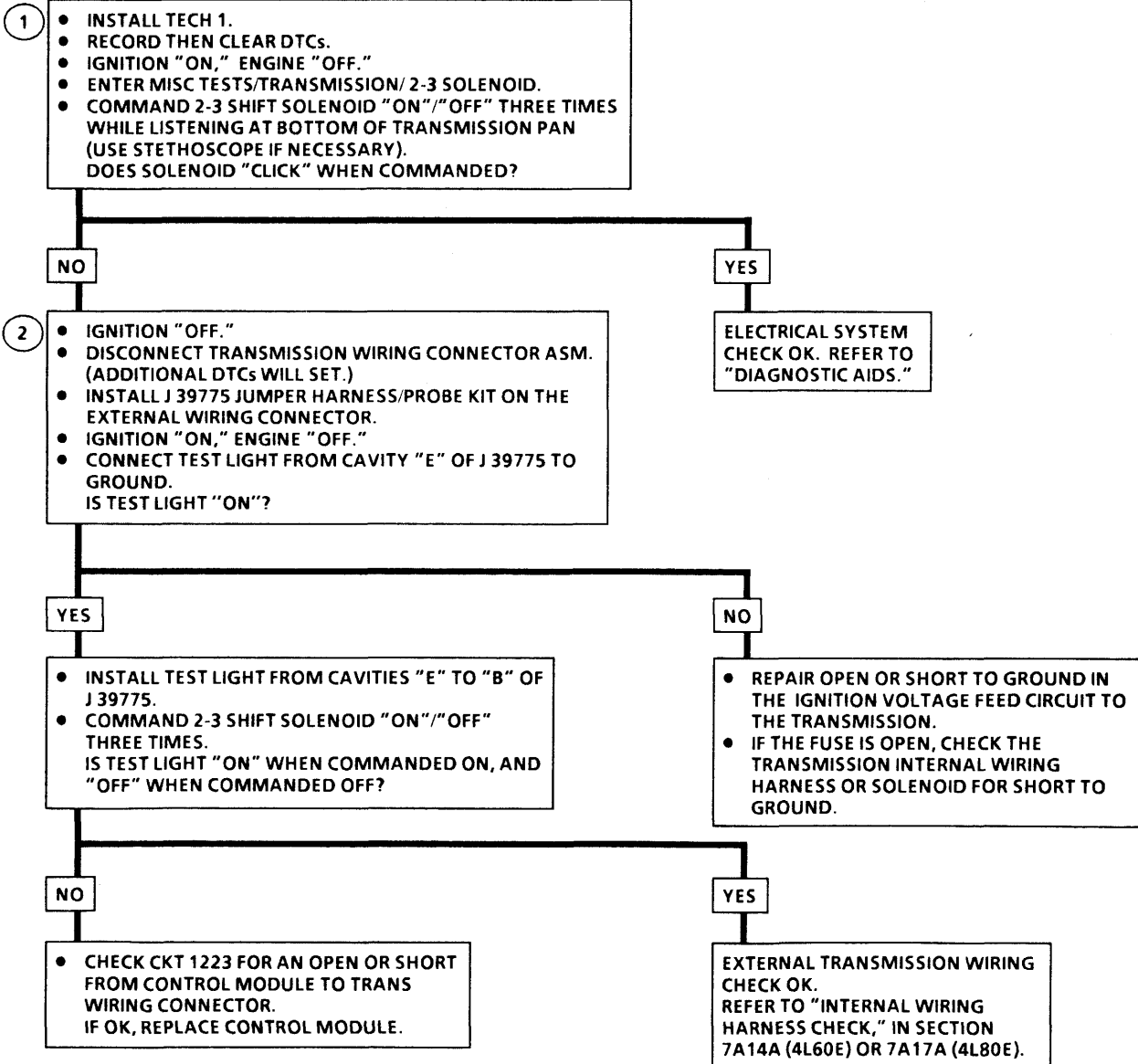
- Maximum line pressure.
- No TCC.
- Second or third gear only.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the function of the 2-3 shift solenoid and the internal transmission wiring.
2. This test checks for power to 2-3 shift solenoid from the ignition through the fuse.

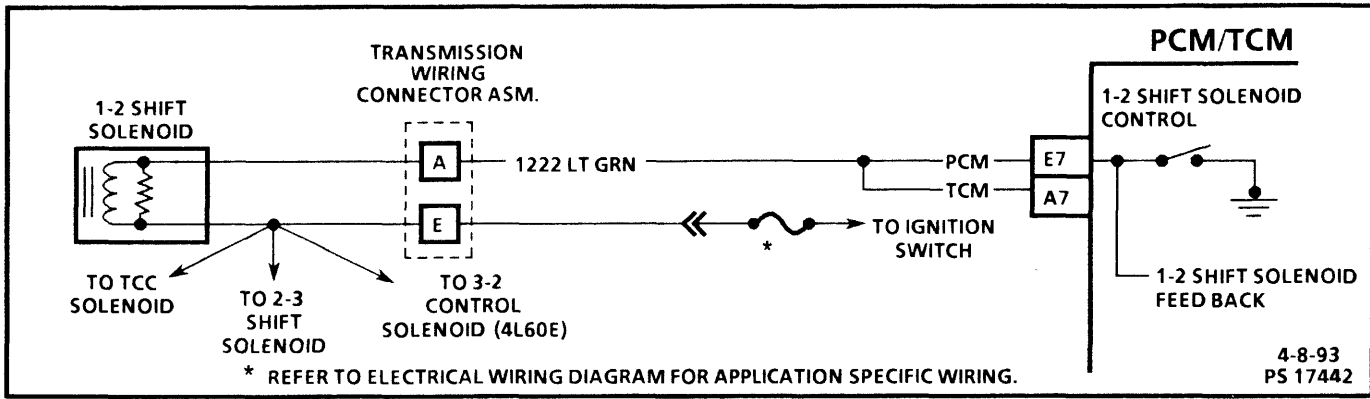
An open in the ignition feed circuit can cause multiple DTC(s) to set.

| CHART 4L60E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | ON                 |
| 2           | OFF                | ON                 |
| 3           | OFF                | OFF                |
| 4           | ON                 | OFF                |

**DTC 81****2-3 SHIFT SOLENOID CIRCUIT FAULT**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17093



## DTC 82

### 1-2 SHIFT SOLENOID FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 1-2 shift solenoid on CKT 641. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1222.

#### DTC 82 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high.
- The PCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
  - Second or third gear only.
- OR
- First or fourth gear only.

**DTC 82 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the function of the 1-2 shift solenoid and the internal transmission wiring harness.
2. This test checks for power to 1-2 shift solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections for the transmission.

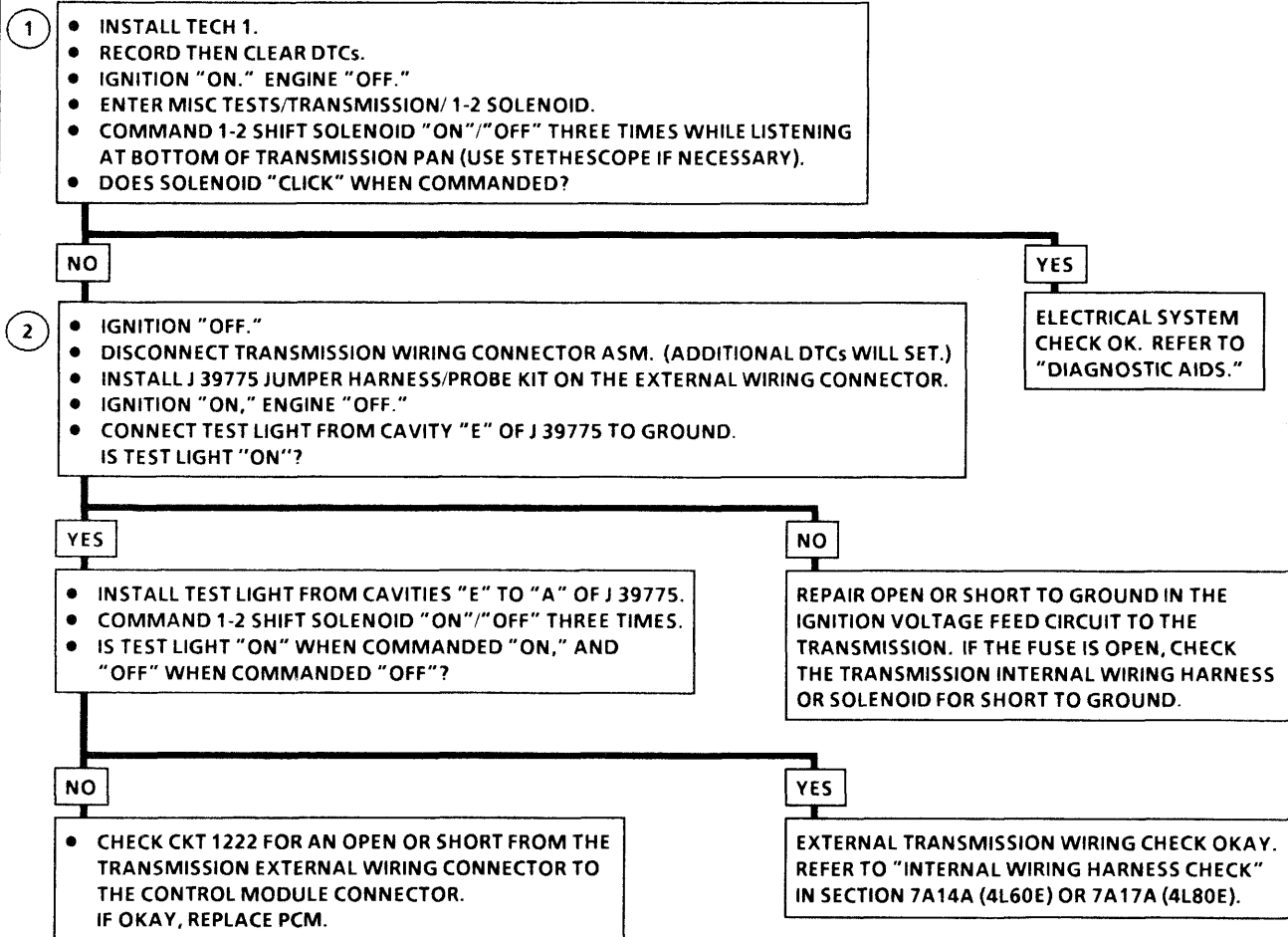
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

| CHART 4L60E |                    |                    |
|-------------|--------------------|--------------------|
| Gear        | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1           | ON                 | ON                 |
| 2           | OFF                | ON                 |
| 3           | OFF                | OFF                |
| 4           | ON                 | OFF                |

## DTC 82

### 1-2 SHIFT SOLENOID FAULT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17094



## **ON-VEHICLE SERVICE**

### **INTERNAL TRANSMISSION COMPONENTS**

The following list of components will be serviced in SECTION 7A14A of the appropriate service manual.

- 1 - 2 shift solenoid.
- 2 - 3 shift solenoid.
- 3 - 2 control solenoid.
- Pressure control solenoid.
- TCC solenoid with internal wiring harness.
- Any service that requires removal of the pan.

### **EXTERNAL TRANSMISSION COMPONENTS**

#### **Engine Coolant Temperature (ECT) Sensor**

All ECT sensor diagnosis and service will be in SECTION 3.

#### **Throttle Position (TP) Sensor**

All TP sensor diagnosis and service will be in SECTION 3.

### **Vehicle Speed Sensor (VSS)**

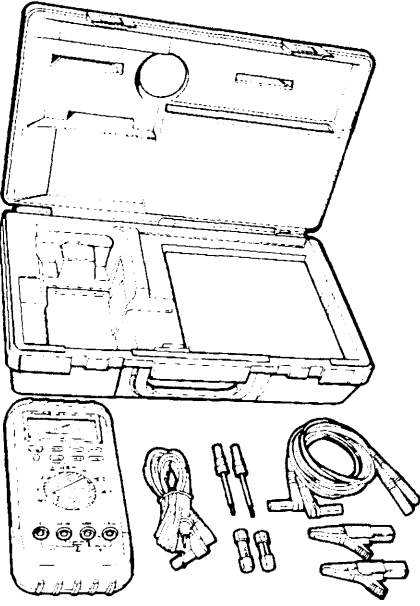
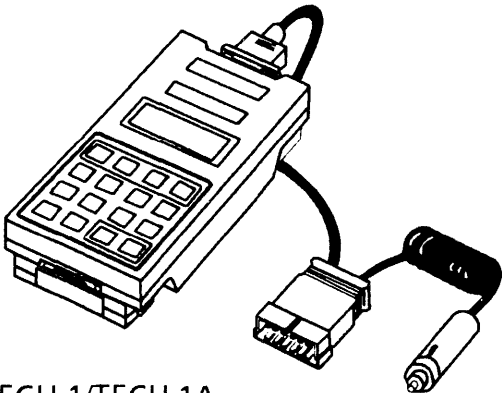
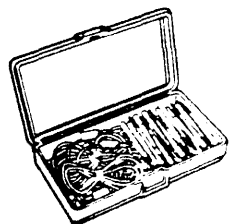
Refer to SECTION 7 of the appropriate service manual for Vehicle Speed Sensor (VSS) service. The VSS is located on the transmission or transfer case.

### **Vehicle Speed Signal (VSS) Buffer Module**

Refer to SECTION 8 of the appropriate service manual for vehicle speed signal buffer module replacement. The VSS buffer module is located on the PCM.

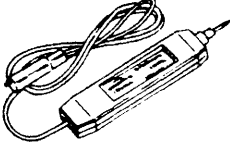
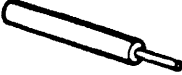
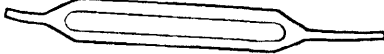
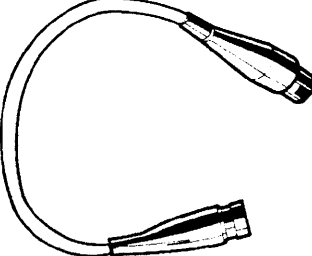
### **PCM WIRING DIAGRAMS AND CONNECTOR TERMINAL END VIEWS**

All wiring diagrams and terminal identification will be in SECTION 3.

|                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>HIGH IMPEDANCE MULTIMETER<br/>(DIGITAL VOLTMETER-DVM)<br/>J 39200</p> | <p><b>VOLTMETER</b> - Voltage Position measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used when circuits require accurate low voltage readings, and some circuits in the PCM/TCM have a very high resistance.</p> <p><b>AMMETER</b> - When used as ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• Selector must be set properly for both function and range. DC is used for most automotive measurements.</li> </ul> <p><b>OHMMETER</b> - Measures resistance of circuit directly in ohms. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• OL display in all ranges indicates an open circuit.</li> <li>• Zero display in all ranges indicates a short circuit.</li> <li>• Intermittent connection in circuit may be indicated by digital reading that will not stabilize.</li> <li>• Range Switch. <ul style="list-style-type: none"> <li>200<math>\Omega</math> - Displays ohms directly.</li> <li>2K,20K,200K<math>\Omega</math> - Displays ohms in thousands.</li> <li>2M and 20M<math>\Omega</math> - Displays ohms in millions.</li> </ul> </li> </ul> |
|  <p>TECH 1/TECH 1A<br/>3000003 MASS STORAGE CARTRIDGE</p>               | <p><b>TECH 1 DIAGNOSTIC SCAN TOOL</b><br/>A hand-held SCAN tool used to analyze and diagnose the PCM/TCM control system.</p> <p>(With GM 81-93 Powertrain Software)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                         | <p><b>TACHOMETER</b><br/>Inductive trigger signal pickup type to check RPM.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  <p>J 35616</p>                                                         | <p><b>CONNECTOR TEST ADAPTER KIT</b><br/>Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

5-18-92  
MS 13416

Figure 10A-15 - Special Tools (1 of 2)

|                                                                                                              |                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 34636/BT-8405</p>     | <p><b>CIRCUIT TESTER</b><br/>Used to check all relays and solenoids before connecting them to a new PCM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.</p> |
|  <p>J 35689-A</p>           | <p><b>METRI-PACK TERMINAL REMOVER</b><br/>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors.</p>                                                                                                                                                              |
|  <p>J 28742-A/BT-8234-A</p> | <p><b>WEATHER PACK TERMINAL REMOVER</b><br/>Used to remove terminals from Weather Pack connectors.</p>                                                                                                                                                                                    |
|  <p>J 33095/BT-8234-A</p> | <p><b>PCM CONNECTOR TERMINAL REMOVER</b><br/>Used to remove terminal from Micro-Pack connectors.</p>                                                                                                                                                                                      |
|  <p>J 39775</p>           | <p><b>4L60E JUMPER HARNESS</b><br/>Used with J 39200 to measure circuit voltage, amperage, or resistance in the transmission through the transmission connector.</p>                                                                                                                      |
|  <p>J 38125-4</p>         | <p><b>TERMINAL REPAIR KIT</b><br/>Used to replace damaged terminal ends on wiring harnesses.</p>                                                                                                                                                                                          |

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Figure 10A-16 - Special Tools (2 of 2)

## SECTION 10B

# 4L80E DIAGNOSTIC TROUBLE CODES

### (WITH TECH 1 SCAN TOOL DIAGNOSTICS)

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## GENERAL DESCRIPTION

POWERTRAIN CONTROL MODULE  
(PCM)

Figure 10B-1

The Powertrain Control Module (PCM) is an electronic device which monitors various inputs to control various transmission functions including shift quality and transmission diagnostics. The PCM receives various input information from sensors, switches, and components to process for use within its control program. Based on this input information, the PCM controls various transmission output functions and devices. The PCM is located within the passenger compartment, underneath the right hand side of the dash.

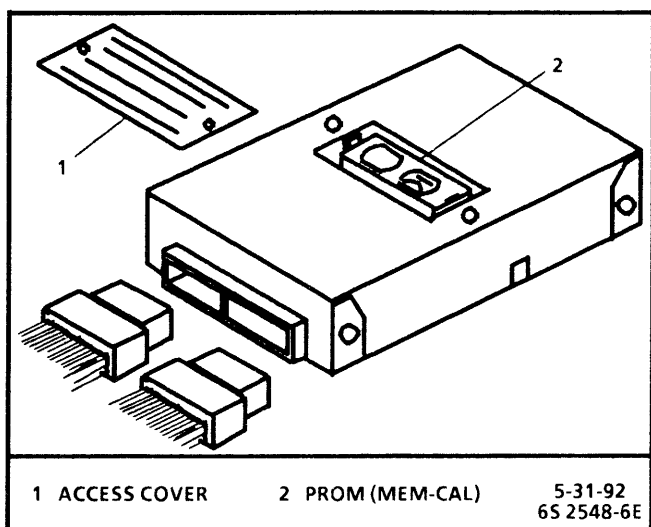


Figure 10B-1 - Powertrain Control Module

## WIRING HARNESS AND CONNECTORS

A wiring harness electrically connects the PCM to various sensors, solenoids, and relays within the system. Many of the connectors used are environmentally protected because of the system low voltages and current levels.

## DATA LINK CONNECTOR (DLC)

Figure 10B-2

This connector is a multiple cavity connector. The DLC provides the technician a means of accessing serial data for aid in diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display DTC(s). The DLC connector is located within the driver's compartment, normally on the left side near the steering column.

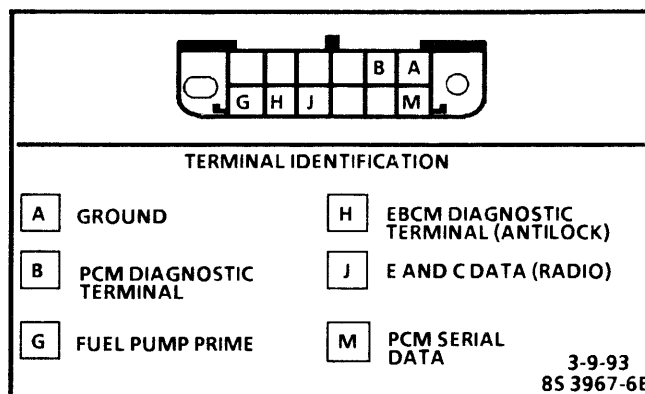


Figure 10B-2 - Data Link Connector (DLC)

## INPUT INFORMATION

## INFORMATION SENSORS AND SWITCHES

The PCM uses the following information sensors to gather data for electronically controlling transmission functions.

- Transmission Fluid Temperature (TFT) sensor.
- Transmission Range (TR) pressure switch assembly.
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Transmission or transfer case Vehicle Speed Sensor (VSS).
- Brake switch.

TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR

Figure 10B-13

The TFT sensor is a thermistor (a device that changes resistance according to changes in temperature) used to indicate transmission fluid temperature. High sensor resistance produces high signal input voltage which corresponds to low fluid temperature. Low sensor resistance produces low signal input voltage which corresponds to high fluid temperature. The PCM uses the TFT sensor signal input to determine the following:

- TCC apply and release schedules.
- Hot mode determination.
- Shift quality.

The TFT sensor is part of the internal wiring harness within the transmission.

## TRANSMISSION ELECTRICAL CONNECTOR

THE TRANSMISSION WIRING CONNECTOR IS A VERY IMPORTANT PART OF THE TRANSMISSION OPERATING SYSTEM. ANY INTERFERENCE WITH THE ELECTRICAL CONNECTION CAN CAUSE THE TRANSMISSION TO SET DIAGNOSTIC TROUBLE CODES (DTC)s AND/OR AFFECT PROPER OPERATION.

THE FOLLOWING ITEMS CAN AFFECT THE ELECTRICAL CONNECTION:

- BENT PINS IN THE CONNECTOR FROM ROUGH HANDLING DURING CONNECTION AND DISCONNECTION.
- WIRES BACKING AWAY FROM THE PINS OR COMING UNCRIMPED (IN EITHER INTERNAL OR EXTERNAL WIRING HARNESS).
- DIRT CONTAMINATION ENTERING THE CONNECTOR WHEN DISCONNECTED.
- PINS IN THE INTERNAL WIRING CONNECTOR BACKING OUT OF THE CONNECTOR OR PUSHED OUT DURING RECONNECTION.
- EXCESSIVE TRANSMISSION FLUID LEAKING INTO THE CONNECTOR, WICKING UP INTO THE EXTERNAL WIRING HARNESS, AND DEGRADING OF THE WIRE INSULATION. \*
- WATER/MOISTURE INTRUSION IN THE CONNECTOR.
- LOW PIN RETENTION IN THE EXTERNAL CONNECTOR FROM EXCESSIVE CONNECTION AND DISCONNECTION OF THE WIRING CONNECTOR ASSEMBLY.
- PIN CORROSION FROM CONTAMINATION.
- \* THE PRESENCE OF TRANSMISSION FLUID IN THE TRANSMISSION CONNECTOR IS NOT HARMFUL IN ITSELF. THE FLUID ONLY AFFECTS THE EXTERNAL HARNESS WIRING INSULATION IF THE FLUID WICKS UP TO THE HARNESS.

POINTS TO REMEMBER WHEN WORKING WITH THE TRANSMISSION WIRING CONNECTOR ASSEMBLY:

- TO REMOVE THE CONNECTOR, SQUEEZE THE TWO TABS TOWARDS EACH OTHER AND PULL STRAIGHT UP (REFER TO THE ILLUSTRATION).
- CAREFULLY LIMIT TWISTING OR WIGGLING THE CONNECTOR DURING REMOVAL. BENT PINS CAN OCCUR.
- **DO NOT** PRY THE CONNECTOR OFF WITH A SCREWDRIVER OR OTHER TOOL.
- TO REINSTALL THE EXTERNAL WIRING CONNECTOR, FIRST ORIENT THE PINS BY LINING UP THE ARROWS ON EACH HALF OF THE CONNECTOR. PUSH THE CONNECTOR STRAIGHT DOWN INTO THE TRANSMISSION WITHOUT TWISTING OR ANGLING THE MATING PARTS.
- THE CONNECTOR SHOULD CLICK INTO PLACE WITH A POSITIVE FEEL AND/OR NOISE.
- WHENEVER THE TRANSMISSION EXTERNAL WIRING CONNECTOR IS DISCONNECTED FROM THE INTERNAL HARNESS AND THE ENGINE IS OPERATING DTC(s) WILL SET. CLEAR THESE DTC(s) AFTER RECONNECTING THE EXTERNAL CONNECTOR.

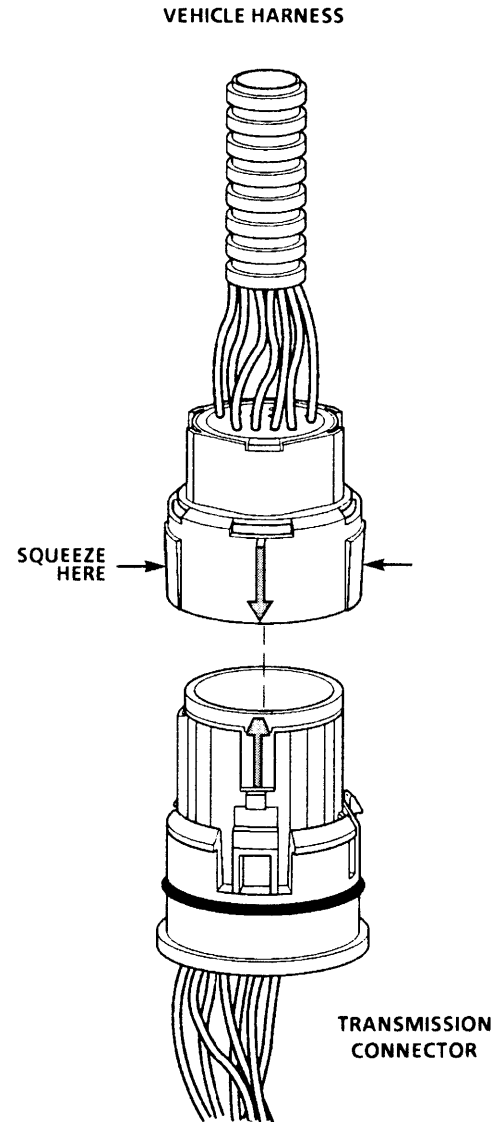


Figure 10B-3 - Transmission Electrical Connector

## 10B-4 DRIVEABILITY AND EMISSIONS (DIESEL)

### TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY

#### Figure 10B-4

This device is a set of five normally open pressure switches that detect fluid pressure within the valve body passages. The five pressure switches are connected to three signal circuits referred to as range signals A, B, C.

Valid Combination Chart

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | ON  | OFF | ON  |
| Rev          | OFF | OFF | ON  |
| Neutral      | ON  | OFF | ON  |
| 4th          | ON  | OFF | OFF |
| 3rd          | ON  | ON  | OFF |
| 2nd          | ON  | ON  | ON  |
| 1st          | OFF | ON  | ON  |
| Illegal      | OFF | ON  | OFF |
| Illegal      | OFF | OFF | OFF |

Expected Readings

"ON" = B+      "OFF" = 0 volts

The combination of pressure switch states determine the voltage signal (B+ or 0) on each range signal to the PCM. These three range signals are then interpreted by the PCM to indicate the transmission range selected. The transmission range pressure switch assembly is attached to the control valve body within the transmission.

### ENGINE COOLANT TEMPERATURE (ECT) SENSOR

#### Figure 10B-6

The Engine Coolant Temperature (ECT) sensor is a thermistor (a device that changes resistance according to change in temperature) used to indicate engine coolant temperature. High sensor resistance produces high signal input voltage which corresponds to low engine temperature. Low sensor resistance produces low signal input voltage which corresponds to high engine coolant temperature. The PCM uses the ECT sensor signal to determine the TCC apply and release schedules. The ECT sensor is attached to the engine assembly.

### THROTTLE POSITION (TP) SENSOR

#### Figure 10B-7

The Throttle Position (TP) sensor is a potentiometer (a device for measuring an unknown voltage or potential difference by comparison to a standard voltage).

The TP sensor sends a voltage to the control module, varying from (approximately .5 volt) to (approximately 5 volts). This voltage signal to the control module represents throttle shaft angle. At closed throttle, the signal voltage to the control module is approximately 0.5 volt as the throttle shaft angle increases the signal voltage increases to greater than 4.5 volts at wide open throttle. The TP sensor is attached to the throttle body assembly.

### TRANSFER CASE SWITCH ASSEMBLY

This switch assembly is used to indicate the position of the transfer case select lever. When four wheel drive (4WD) low is selected a ground path is provided, changing 4WD low input signal from B+ to 0 voltage. The 4WD low signal input is used to correct the transmission output speed signal from the VSS buffer module to the PCM, to compensate for the transfer case gear reduction. This switch is attached to the transfer case.

### INPUT SPEED SENSOR

#### Figure 10B-8

This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth cut into the outside diameter of the forward clutch housing. As the serrations interrupt the magnetic field an AC voltage is generated in the circuit. This device is used to provide an input speed signal to the control module. The control module uses the input speed sensor signal input to:

- Calculate TCC slip speed.
- Calculate gear ratio.

### VEHICLE SPEED SENSOR (VSS)

#### Figure 10B-8

This device contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth pressed on an output shaft. As the rotor interrupts the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an output shaft speed signal to the control module. The control module uses the vehicle speed sensor signal input to:

- Calculate vehicle speed, trans output speed, TCC slip speed.
- Control shift quality.

The VSS is attached to the output shaft housing.

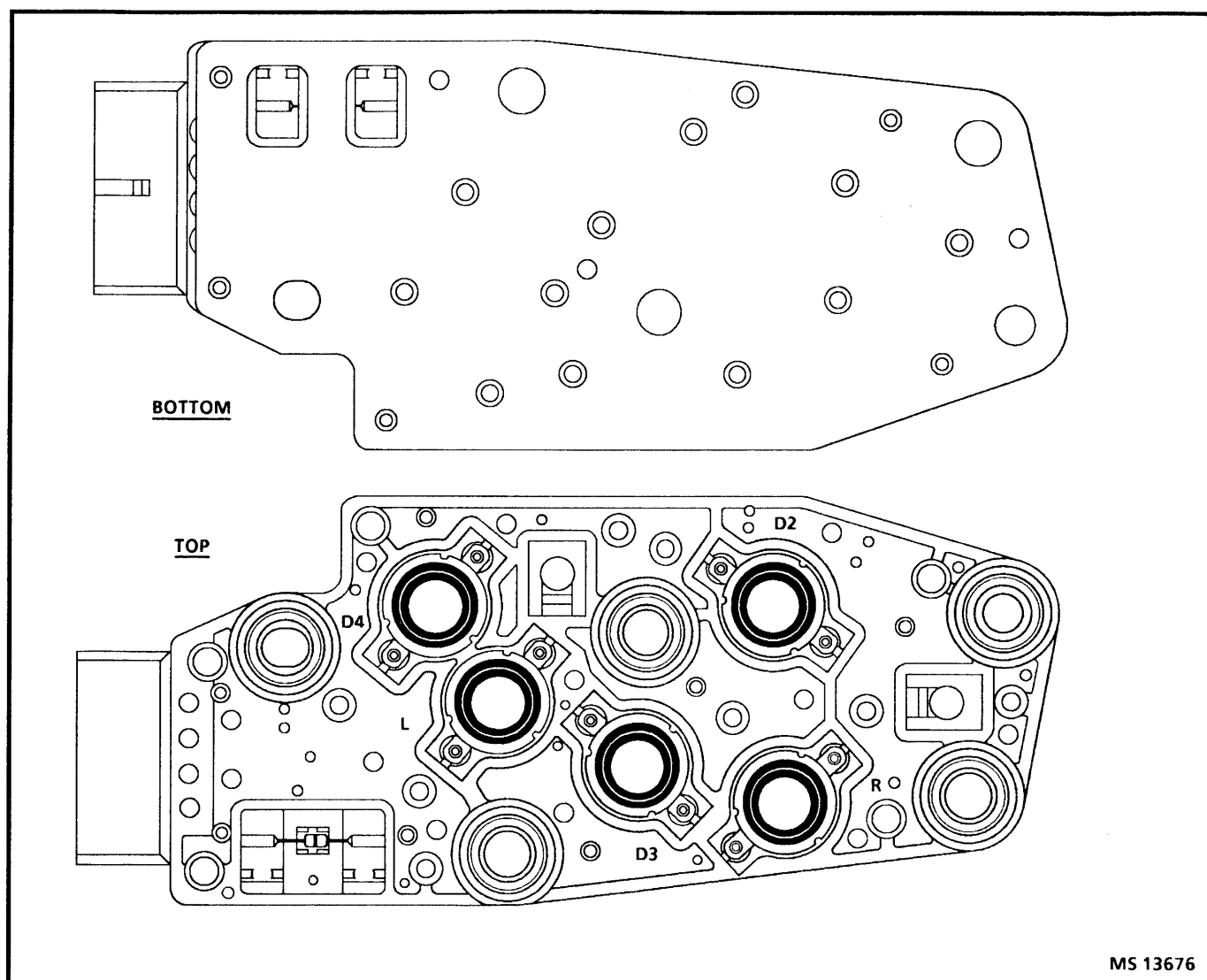


Figure 10B-4 - Transmission Range (TR) Pressure Switch Assembly

## VEHICLE SPEED SIGNAL (VSS) BUFFER MODULE

The Vehicle Speed Signal (VSS) buffer module is an electronic device. The VSS buffer module processes inputs from the vehicle speed sensor and outputs various signals. The VSS buffer module outputs a 40 Pulse Per Revolution (PPR) signal. This 40 PPR signal is used by the control module to determine transmission output speed. The VSS buffer module is matched to the vehicle based on transmission, final drive ratio and tire size. The VSS buffer module is located on the right hand side of the instrument panel attached to the PCM bracket.

## BRAKE SWITCH

This electrical switch is used to indicate brake pedal status. This switch is normally closed when the brake pedal is not applied. When the brake pedal is applied the switch will open, changing the signal to

the PCM. The PCM uses this signal to de-energize the TCC solenoid when brake pedal is applied. The brake switch is located on the brake pedal mounting bracket.

## OUTPUT INFORMATION

### 1-2 SHIFT SOLENOID

#### Figure 10B-9

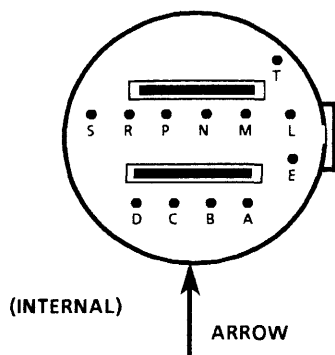
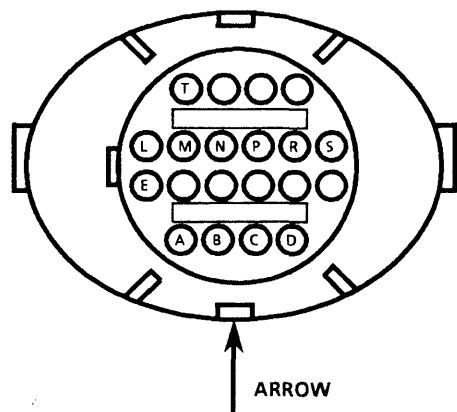
This electrical device is used to control fluid flow acting on the 1-2 and 3-4 shift valves. The solenoid is a normally open exhaust valve that is used with the 2-3 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

### 2-3 SHIFT SOLENOID

#### Figure 10B-10

This electrical device is used to control fluid flow acting on the 2-3 shift valves.





| CAVITY | FUNCTION                                                         |
|--------|------------------------------------------------------------------|
| A      | 1-2 SHIFT SOLENOID CONTROL CIRCUIT                               |
| B      | 2-3 SHIFT SOLENOID CONTROL CIRCUIT                               |
| C      | PRESSURE CONTROL SOLENOID (HIGH)                                 |
| D      | PRESSURE CONTROL SOLENOID (LOW)                                  |
| E      | BOTH SHIFT SOLENOIDS, TCC SOLENOID, IGNITION (B + ) FEED CIRCUIT |
| L      | TRANSMISSION FLUID TEMPERATURE (TFT) SIGNAL CIRCUIT              |
| M      | TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR GROUND CIRCUIT       |
| N      | RANGE SIGNAL "A" CIRCUIT                                         |
| P      | RANGE SIGNAL "C" CIRCUIT                                         |
| R      | RANGE SIGNAL "B" CIRCUIT                                         |
| S      | TCC PWM SOLENOID CONTROL CIRCUIT                                 |

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Figure 10B-5 - Harness Connector

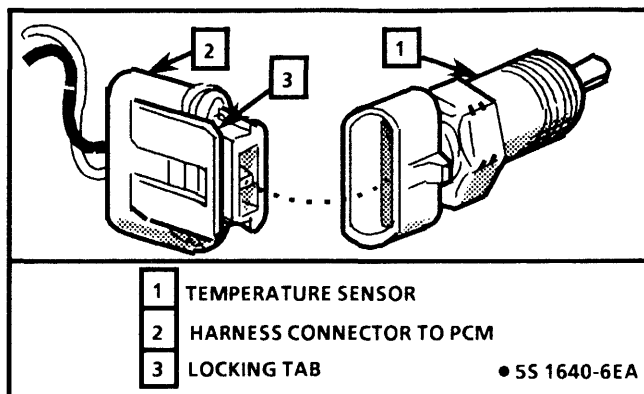


Figure 10B-6 - Engine Coolant Temperature (ECT) Sensor

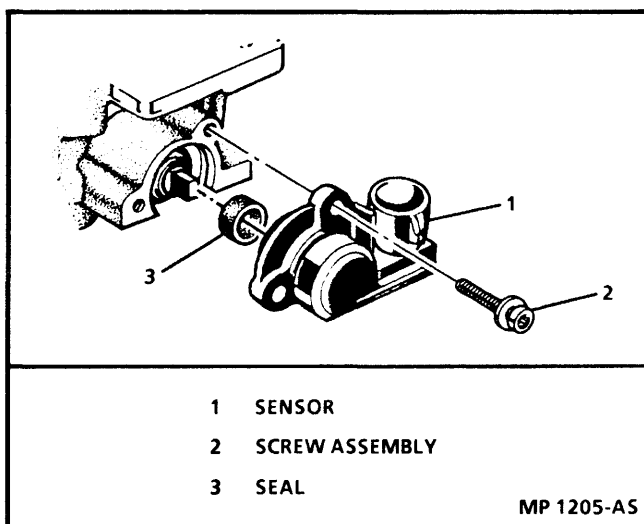


Figure 10B-7 - Throttle Position (TP) Sensor

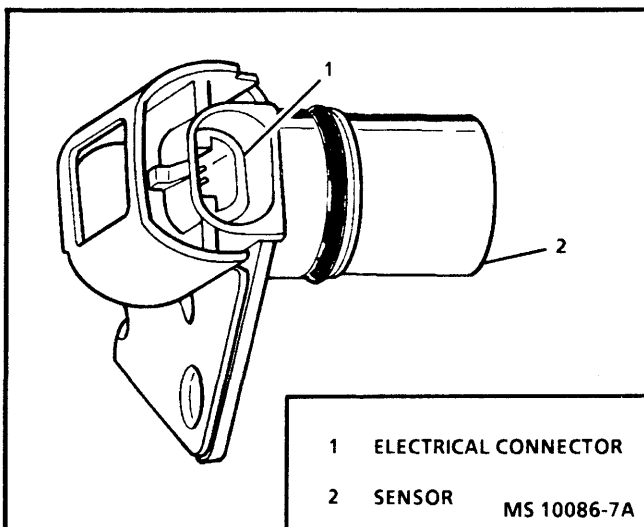


Figure 10B-8 - Input/Vehicle Speed Sensor

The solenoid is a normally open exhaust valve that is used with the 1-2 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

CHART

| Gear | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
|------|--------------------|--------------------|
| 1    | ON                 | OFF                |
| 2    | OFF                | OFF                |
| 3    | OFF                | ON                 |
| 4    | ON                 | ON                 |

The solenoid is a normally closed solenoid valve that controls fluid pressure when operating on a duty cycle. The solenoid is attached to the control valve body within the transmission.

**TORQUE CONVERTER CLUTCH (TCC) PWM SOLENOID**  
*Figure 10B-12*

This electrical device is used to control fluid acting on the TCC converter clutch valve, which then controls TCC apply and release. This solenoid is attached to the control valve body within the transmission.

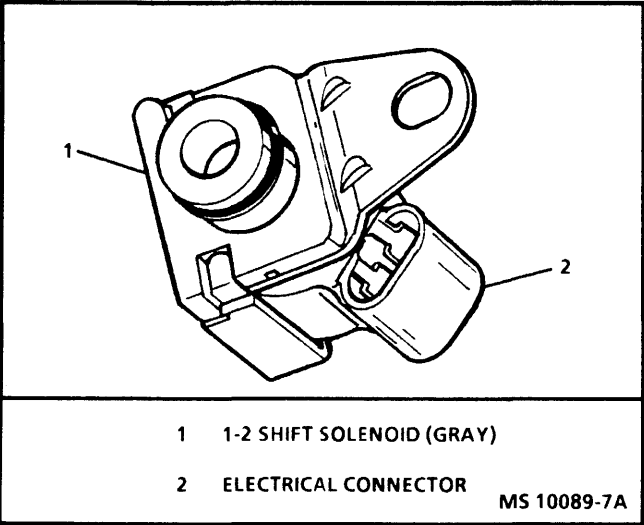


Figure 10B-9 - 1-2 Shift Solenoid

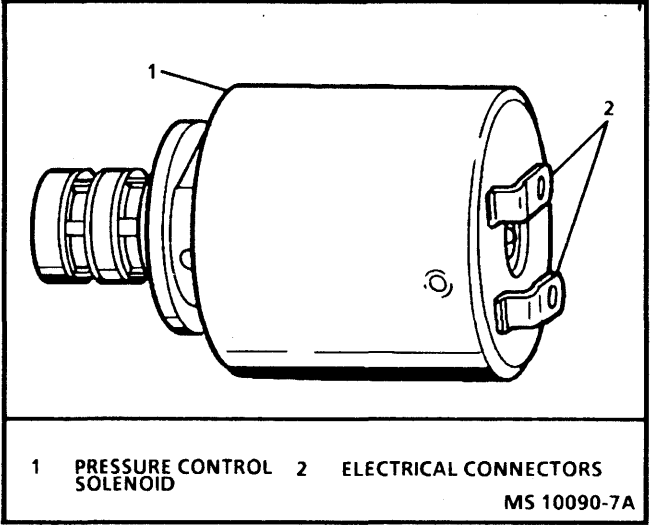


Figure 10B-11 - Pressure Control Solenoid (PCS)

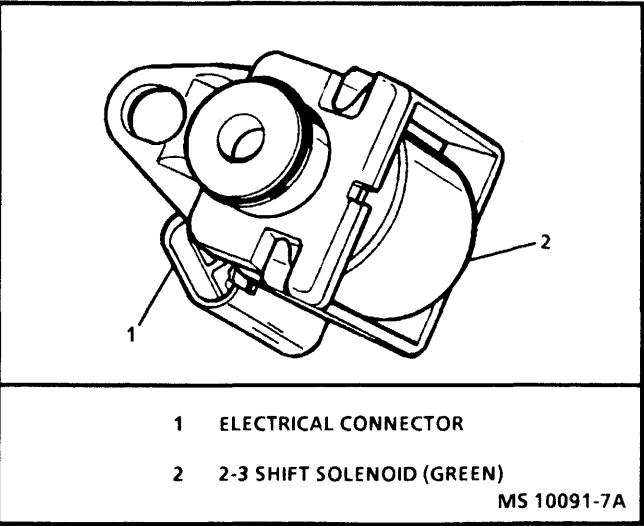


Figure 10B-10 - 2-3 Shift Solenoid

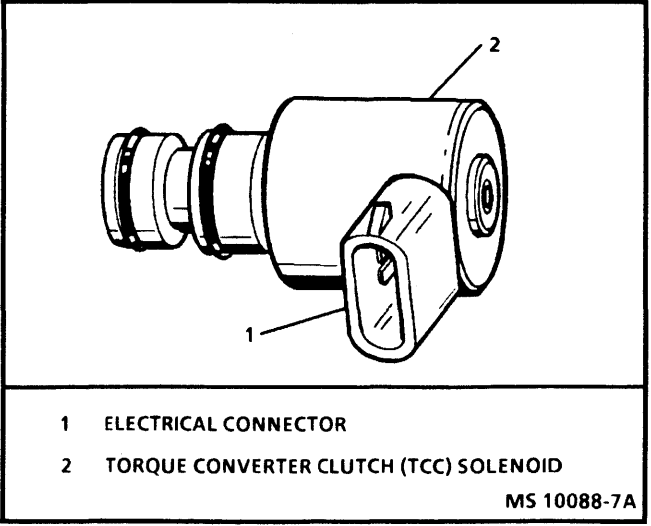


Figure 10B-12 - Torque Converter Clutch (TCC) PWM Solenoid

**PRESSURE CONTROL SOLENOID (PCS)**  
*Figure 10B-11*

This electrical device is used to control fluid line pressure by controlling actuator feed limit fluid flow acting on an internal spool valve and spring pressure.

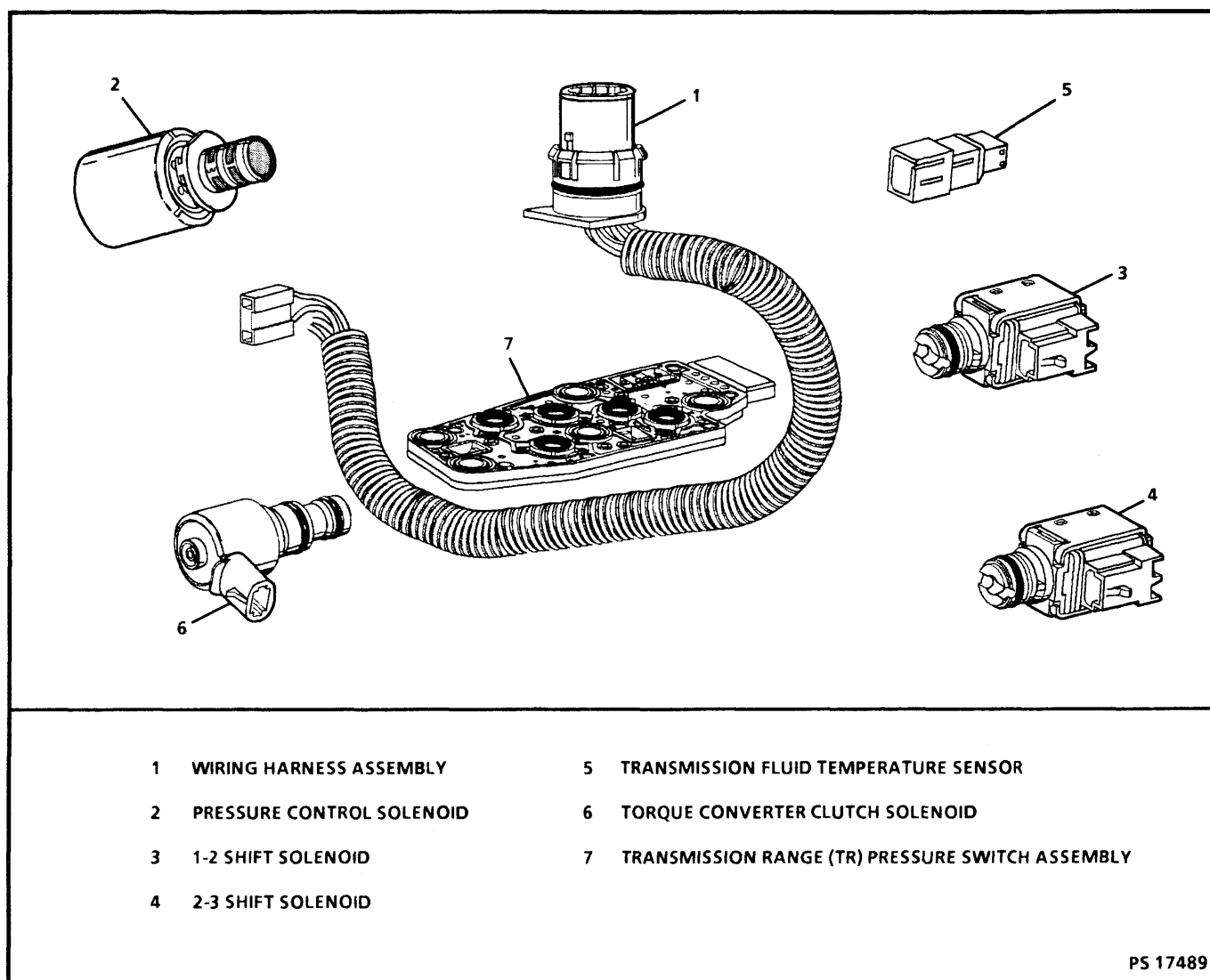


Figure 10B-13 - Electrical Components

## DIAGNOSIS

The PCM is equipped with a self diagnostic feature that detects system failures and aids the technician in locating a faulty circuit. The PCM has memory for comparing the various input information to programmed information. These conditions are described on the facing page of each Diagnostic Trouble Code (DTC) chart. If a value is not within the PCM parameters, a DTC will set and default values will be used.

The PCM will continually perform a self diagnosis check. The PCM can be requested to display any stored DTC by using a scan tool or manually grounding the diagnostic test terminal. When the diagnostic test terminal of the Data Link Connector (DLC) is grounded, the PCM will check the engine speed circuit input, if the voltage is zero, the PCM will flash DTC 12 and any other DTC(s) stored. If DTC 12 will not flash, refer to CHART A-1 or CHART A-2 in SECTION 3 for further diagnostic information.



### Important

- Always refer to the "On-Board Diagnosis (OBD) System Check" in SECTION 3 before proceeding to diagnose the system.

The scan tool will display all stored DTC(s) in current or history status. A DTC 12 is not a fault condition with the ignition "ON," engine "OFF." When the manual grounding procedure is used, the MIL will flash all DTC(s) stored in the PCM memory (current and history). The DTC charts assume the DTC is in current status. If the DTC is in history status, the fault may be an intermittent. An "intermittent" DTC is one which will not reset during the current ignition cycle. The facing page of a DTC chart will contain "DIAGNOSTIC AIDS" to help locate intermittent conditions.

If a visual (physical) check does not locate the cause of the fault, J 39200 DVM can be used to test the suspected circuit. The J 39200 DVM can be used to check for opens or shorts:

- **SHORT TO VOLTAGE** - Connect J 39200 to a known good ground on the DC voltage scale.
- **SHORT TO GROUND** - Connect J 39200 to a known good B+ on the DC voltage scale.
- **OPEN CIRCUIT** - Connect J 39200 to each end of the circuit on the ohms scale with voltage removed from the circuit.

## PCM INTERMITTENT DIAGNOSTIC TROUBLE CODES OR PERFORMANCE

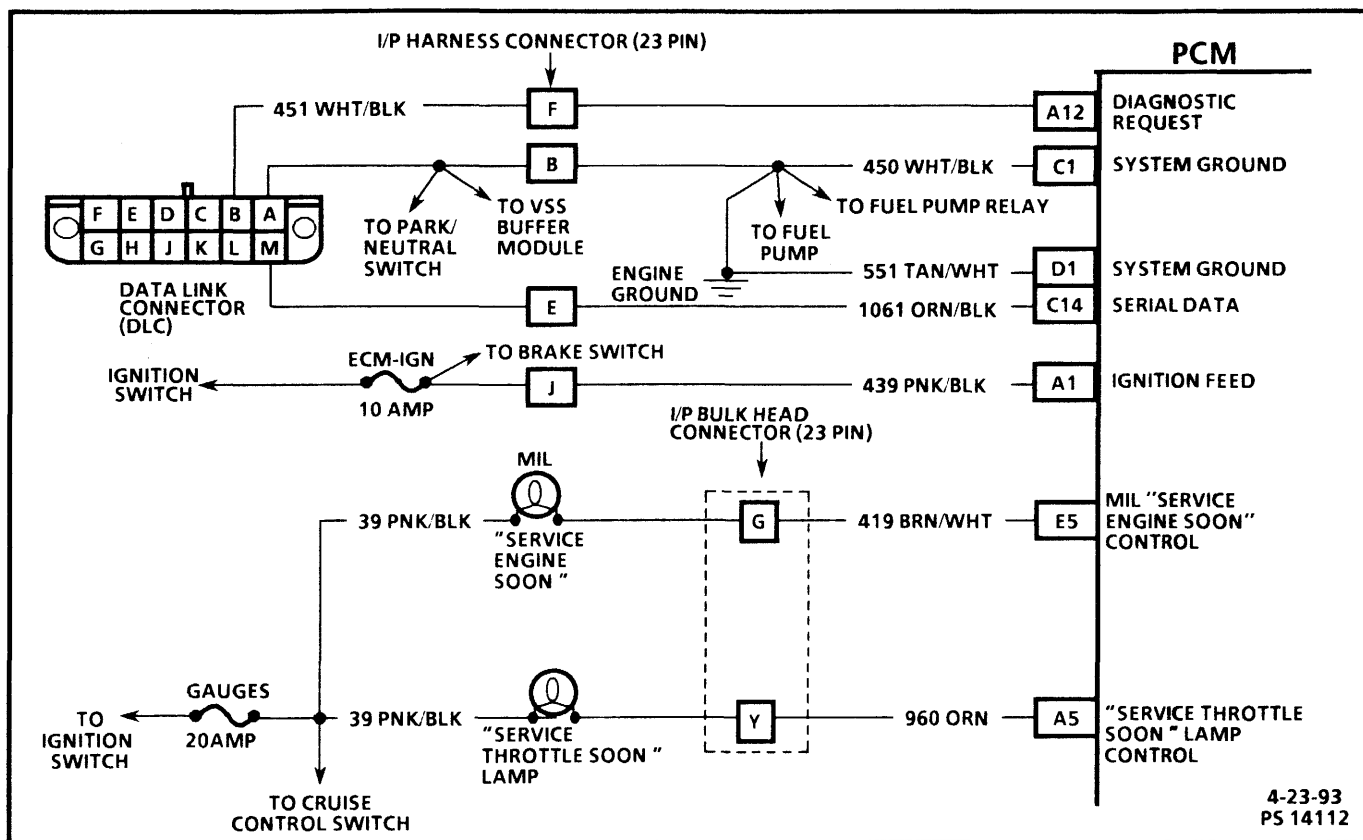
The DTC charts in this section determine if there is a fault within the circuit. The fault must be present to locate the problem. If an intermittent condition occurs, a DTC will be stored in history status, but the circuit check will indicate a normal condition. Most intermittent conditions are usually a faulty connection or component. When diagnosing intermittents, thoroughly check the suspected circuits for:

- Poor terminal tension.
- Poor seating of connector halves.
- Poor terminal to wire connection.
- Improperly formed or damaged terminals.
- Improperly installed electrical options.
- Faulty PCM power or ground connection.
- Intermittent short or open.
- Electrical system surges caused by a defective relay, solenoid, or switch. Normally these conditions will occur when the faulty component is operated.

## CLEARING HISTORY DTC(s)

All history DTC(s) can be cleared after all repairs have been completed in the following ways:

1. With a scan tool.
2. By removing voltage from the PCM.
3. Fifty ignition cycles with fault removed.



## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)

### Circuit Description:

The "On-Board Diagnostic (OBD) System Check" is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, this will direct the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it properly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

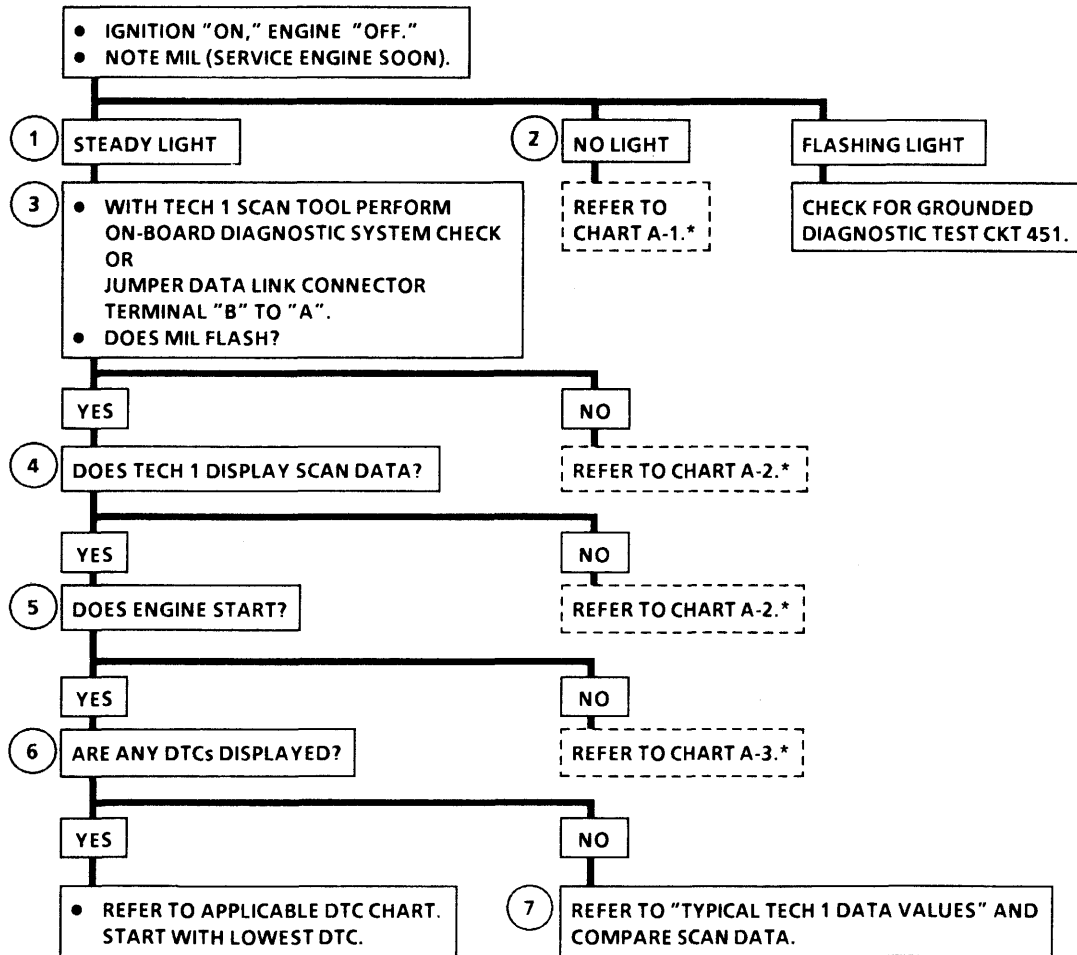
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. When the ignition switch is cycled to "ON," the MIL should turn "ON" briefly, then "OFF" briefly, then remain "ON" steady. This sequence will determine that the vehicle diagnostics are operational.
2. This step will isolate if the customer complaint is a MIL or driveability problem.
3. Although the control module is powered up, a symptom could exist because of a system fault.
4. Use Tech 1 to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the PCM may have been able to flash DTC 12/51, but not enable serial data.
5. Although the PCM is powered up, a "Cranks But Will Not Run" symptom could exist because of a PCM or system problem.

6. This step will isolate if the customer complaint is a MIL or driveability problem with no MIL. Refer to "Diagnostic Trouble Code Identification" in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM or PCM.
7. Comparison of actual control system data with the Typical Tech 1 Data Values is a quick check to determine if any parameter is not within limits. A base engine problem (i.e., advanced cam timing may substantially alter sensor values).

**NOTICE:** The PCM utilizes a 24 pin "Pink" connector, a 32 pin "Pink" connector and a 32 pin "Blue" connector. The 24 pin "Pink" connector is labeled "A" and "B", the 32 pin "Pink" connector is labeled "C" and "D" and the 32 pin "Blue" connector is a labeled "C" and "D". When referencing PCM connector pinouts, the "Blue" PCM connector will be referred to as the "E" and "F" connector.

# ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (WITH TECH 1 SCAN TOOL)



IF PCM IS FAULTY AND MUST BE REPLACED, "TDC OFFSET" MUST BE PROGRAMMED INTO THE NEW PCM.  
REFER TO "ON-VEHICLE SERVICE" IN THIS SECTION.

\* IN SECTION 3.

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## 10B-12 DRIVEABILITY AND EMISSIONS (DIESEL)

If after completing the On-Board Diagnostic (OBD) system check and finding the Tech 1 diagnostics functioning properly and no DTC(s) displayed, the "Transmission Tech 1 Values" may be used for comparison with values obtained on the vehicle being diagnosed. The "Transmission Tech 1 Values" are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosing. For further description on the values and use of the Tech 1 to diagnosis PCM inputs, refer to "General Description." If all values are within the range illustrated, refer to SECTION 7A14A (4L60E) or 7A17A (4L80E) "Functional Test Procedure."

### TRANSMISSION TECH 1 DATA

Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Closed Loop / Accessories Off

| SCAN Position          | Units Displayed                                      | Typical Data Value           | Refer To Section |
|------------------------|------------------------------------------------------|------------------------------|------------------|
| Engine Speed           | RPM                                                  | ± 50 RPM From desired        | 3                |
| Trans Output Spd       | RPM                                                  | 0 RPM                        | 10A/10B          |
| Eng Cool Temp          | C°/F°                                                | 85°C - 105°C (185°F - 221°F) | 3                |
| Trans Fluid Temp       | C°/F°                                                | 82°C - 94°C (180°F - 200°F)  | 10A/10B          |
| Throt Position         | Volts                                                | 0.3 - 0.9V                   | 3                |
| Throttle Angle         | Percentage                                           | 0%                           | 3                |
| # A/B/C RNG            | Off/On                                               | Off/On/Off                   | 10A              |
| * A/B/C RNG            | Off/On                                               | On/Off/On                    | 10B              |
| Trans Range Sw         | Invalid, Rev,<br>Drive 4, 3,<br>2, Low,<br>Park/Neut | Park/Neut                    | 10A/10B          |
| Commanded Gear         | 1-4                                                  | 1                            | 10A/10B          |
| Adaptable Shift        | No, Yes                                              | No                           | 10A/10B          |
| 1-2 Sol 2-3 Sol        | Off/On                                               | On/On                        | 10A/10B          |
| CTR FDBK 1/2 2/3       | Off/On                                               | On/On                        | 10A/10B          |
| * Trans Input Speed    | RPM                                                  | ± 50 RPM of Engine Speed     | 10B              |
| # 3-2 Control Sol      | Percentage                                           | 0%                           | 10A/10B          |
| # 3-2 Control FDBK     | Off/On                                               | Off                          | 10A              |
| Hot Mode               | No, Yes                                              | No                           | 10A/10B          |
| * TCC PWM Solenoid     | Percentage                                           | 0%                           | 10B              |
| TCC Slip Speed         | RPM                                                  | ± 50 RPM From Engine Speed   | 10A/10B          |
| # TCC Solenoid         | Off/On                                               | Off                          | 10A              |
| # CTR FDBK TCC Sol     | Off/On                                               | Off                          |                  |
| Desired PCS            | Amps                                                 | 1.01 Amps                    | 10A/10B          |
| Actual PCS             | Amps                                                 | 1.01 Amps                    | 10A/10B          |
| PCS Duty Cycle         | Percentage                                           | 40% - 60%                    | 10A/10B          |
| MPH Km/h               | 0-255                                                | 0                            | 10A/10B          |
| 4WD Low Switch         | No, Yes                                              | No                           | 10A/10B          |
| Cruise Engaged         | No, Yes                                              | No                           | 9B               |
| TCC Brake Switch       | Open/Closed                                          | Closed                       | 10A/10B          |
| Kickdown Enabled       | No, Yes                                              | No                           | 10A/10B          |
| * Trans Gear Ratio     | Ratio                                                | 0.00                         | 10B              |
| * Turbine Speed        | RPM                                                  | ± 50 RPM Of Engine Speed     | 10B              |
| 1-2 Shift Time         | Seconds                                              | 0                            | 10A/10B          |
| 2-3 Shift Time         | Seconds                                              | 0                            | 10A/10B          |
| # 1-2 Shift Time Error | Seconds                                              | 0                            | 10A              |
| # Curr Adapt Cell      | % TP                                                 | Not Used                     | 10A              |
| Trans Calib ID         | 0-65535                                              | Internal ID                  | 10A/10B          |
| System Voltage         | Volts                                                | 12.0 - 14.5V                 | 10A/10B          |

# 4L60E Only

\* 4L80E Only

## TRANSMISSION TECH 1 DATA DEFINITIONS

**ENGINE SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

**TRANS OUTPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

**ENGINE (ENG) COOLANT (COOL) TEMPERATURE (TEMP)** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the engine coolant temperature sensor. Engine coolant temperature is high (151°C) when signal voltage is low (0 volt), and engine coolant temperature is low (-40°C) when signal voltage is high (5 volts).

**TRANS FLUID TEMP** - Scan tool displays a range of -40°C to 151°C, 40°F to 304°F. - This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high (151°C) when signal voltage is low (0 volt), and transmission fluid temperature is low (-40°C) when signal voltage is high (5 volts).

**THROTTLE (THROT) POSITION** - Scan tool displays a range of 0.00 volt to 5.10 volts. - This parameter indicates the signal input of the throttle position sensor circuit. Low voltage (approximately .3V to 1.3V) indicates closed throttle, high voltage (approximately greater than 4.5V) indicates wide open throttle.

**THROTTLE ANGLE** - Scan tool displays a range of 0% to 100%. - This parameter indicates the signal input of the throttle position sensor circuit. 0% throttle angle (low voltage) indicates closed throttle, 100% throttle angle (high voltage) indicates wide open throttle.

**A/B/C RANGE (RNG)** - Scan tool displays "ON"/"OFF," "ON"/"OFF," "ON"/"OFF." - These parameters are the three inputs from the transmission range pressure switch assembly. "ON" represents a B+ voltage signal, "OFF" represents a 0 voltage signal.

**TRANS RANGE SWITCH (SW)** - Scan tool displays a range of invalid, Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, and Low. - This parameter is the decoded status of the three A/B/C range inputs from the transmission range pressure switch assembly and represents the position of the transmission manual valve.

**COMMANDED GEAR** - Scan tool displays a range of 1, 2, 3, or 4. - This parameter is the decoded commanded state of the 1-2 and 2-3 shift solenoids.

**1-2 SOLENOID (SOL)/2-3 SOLENOID (SOL)** - Scan tool displays "ON"/"OFF." - These parameters are the commanded status of the 1-2 and 2-3 shift solenoids. "ON" represents a commanded energized state (current flowing through solenoid). "OFF" represents a commanded non-energized state (current not flowing through solenoid).

**CONTROL (CTR) FEEDBACK (FDBK) 1/2 2/3** - Scan tool displays "ON"/"OFF." - These parameters are the actual states of the 1-2 and 2-3 shift solenoid driver control circuits. "ON" represents a driver control signal at 0 voltage. "OFF" represents a driver control signal at B+ voltage.

**TRANS INPUT SPEED** - Scan tool displays 0 RPM to 8191 RPM. - This parameter indicates the rotational speed of the transmission input shaft expressed as revolutions per minute.

**TCC SLIP SPEED** - Scan tool displays a range of -4096 RPM to +4095 RPM. - This parameter is the difference between transmission input speed and engine speed. A negative value indicates input speed is less than engine speed (deceleration). A positive value indicates engine speed is greater than input speed (acceleration). A value of zero indicates input speed is equal to engine speed (TCC applied).

**HOT MODE** - Scan tool displays "ON"/"OFF." - "ON" indicates transmission fluid temperature has exceeded 146°C (295°F).

**TCC PWM SOLENOID** - Scan tool displays a range of 0% to 100%. - This parameter is the commanded percentage of "ON" time of the TCC solenoid. 100% represents an "ON" (energized) commanded state. 0% represents (non-energized) commanded state.

**DESIRED PRESSURE CONTROL SOLENOID (PCS)** - Scan tool displays a range of 0.00 amp to 1.10 amps. - This parameter is the commanded current of the pressure control solenoid circuit. 0.00 amps (no current flow) indicates commanded higher line pressure. 1.10 amps (high current flow) indicates commanded lower line pressure.



## 10B-14 DRIVEABILITY AND EMISSIONS (DIESEL)

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**ACTUAL PRESSURE CONTROL SOLENOID (PCS) - Scan tool displays a range of 0.00 amp to 1.10 amps.** - This parameter is the actual current of the pressure control solenoid circuit at the control module. 0.00 amps (no current flow) indicates actual higher line pressure. 1.10 amps (high current flow) indicates actual lower line pressure.

**PRESSURE CONTROL SOLENOID (PCS) DUTY CYCLE - Scan tool displays a range of 0% to 100%.** - This parameter is the commanded state of the pressure control solenoid expressed as a percent of energized on-time. 0% indicates zero on-time (non-energized) or no current flow. 100% indicates maximum on-time (energized) or high current flow.

**MPH/Km/h - Scan tool displays a range of 0 mph to 255 mph.** - This parameter is the input signal from the vehicle speed sensor.

**FOUR WHEEL DRIVE (4WD) LOW SWITCH - Scan tool displays NO/YES.** - This parameter is the signal state of the four wheel drive low circuit. NO indicates a B+ voltage signal (4WD low not requested), YES indicates a 0 voltage signal (4WD low requested).

**CRUISE ENGAGED - Scan tool displays NO/YES.** - This parameter is the signal state of the cruise control "ON"/"OFF" switch. NO indicates a 0 voltage signal (cruise control not requested). YES indicates a B+ voltage (cruise control requested).

**TCC BRAKE SWITCH - Scan tool displays OPEN/CLOSED.** - This parameter indicates the state of the TCC brake switch circuit input. Applied indicates a 0 voltage input (brake switch open, brake pedal applied). Released indicates a B+ voltage input (brake switch closed, brake pedal released).

**KICKDOWN ENABLED - Scan tool displays NO/YES.** - This parameter indicates whether enabling conditions exist for an acceleration mode downshift. NO indicates enabling conditions (throttle position, vehicle speed, input speed, etc.) do not exist for an acceleration mode downshift. YES indicates enabling conditions exist for an acceleration mode downshift.

**1-2 SHIFT TIME - Scan tool displays a range of 0.00 seconds to 6.38 seconds.** - This parameter is the actual time of the last 1-2 shift.

**2-3 SHIFT TIME - Scan tool displays a range of 0.00 seconds to 6.38 seconds.** - This parameter is the actual time of the last 2-3 shift.

**TRANS GEAR RATIO - Scan tool displays a range of 0.00 to 5.00.** - This parameter is the difference between input speed and output speed.

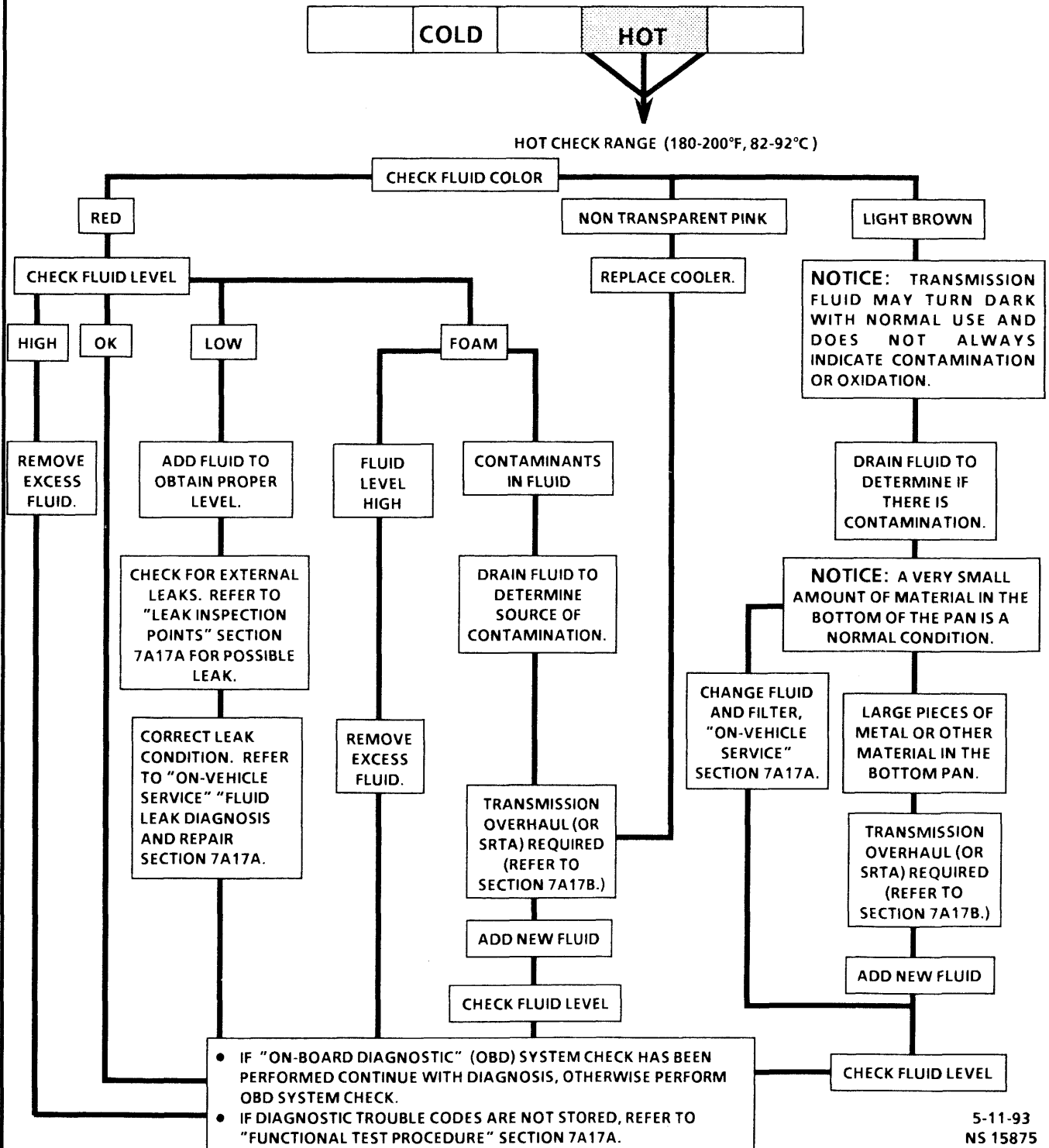
**TURBINE SPEED - Scan tool displays a range of 0 RPM to 8191 RPM.** - This parameter indicates rotational speed of the turbine shaft.

**TRANS CALIBRATION (CALIB) ID - Scan tool displays a four digit identification of the software calibration.**

**SYSTEM VOLTAGE - Scan tool displays 0.00 volt to 25.5 volts.** - This parameter is the battery ignition voltage input to the control module.

## 4L80E TRANSMISSION FLUID CHECKING PROCEDURE

1. Warm the transmission to normal operating temperature by driving the vehicle about 15 miles (24 km). Operating temperature is 180-200°F (82-94°C).
  2. Park vehicle on a level surface, place shift lever in "P" park and apply the parking brake.
  3. Check fluid level on the dipstick (read the lower level).
  4. If fluid level is low, add only enough DEXRON®-III to bring the fluid level into the hot area.
- \* It is important to check fluid level when the transmission has reached operating temperature. The hot range is calibrated correspond to the correct fluid level range for fluid between 180 and 200°F (82-94°C).



## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                                                       | SECTION | DTC NUMBER AND NAME                                                 | SECTION                    |
|-------------------------------------------------------------------------------------------|---------|---------------------------------------------------------------------|----------------------------|
| DTC 13 - Engine Shutoff Solenoid Circuit Fault                                            | 3       | DTC 23 - Accelerator Pedal Position 1 Circuit Range Fault           | 3                          |
| DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit Low (High Temperature Indicated) | 3       | *DTC 24 - Vehicle Speed Sensor Circuit Low (Output Speed Signal)    | 10A (4L60E)<br>10B (4L80E) |
| DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit High (Low Temperature Indicated) | 3       | DTC 25 - Accelerator Pedal Position 2 Circuit High                  | 3                          |
| DTC 16 - Vehicle Speed Sensor Buffer Fault                                                | 3       | DTC 26 - Accelerator Pedal Position 2 Circuit Low                   | 3                          |
| DTC 17 - High Resolution Circuit Fault                                                    | 3       | DTC 27 - Accelerator Pedal Position 2 Circuit Range Fault           | 3                          |
| DTC 18 - Pump Cam Reference Pulse Error                                                   | 3       | *DTC 28 - Trans Range Pressure Switch Circuit                       | 10A (4L60E)<br>10B (4L80E) |
| DTC 19 - Crankshaft Position Reference Error                                              | 3       | DTC 29 - Glow Plug Relay Fault                                      | 3                          |
| DTC 21 - Accelerator Pedal Position 1 Circuit High                                        | 3       | DTC 31 - EGR Control Pressure/Baro Sensor Circuit Low (High Vacuum) | 3                          |
| DTC 22 - Accelerator Pedal Position 1 Circuit Low                                         | 3       | DTC 32 EGR Circuit Error                                            | 3                          |

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                         | SECTION                    | DTC NUMBER AND NAME                                                      | SECTION                    |
|-------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------|----------------------------|
| DTC 33 - EGR Control Pressure/Baro Sensor Circuit High      | 3                          | DTC 47 - Intake Air Temperature Sensor Circuit Low (High Temp Indicated) | 3                          |
| DTC 34 - Injection Timing Stepper Motor Fault               | 3                          | DTC 48 - Intake Air Temperature Sensor Circuit High (Low Temp Indicated) | 3                          |
| DTC 35 - Injection Pulse Width Error (Response Time Short)  | 3                          | DTC 49 - Service Throttle Soon Lamp Circuit Fault                        | 3                          |
| DTC 36 - Injection Pulse Width Error (Response Time Long)   | 3                          | DTC 51 - PROM Error                                                      | 3                          |
| *DTC 37 - TCC Brake Switch Stuck "ON"                       | 10A (4L60E)<br>10B (4L80E) | *DTC 52 - System Voltage High Long                                       | 10A (4L60E)<br>10B (4L80E) |
| *DTC 38 - TCC Brake Switch Stuck "OFF"                      | 10A (4L60E)<br>10B (4L80E) | *DTC 53 - System Voltage High                                            | 10A (4L60E)<br>10B (4L80E) |
| *DTC 39 - TCC Stuck "OFF"                                   | 10B (4L80E)                | DTC 56 - Injection Pump Calibration Resistor Error                       | 3                          |
| DTC 41 - Brake Switch Circuit Fault                         | 3                          | DTC 57 - PCM 5 Volt Shorted                                              | 3                          |
| DTC 42 - Fuel Temperature Circuit Low (High Temp Indicated) | 3                          | *DTC 58 - Trans Fluid Temp Circuit Low                                   | 10A (4L60E)<br>10B (4L80E) |
| DTC 43 - Fuel Temperature Circuit High (Low Temp Indicated) | 3                          | *DTC 59 - Trans Fluid Temp Circuit High                                  | 10A (4L60E)<br>10B (4L80E) |
| DTC 44 - EGR Pulse Width Error                              | 3                          | DTC 61 - Turbo Boost Sensor Circuit High                                 | 3                          |
| DTC 45 - EGR Vent Error                                     | 3                          | DTC 62 - Turbo Boost Sensor Circuit Low                                  | 3                          |
| DTC 46 - Malfunction Indicator Lamp Circuit Fault           | 3                          |                                                                          |                            |

## DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

The MIL (Service Engine Soon) will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within 50 engine starts.

### Important

- All DTCs with the sign \* are transmission related DTCs and have descriptions, diagnostic charts are in SECTION 10A (4L60E)/10B (4L80E). Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

| DTC NUMBER AND NAME                                               | SECTION                    | DTC NUMBER AND NAME                                            | SECTION                    |
|-------------------------------------------------------------------|----------------------------|----------------------------------------------------------------|----------------------------|
| DTC 63 - Accelerator Pedal Position 3 Circuit High                | 3                          | *DTC 82 - 1-2 Shift Solenoid Circuit                           | 10A (4L60E)<br>10B (4L80E) |
| DTC 64 - Accelerator Pedal Position 3 Circuit Low                 | 3                          | *DTC 83 - TCC Pwm Solenoid Circuit                             | 10B (4L80E)                |
| DTC 65 - Accelerator Pedal Position 3 Circuit Range Fault         | 3                          | *DTC 84 - Accelerator Pedal Position Circuit Fault             | 10B (4L80E)                |
| *DTC 66 - 3-2 Control Solenoid Circuit                            | 10A (4L60E)                | *DTC 85 - Undefined Ratio Error                                | 10B (4L80E)                |
| *DTC 67 - TCC Solenoid Circuit                                    | 10A (4L60E)                | *DTC 86 - Low Ratio Error                                      | 10B (4L80E)                |
| *DTC 68 - Trans Component Slipping                                | 10A (4L60E)<br>10B (4L80E) | *DTC 87 - High Ratio Error                                     | 10B (4L80E)                |
| *DTC 69 - TCC Stuck "ON"                                          | 10A (4L60E)<br>10B (4L80E) | DTC 88 - TDC Offset Error                                      | 3                          |
| DTC 71 - Set/Coast Switch Fault                                   | 3                          | DTC 91 - Cylinder Balance Fault #1 Cyl                         | 3                          |
| *DTC 72 - Vehicle Speed Sensor Circuit Loss (Output Speed Signal) | 10A (4L60E)<br>10B (4L80E) | DTC 92 - Cylinder Balance Fault #2 Cyl                         | 3                          |
| *DTC 73 - Pressure Control Solenoid Circuit                       | 10A (4L60E)<br>10B (4L80E) | DTC 93 - Cylinder Balance Fault #3 Cyl                         | 3                          |
| *DTC 74 - Trans Input Speed Sensor Circuit                        | 10B (4L80E)                | DTC 94 - Cylinder Balance Fault #4 Cyl                         | 3                          |
| *DTC 75 - System Voltage Low                                      | 10A (4L60E)<br>10B (4L80E) | DTC 95 - Cylinder Balance Fault #5 Cyl                         | 3                          |
| DTC 76 - Resume/Accel Switch Fault                                | 3                          | DTC 96 - Cylinder Balance Fault #6 Cyl                         | 3                          |
| DTC 78 - Wastegate Solenoid Fault                                 | 3                          | DTC 97 - Cylinder Balance Fault #7 Cyl                         | 3                          |
| *DTC 79 - Trans Fluid Overtemp                                    | 10A (4L60E)                | DTC 98 - Cylinder Balance Fault #8 Cyl                         | 3                          |
| *DTC 81 - 2-3 Shift Solenoid Circuit                              | 10A (4L60E)<br>10B (4L80E) | DTC 99 - Accelerator Pedal Position 2 (5 Volt Reference Fault) | 3                          |

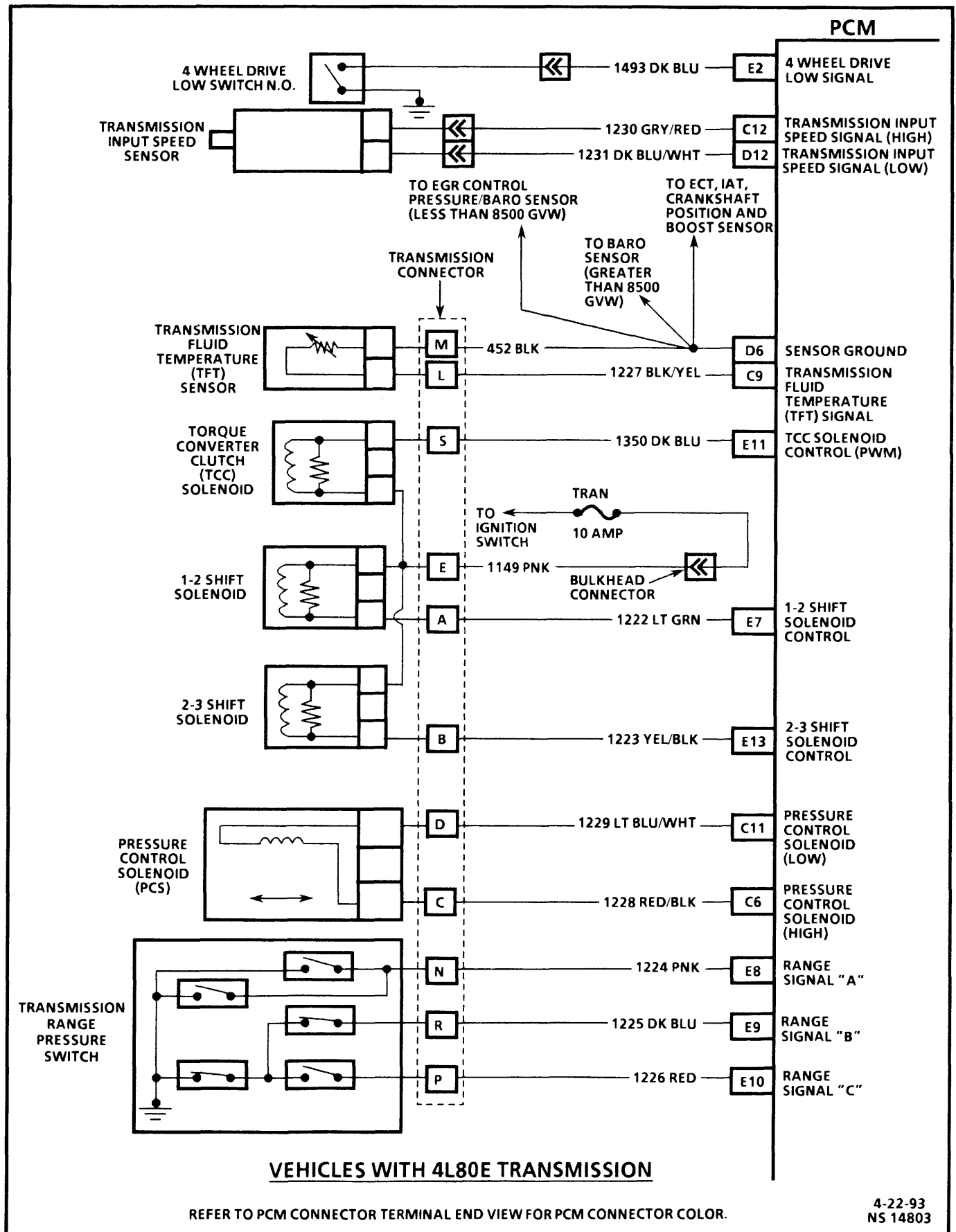
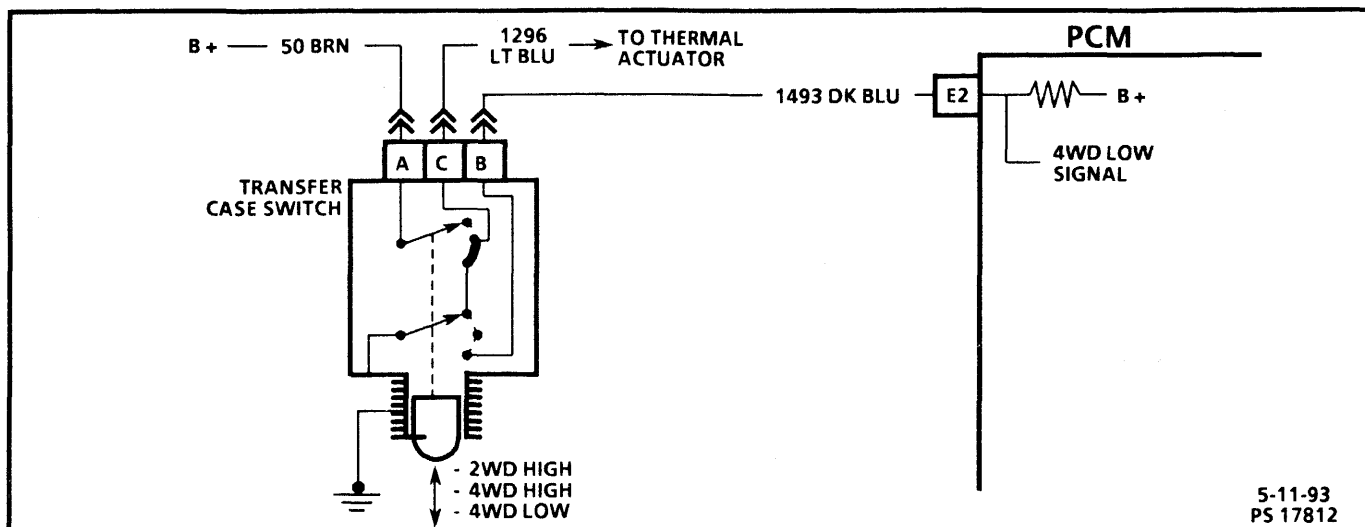


Figure 10B-14 - PCM Wiring Diagram 4L80E Transmission



## 4WD LOW SWITCH SIGNAL CHECK

### Circuit Description:

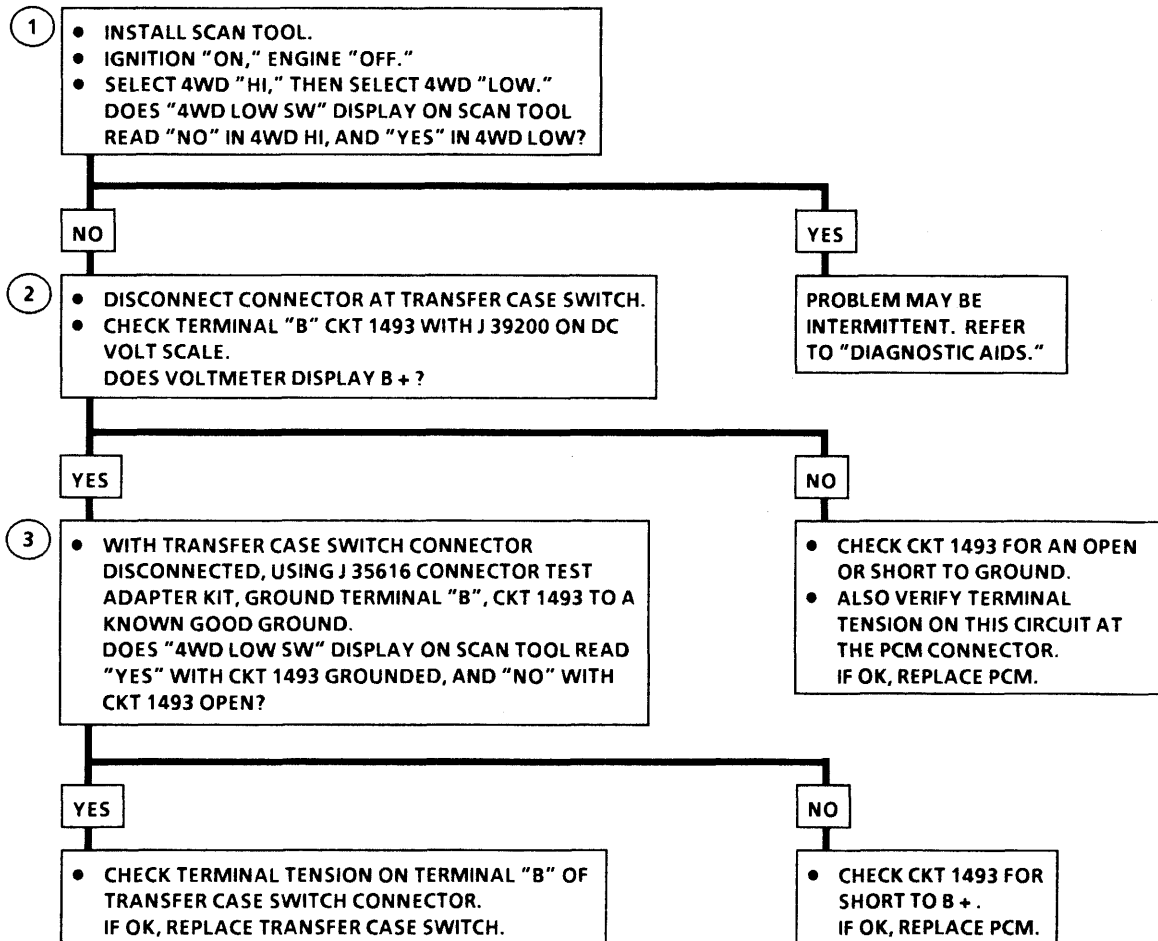
The 4WD low circuit consists of a transfer case switch, front axle actuator, and wiring. The PCM supplies a B+ voltage signal to the transfer case switch on CKT 1493. With 2WD or 4WD HI selected, no ground path is provided for CKT 1493, and the voltage signal at the PCM will be B+. When 4WD low is selected the transfer case switch provides a ground for CKT 1493 and the PCM 4WD low signal CKT 1493 will change from B+ to zero volt. The transfer case switch also completes CKT 50 (B+) to CKT 1296 to provide B+ to the front axle actuator.

**Action Taken (PCM will default to):** Failures of the 4WD low circuit can cause many types of complaints such as: early/late shifts, erratic shifts.

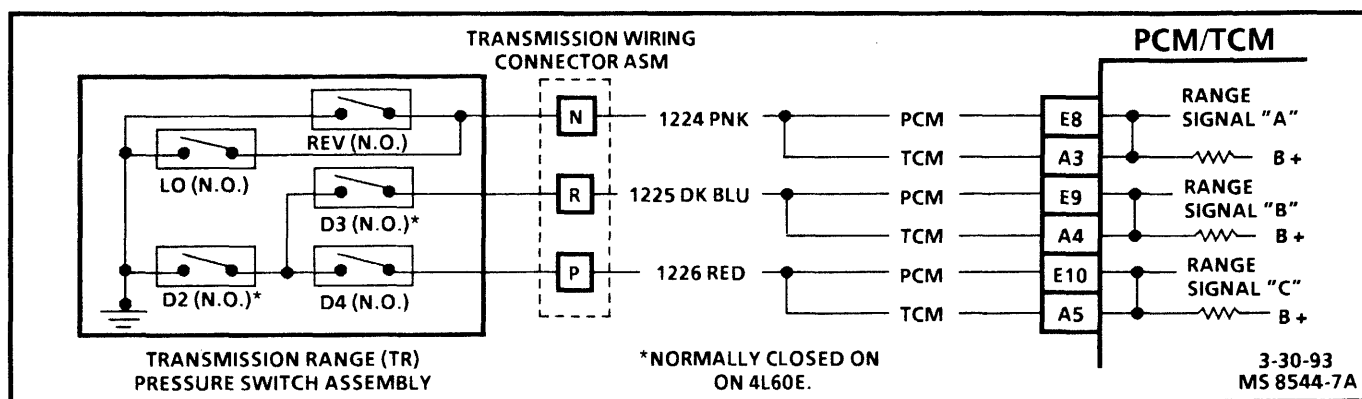
**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for proper circuit operation.
2. This test checks for a proper reference signal from the PCM.
3. This test checks the ability of the transfer case switch to ground the reference signal from the PCM.

**Diagnostic Aids:** For further information, refer to SECTION 7D of the appropriate service manual. For further information on the 4WD indicator refer to SECTION 38A of the electrical diagrams in this manual.

**4WD LOW SWITCH SIGNAL CHECK**





## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

### Circuit Description:

The Transmission Range (TR) switch assembly consists of five normally open pressure switches. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected by the vehicle operator. With ignition "ON" and engine "OFF," P/N will be indicated. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and with ignition "ON," D2 will be indicated.

**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

### Valid Combination Chart "ON" = 0 volts/"OFF" = B +

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings 4L60E

**Diagnostic Aids:** Refer to accompanying chart for various A/B/C range combinations. Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A17A of the appropriate service manual for further information.

### Valid Combination Chart "ON" = B +/"OFF" = 0 volts

|         | A   | B   | C   |
|---------|-----|-----|-----|
| Park    | ON  | OFF | ON  |
| Rev     | OFF | OFF | ON  |
| Neutral | ON  | OFF | ON  |
| 4th     | ON  | OFF | OFF |
| 3rd     | ON  | ON  | OFF |
| 2nd     | ON  | ON  | ON  |
| 1st     | OFF | ON  | ON  |
| Illegal | OFF | ON  | OFF |
| Illegal | OFF | OFF | OFF |

Expected Readings 4L80E

## TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY CIRCUIT CHECK

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

- 1
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO

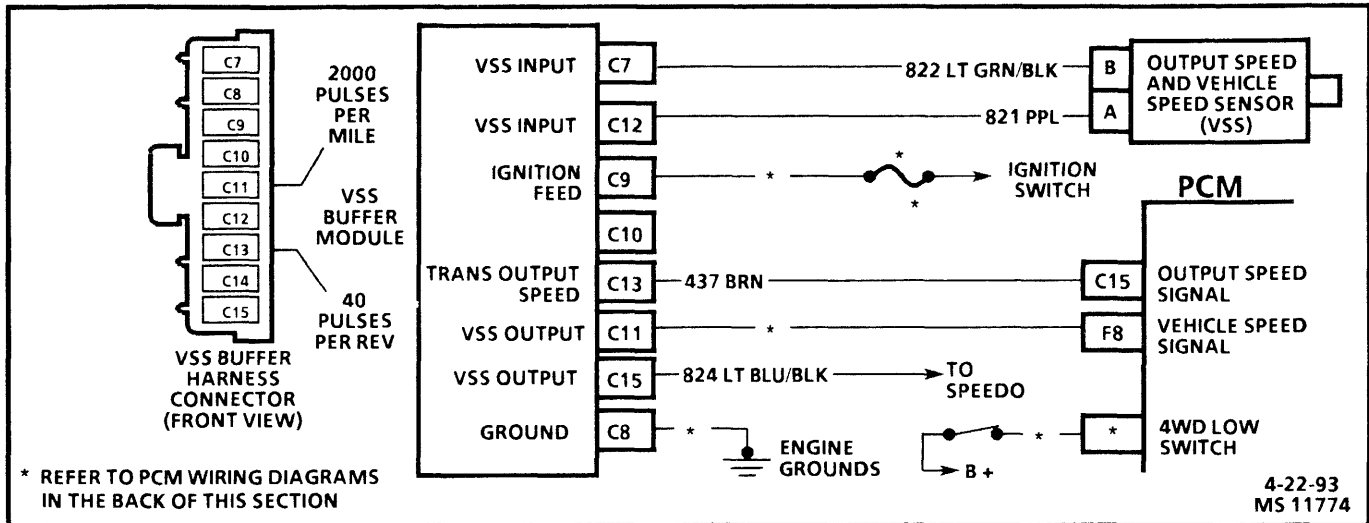
- 3
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

YES

- 2
- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.



## DTC 24

## VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW (TRANS OUTPUT SPEED SIGNAL)

### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 pulse per revolution signal to the PCM.

### DTC 24 Will Set When:

- No DTC(s) 21, 22, 28, 33, or 34.
- Not in P/N.
- CKT 437 voltage is constant.
- Engine speed is greater than 3000 RPM.
- Output speed is less than 200 RPM.
- MAP is greater than 40 kPa.
- TP is between 10% and 100%.
- All conditions are met for 3 seconds.

**Action Taken (PCM will default to):** Second gear only at maximum line pressure.

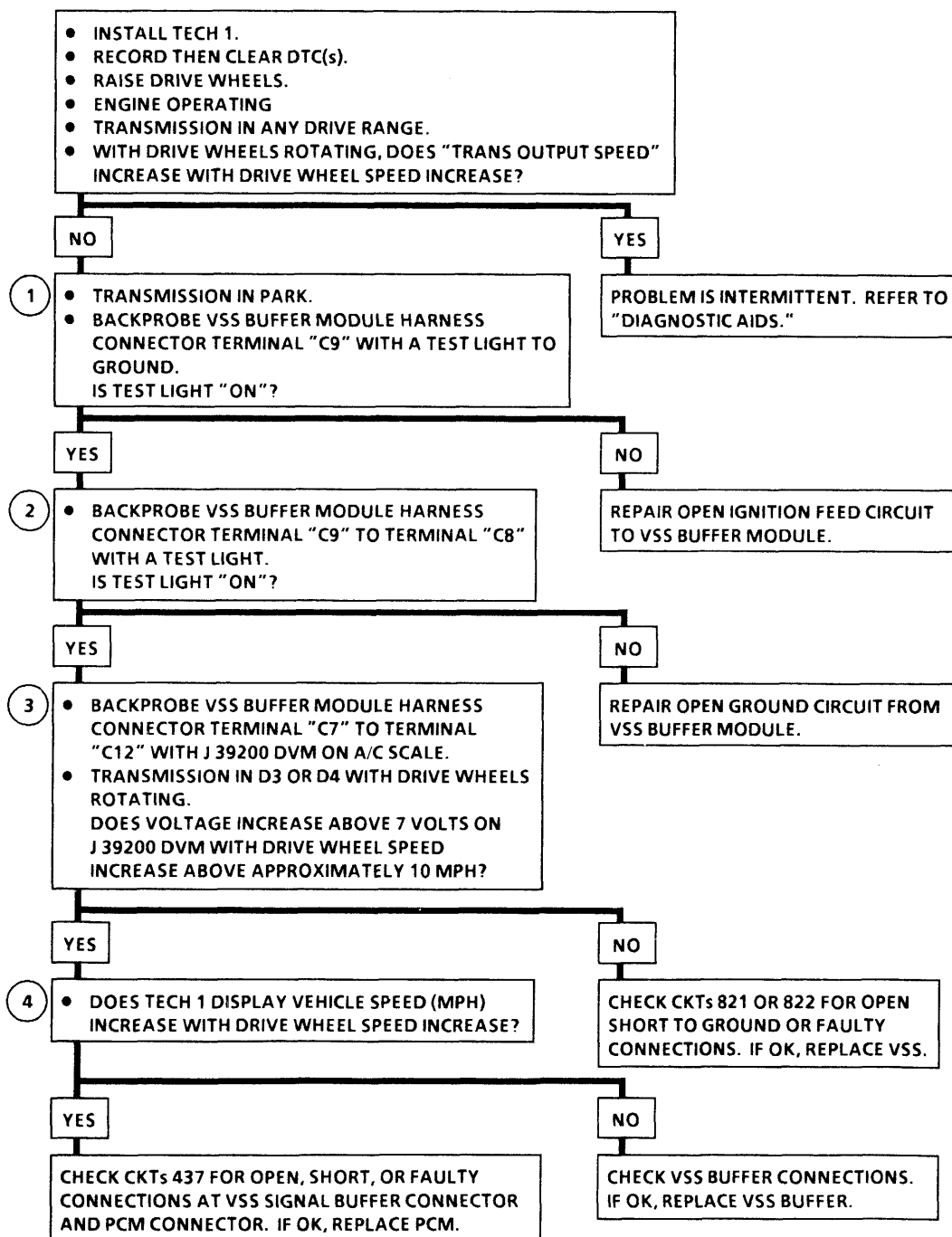
**DTC 24 Will Clear When:** The ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

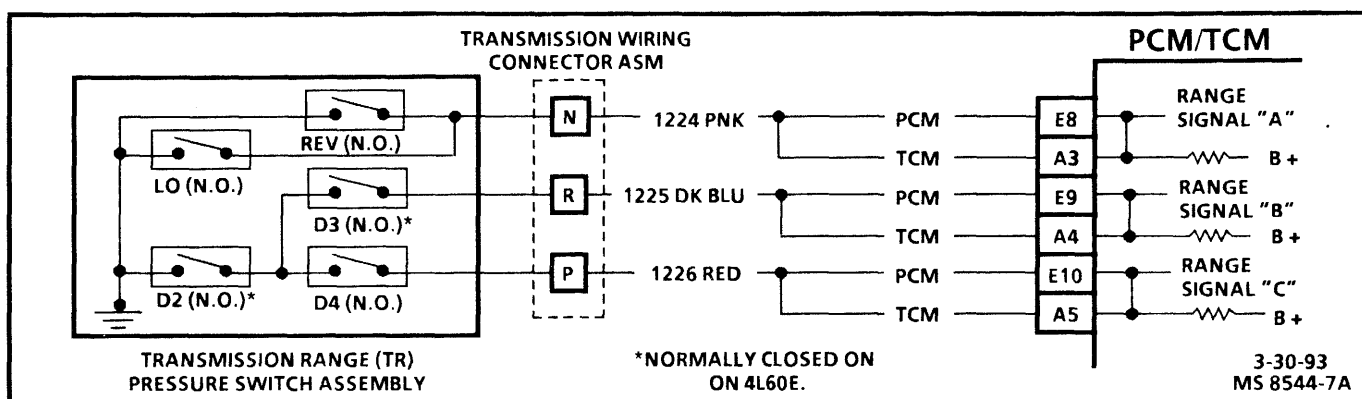
### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost during vehicle operation.

**DTC 24****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697



## DTC 28

### TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT

#### Circuit Description:

The Transmission Range (TR) switch assembly consists of five normally open pressure switches mounted on the valve body. The PCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what transmission range has been selected by the vehicle operator. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the PCM will be removed, and D2 will be indicated.

#### DTC 28 Will Set When:

- Range signals "A" and "C" are both zero volt.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Drive four shift pattern control.
- No fourth gear in hot mode.
- No TCC.

**DTC 28 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled from "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage from the PCM to the transmission external connector.
3. This test checks a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** DTC 28 will set if the PCM detects one of two "Illegal" combinations.

Refer to accompanying chart for various A/B/C range combinations.

Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in SECTION 7A14A (4L60E)/7A17A (4L80E) of the appropriate service manual for further information.

**Valid Combination Chart**  
"ON" = 0 volts/"OFF" = B +

| Range Signal | A   | B   | C   |
|--------------|-----|-----|-----|
| Park         | OFF | ON  | OFF |
| Rev          | ON  | ON  | OFF |
| Neutral      | OFF | ON  | OFF |
| D4           | OFF | ON  | ON  |
| D3           | OFF | OFF | ON  |
| D2           | OFF | OFF | OFF |
| D1           | ON  | OFF | OFF |
| Illegal      | ON  | OFF | ON  |
| Illegal      | ON  | ON  | ON  |

Expected Readings 4L60E

**Valid Combination Chart**  
"ON" = B +/"OFF" = 0 volts

|         | A   | B   | C   |
|---------|-----|-----|-----|
| Park    | ON  | OFF | ON  |
| Rev     | OFF | OFF | ON  |
| Neutral | ON  | OFF | ON  |
| 4th     | ON  | OFF | OFF |
| 3rd     | ON  | ON  | OFF |
| 2nd     | ON  | ON  | ON  |
| 1st     | OFF | ON  | ON  |
| Illegal | OFF | ON  | OFF |
| Illegal | OFF | OFF | OFF |

Expected Readings 4L80E

**DTC 28****TRANSMISSION RANGE (TR) PRESSURE  
SWITCH ASSEMBLY FAULT**

THIS CHART ASSUMES THAT:

- THE TRANSMISSION LINKAGE FROM THE SELECT LEVER TO THE MANUAL VALVE IS ADJUSTED PROPERLY.
- OBD SYSTEM CHECK HAS BEEN PERFORMED.
- FLUID CHECKING PROCEDURE HAS BEEN PERFORMED.
- ALL DTC(s) HAVE BEEN RECORDED AND THEN CLEARED.
- SCAN TOOL STILL INSTALLED.

- 1
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
  - PARKING BRAKE APPLIED AND WHEELS BLOCKED.
  - APPLY BRAKE PEDAL AND SELECT EACH TRANSMISSION RANGE D1, D2, D3, D4, N, R, P.
- DOES EACH SELECTED TRANSMISSION RANGE MATCH THE SCAN TOOL "TRANS RANGE SW" DISPLAY?

NO

- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 - JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
  - IGNITION "ON," ENGINE "OFF."
  - WITH J 39200 TO GROUND, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "N", "R" AND "P".
- DOES J 39200 DISPLAY B+ AT ALL THREE CIRCUITS?

NO

- 3
- ON CIRCUIT(S) THAT DID NOT INDICATE B+, CHECK FOR AN OPEN OR SHORT TO GROUND. IF OK, CHECK CONTROL MODULE CONNECTOR TERMINAL TENSION ON THESE CIRCUITS. IF OK, REPLACE CONTROL MODULE.

YES

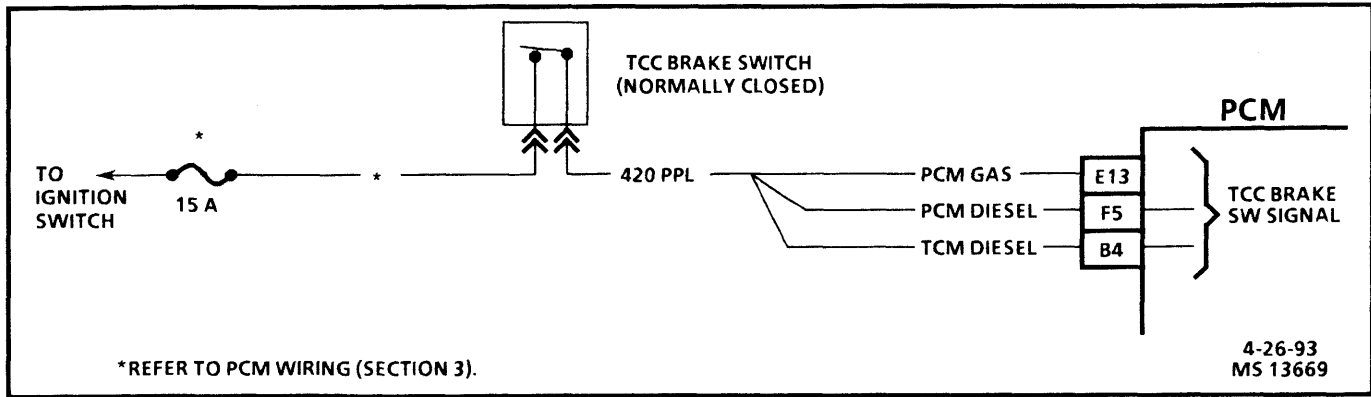
NO TROUBLE FOUND.  
REFER TO DIAGNOSTIC AIDS.

YES

- 2
- VERIFY THAT CKT(s) 1224, 1225, OR 1226 ARE NOT SHORTED TOGETHER. IF OK, REFER TO "FLUID PRESSURE SWITCH ASSEMBLY RESISTANCE CHECK" SECTION 7A14A (4L60E) OR 7A17A (4L80E) OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-27-93  
PS 17065



## DTC 37/38

### TCC BRAKE SWITCH STUCK "ON"/ TCC BRAKE SWITCH STUCK "OFF"

#### Circuit Description:

The normally closed brake switch supplies a B+ signal on CKT 420 to the PCM. The signal voltage drops to 0 volt when the TCC brake switch is opened (brake pedal applied).

#### DTC 37 Will Set When:

- CKT 420 is open.
  - Vehicle speed is less than 5 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - Then vehicle speed is greater than 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

#### DTC 38 Will Set When:

- CKT 420 has constant voltage.
  - Vehicle speed is greater than 20 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

#### Action Taken (PCM will default to):

##### DTC 37:

- No fourth gear in hot mode.

##### DTC 38:

- No fourth gear in hot mode.
- No TCC.

**DTC 37/38 Will Clear When:** Fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 420 at the PCM.

#### Diagnostic Aids:

- Refer to "PCM Intermittent Diagnostic Trouble Code or Performance."
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go expressway traffic).

# DTC 37/38

## TCC BRAKE SWITCH STUCK "ON"/ TCC BRAKE SWITCH STUCK "OFF"

- INSTALL SCAN TOOL.
- IGNITION SWITCH "ON," ENGINE "OFF."
- RECORD THEN CLEAR DTC(s).
- APPLY THEN RELEASE BRAKE PEDAL.
- DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE PEDAL APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

NO

1

- WITH A TEST LIGHT CONNECTED TO GROUND, BACKPROBE IGNITION FEED CIRCUIT ON BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

- WITH TEST LIGHT CONNECTED TO GROUND, BACKPROBE HARNESS CKT 420 AT BRAKE SWITCH. IS TEST LIGHT "ON"?

YES

2

- APPLY BRAKE PEDAL. IS TEST LIGHT "OFF" WHEN BRAKE PEDAL IS APPLIED?

YES

- IGNITION "OFF."
- DISCONNECT CONTROL MODULE CONNECTORS.
- IGNITION "ON," ENGINE "OFF."
- WITH A TEST LIGHT CONNECTED TO GROUND, PROBE CONTROL MODULE CKT 420 HARNESS CONNECTOR. IS TEST LIGHT "ON"?

YES

3

- IGNITION "OFF."
- RECONNECT CONTROL MODULE CONNECTIONS.
- IGNITION "ON."
- APPLY THEN RELEASE BRAKE PEDAL. DOES SCAN TOOL DISPLAY TCC BRAKE SW "OPEN" WITH BRAKE APPLIED, AND THEN DISPLAY "CLOSED" WHEN RELEASED?

YES

ELECTRICAL SYSTEM CHECKS OK AT THIS TIME. THE MALFUNCTION MAY BE INTERMITTENT OR MAY HAVE BEEN CORRECTED DURING THIS DIAGNOSTIC PROCEDURE. REFER TO DIAGNOSTIC AIDS.

YES

NO TROUBLE FOUND. REFER TO "DIAGNOSTIC AIDS."

NO

REPAIR OPEN IN THE IGNITION FEED CIRCUIT TO THE BRAKE SWITCH. IF THE IGNITION VOLTAGE FEED FUSE IS OPEN, ALSO CHECK CKT 420 FOR A SHORT TO GROUND.

NO

BRAKE SWITCH OUT OF ADJUSTMENT OR FAULTY BRAKE SWITCH.

NO

CHECK CKT 420 FOR SHORT TO B+. IF OK, REPLACE BRAKE SWITCH.

NO

REPAIR OPEN CKT 420 FROM TCC BRAKE SWITCH TO PCM.

NO

FAULTY CONTROL MODULE.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-3-93  
PS 17053



## TCC STUCK "OFF"

The PCM commands the TCC PWM solenoid "ON" by modulating TCC signal fluid acting on the converter clutch shift valve. Then TCC apply fluid applies the torque converter clutch.

- No DTC(s) 28, 71, or 74.
- TCC slip speed greater than 65 RPM.
- Trans range in D3 or D4.
- 2nd or 3rd gear.
- All conditions are met for two seconds.

**DTC 39 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

1. This checks the mechanical and hydraulic operation of the TCC, while commanded "ON" by the PCM.

**Diagnostic Aids:** Snapshot mode will record 5 data parameters per second.

**DTC 39**  
**TCC STUCK "OFF"**

- 1
- IF DTC 83 IS SET, REFER TO THAT CHART BEFORE PROCEEDING.
  - INSTALL SCAN TOOL.
  - DRIVE VEHICLE IN D3 AND IN 3<sup>rd</sup> GEAR.
  - USE SNAPSHOT MODE TO RECORD DATA PARAMETERS.
  - WHILE REVIEWING DATA, IS TCC SLIP SPEED GREATER THAN 65 RPM WHILE TCC PWM SOLENOID IS COMMANDED "ON" (GREATER THAN 95%), FOR 2 SECONDS?

YES

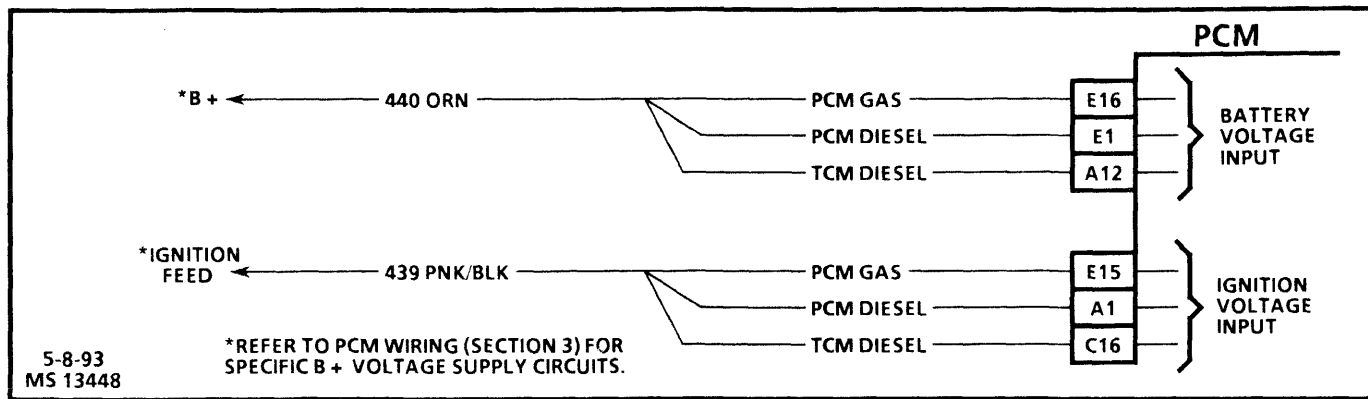
THE TORQUE CONVERTER CLUTCH IS MECHANICALLY STUCK "OFF," REFER TO SYMPTOM DIAGNOSIS CHARTS, "NO TCC" SECTION 7A 17A.

NO

THE CONDITION MAY BE INTERMITTENT, REFER TO "TORQUE CONVERTER CLUTCH (TCC) DIAGNOSIS" IN SECTION 7A 17A OF THE APPROPRIATE SERVICE MANUAL.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17415



## DTC 52/53

### SYSTEM VOLTAGE HIGH LONG/SYSTEM VOLTAGE HIGH

#### Circuit Description:

Ignition voltage is supplied to the control module to indicate the ignition status of the ignition switch. Battery voltage is supplied to the control module to, in part, maintain memory of learned functions and parameters.

#### DTC 52 Will Set When:

- The ignition is "ON" and the system voltage is greater than 16 volts.
- All conditions are met for 109 minutes.

#### DTC 53 Will Set When:

- The ignition is "ON" and the system voltage is greater than 19.5 volts.
- All conditions are met for 2 minutes.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- 2nd gear (4L80E), 3rd gear (4L60E).
- Inhibit TCC.

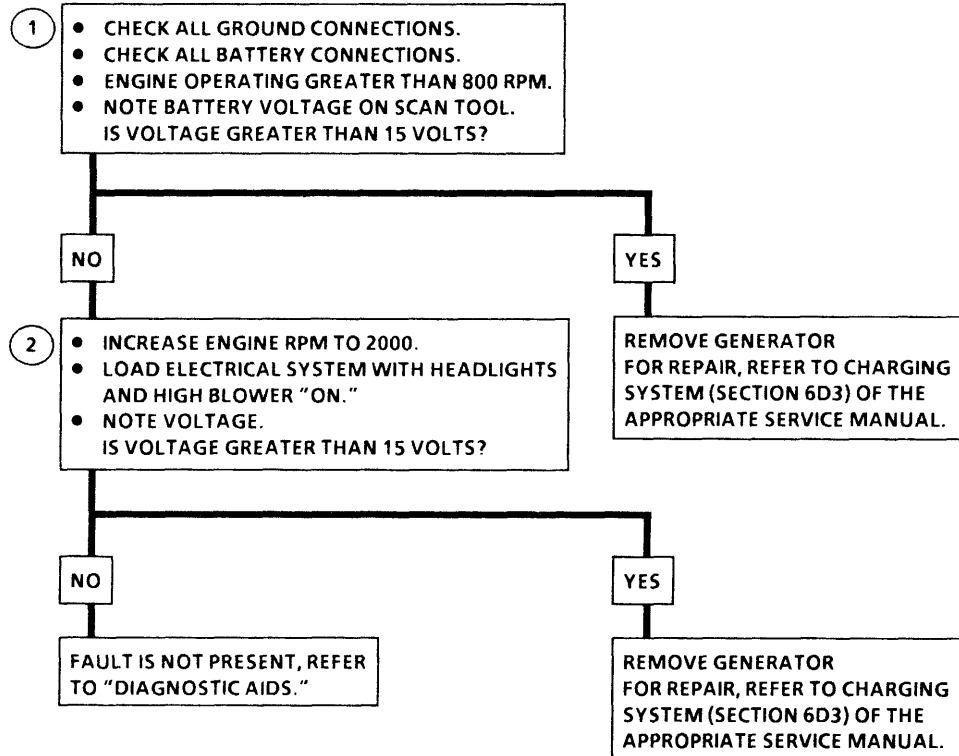
**DTC 52/53 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

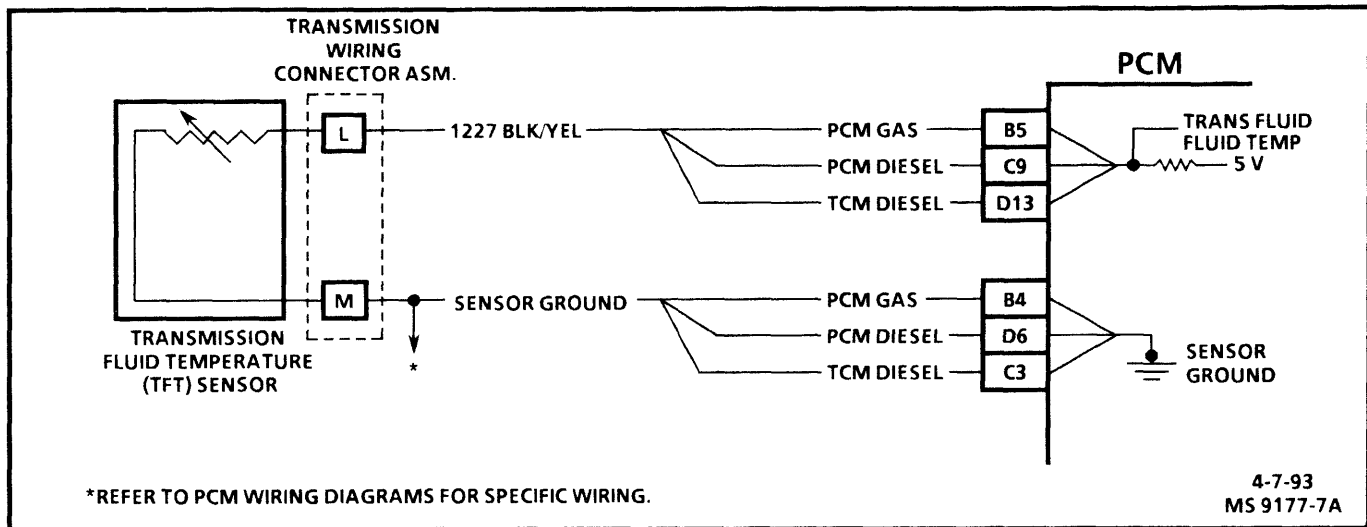
#### Diagnostic Aids:

- Charging the battery and jump-starting an engine may set DTC 52/DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

**DTC 52/53**  
**SYSTEM VOLTAGE HIGH LONG/  
SYSTEM VOLTAGE HIGH**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17067



## DTC 58

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts. With a DTC 79 also set, check the transmission cooling system.

#### DTC 58 Will Set When:

- Signal voltage indicates TFT greater than 151°C (306°F).
- All conditions are met for 1 second.

**Action Taken (PCM will default to):** The PCM will use a warm default trans fluid temperature value.

**DTC 58 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

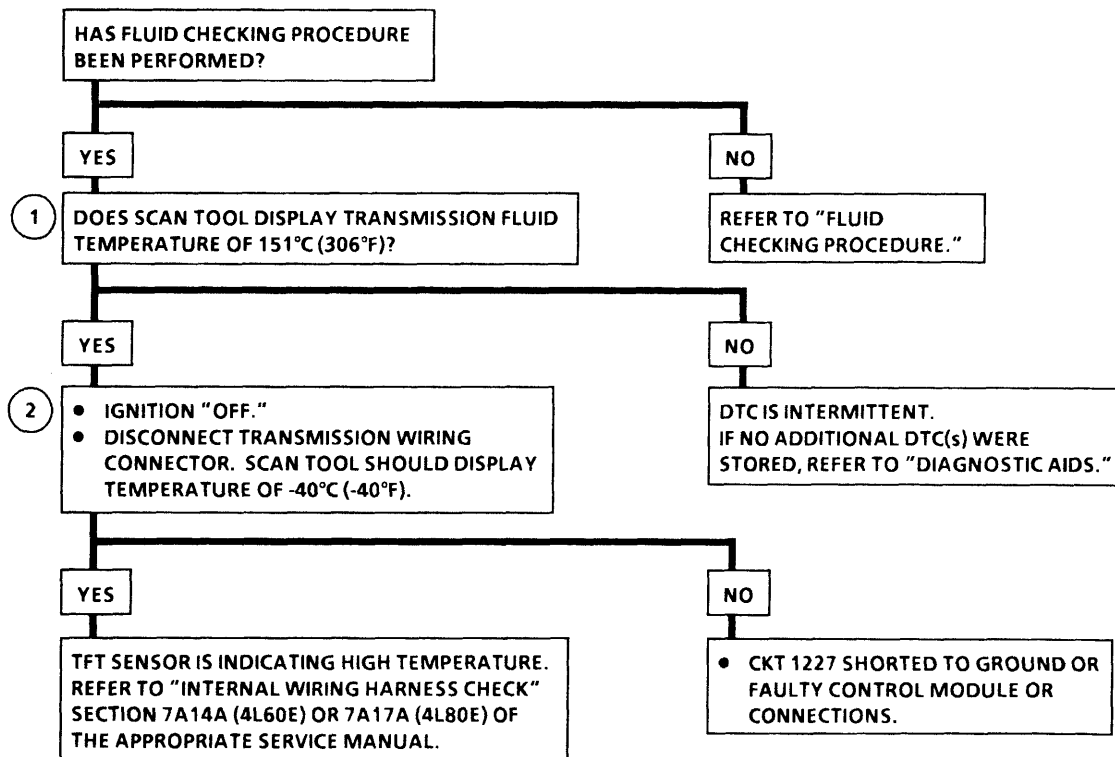
1. This test checks for a short to ground or a "skewed" sensor.
2. This test checks for an internal fault within the transmission by creating an open.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C (212°F) then stabilize.

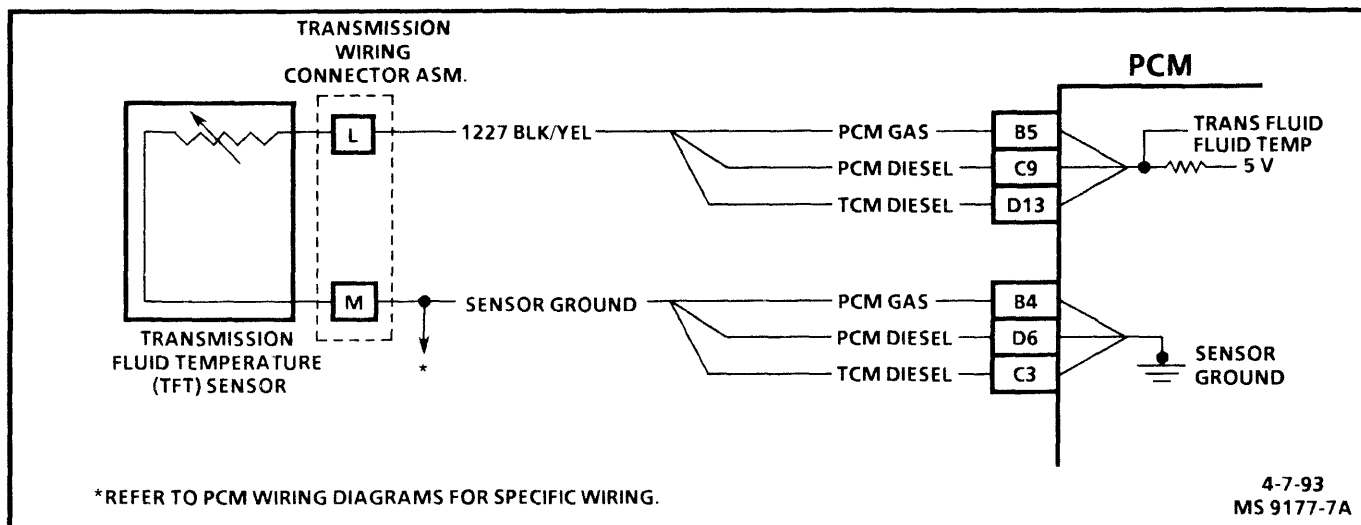
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A17A may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" (mis-scaled) sensor could result in delayed garage shifts or TCC complaints.

**DTC 58****TRANSMISSION FLUID TEMPERATURE (TFT)  
SENSOR CIRCUIT LOW  
(HIGH TEMPERATURE INDICATED)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-29-93  
MS 13671



## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

#### Circuit Description:

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies 5 volts to the sensor on CKT 1227. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases at about 1.5 to 2.0 volts.

#### DTC 59 Will Set When:

- Signal voltage indicates TFT less than -40°C (-40°F).
- All conditions are met for 1 second.

**Action Taken (PCM will default to):** The PCM will use a warm default trans fluid temperature value.

**DTC 59 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks for entire circuit and indicates whether the malfunction is present.
2. This test simulates a DTC 58. If the PCM recognizes the low signal voltage (high temperature), and the scan displays 151°C (305°F) or greater, the PCM and wiring are OK.
3. This test checks if CKT 1227 is open. There should be 5 volts present at the sensor connector if measured with J 39200.

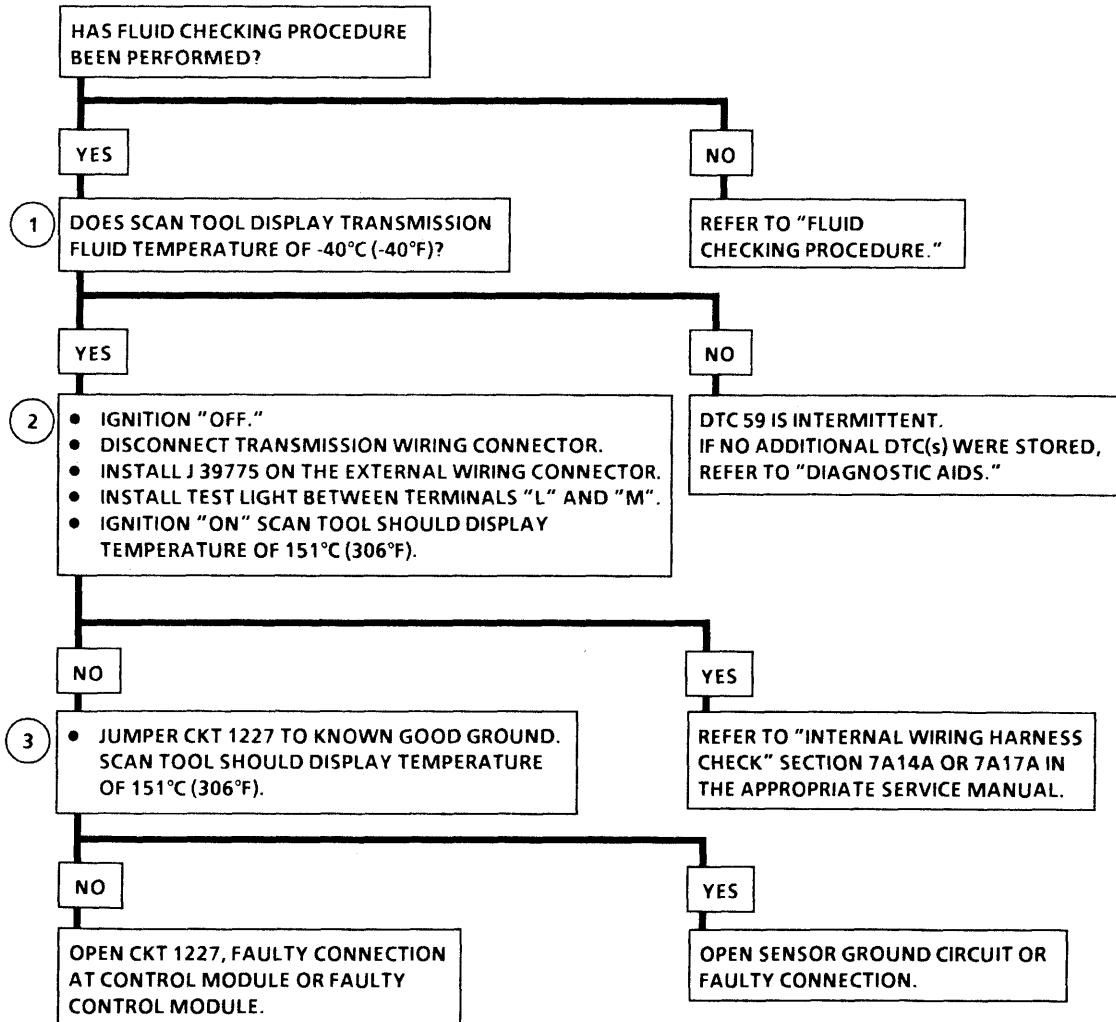
**Diagnostic Aids:** Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100°C (212°F) then stabilize.

A faulty connection or an open in CKT 455 or CKT 1227 can result in a DTC 59.

The "Temperature to Resistance Value" scale in SECTION 7A17A may be used to check the TFT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor can result in firm shifts, or TCC complaints.

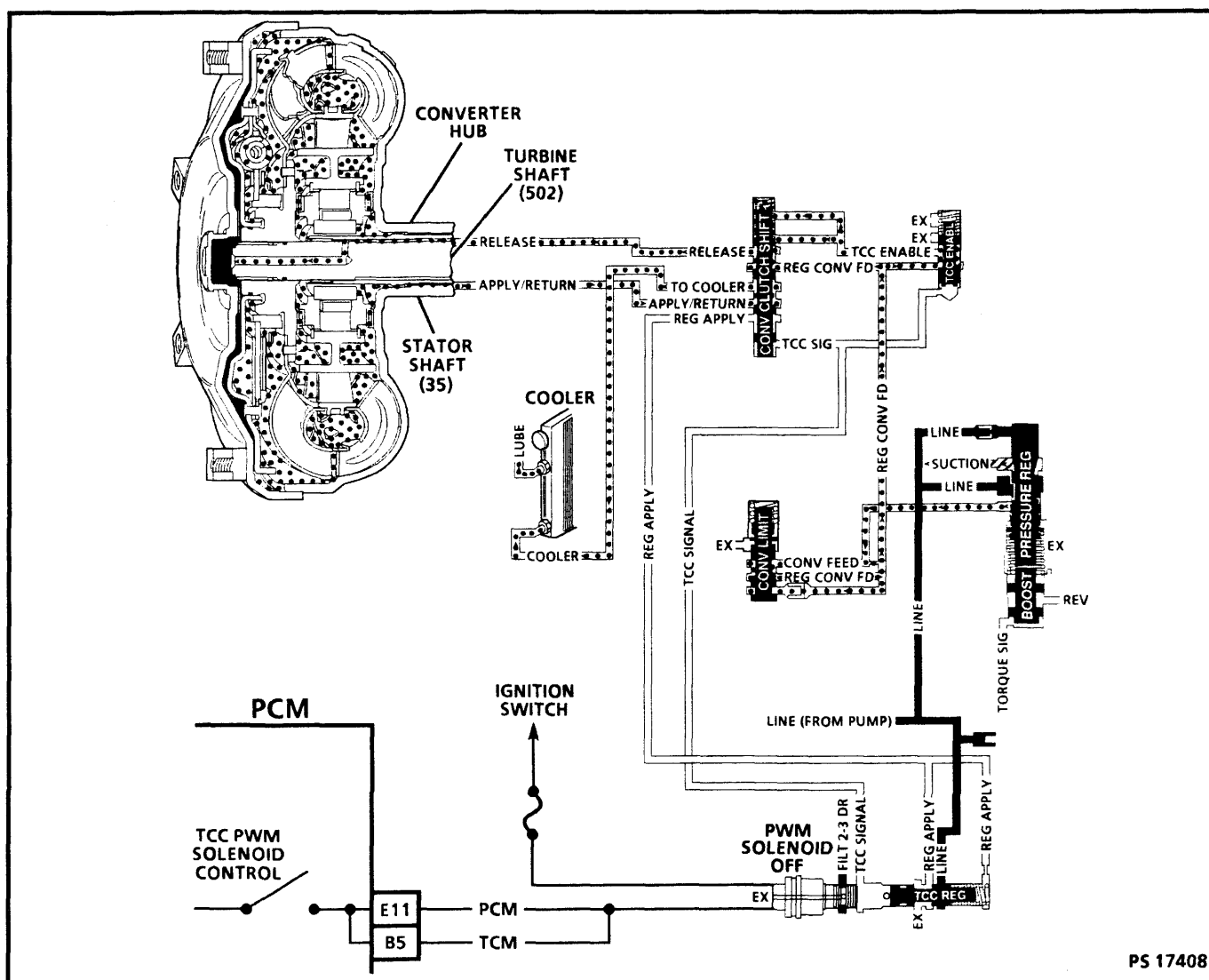
## DTC 59

### TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.





## DTC 68

### TRANS COMPONENT SLIPPING

#### Circuit Description:

The PCM/TCM monitors the difference in engine speed and input speed. With transmission in "drive" and TCC locked, the scan tool should display engine speed closely matching input speed.

#### DTC 68 Will Set When:

- No DTC(s) 28, 71, 74.
- TCC slip speed greater than 200 RPM.
- Fourth gear is indicated.

#### Action Taken (PCM will default to):

- Inhibit TCC operation.

**DTC 68 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the actual selected range. A faulty switch could set DTC 68.
2. This test checks the torque converter for slippage while in a commanded lock-up state.

#### Diagnostic Aids:

- Check for deformed connectors at pass-thru connector.
- DTC 68 will set when going to default (second gear).

- TCC is locked.
- Not in park/neutral.
- All conditions are met for 2 seconds.

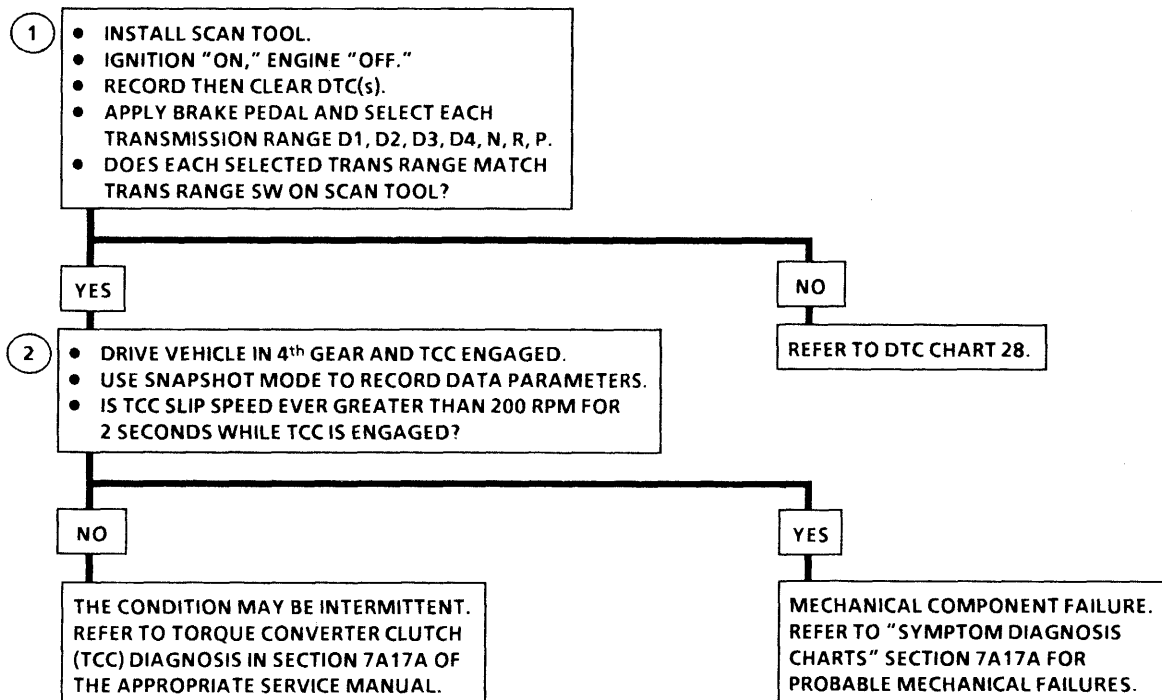
- Inhibit manual mode operation.

- Refer to "PCM/TCM Intermittent DTC(s) or Performance." Refer to SECTION 7A17A for information on "Internal Transmission Faults."

- An intermittent incorrect engine speed signal will set a DTC 68 if the incorrect signal lasts for greater than 2 seconds.
- A mechanical failure in the 1-2 shift solenoid (stuck "OFF") or 2-3 shift solenoid (stuck "ON"), could set DTC 68.

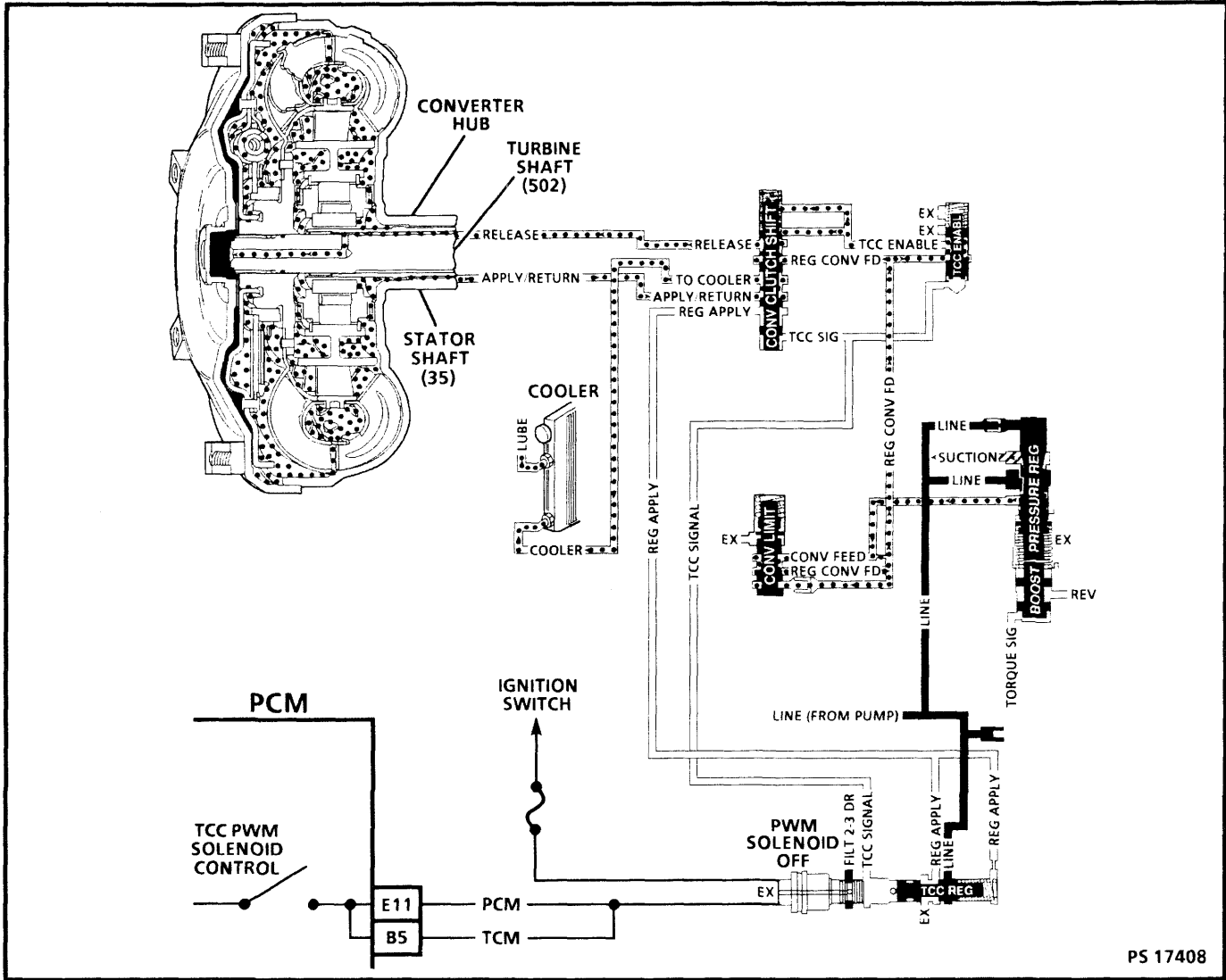
## DTC 68

### TRANS COMPONENT SLIPPING



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-28-93  
PS 17429



## DTC 69

## TORQUE CONVERTER CLUTCH (TCC) STUCK "ON"

### Circuit Description:

The PCM commands the TCC PWM solenoid "ON" by modulating TCC signal fluid acting on the converter clutch shift valve. Then TCC apply fluid applies the torque converter clutch.

### DTC 69 Will Set When:

- No DTC(s) 21, 22, 28, 71, 74 are set.
- TCC slip speed RPM indicates between -5 and +10.
- TCC solenoid is commanded "OFF."
- TP sensor signal is greater than 25%.
- Trans range switch indicates D3 or D4.
- Commanded gear indicates 2<sup>nd</sup> or 3<sup>rd</sup> gear.
- All conditions are met for 2 seconds.

**DTC 69 Will Clear When:** Fault condition no longer exists and the ignition switch is cycled "OFF" then "ON."

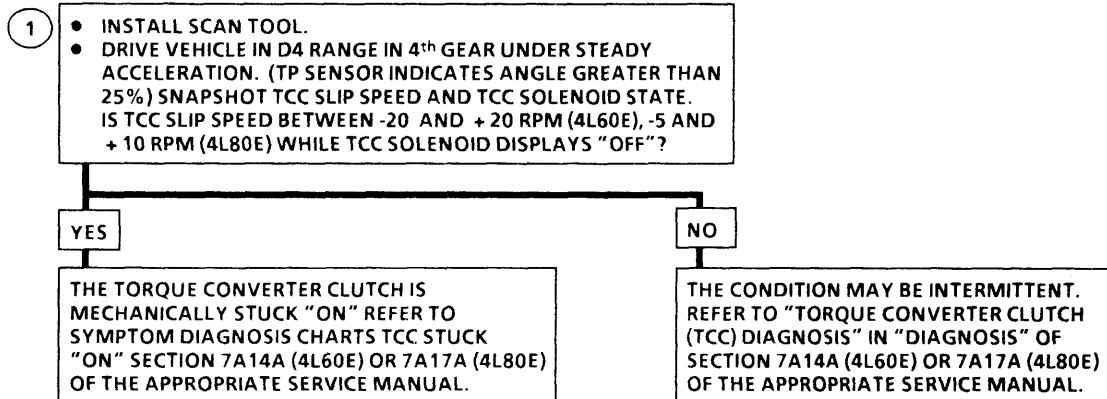
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the mechanical state of the TCC. When the PCM commands the TCC solenoid "OFF," TCC slip speed should increase.

**Diagnostic Aids:** If the TCC is mechanically stuck “ON,” vehicle speed is zero, brakes are applied, and D2 is selected, the TCC fluid will mechanically apply the TCC causing an engine stall.

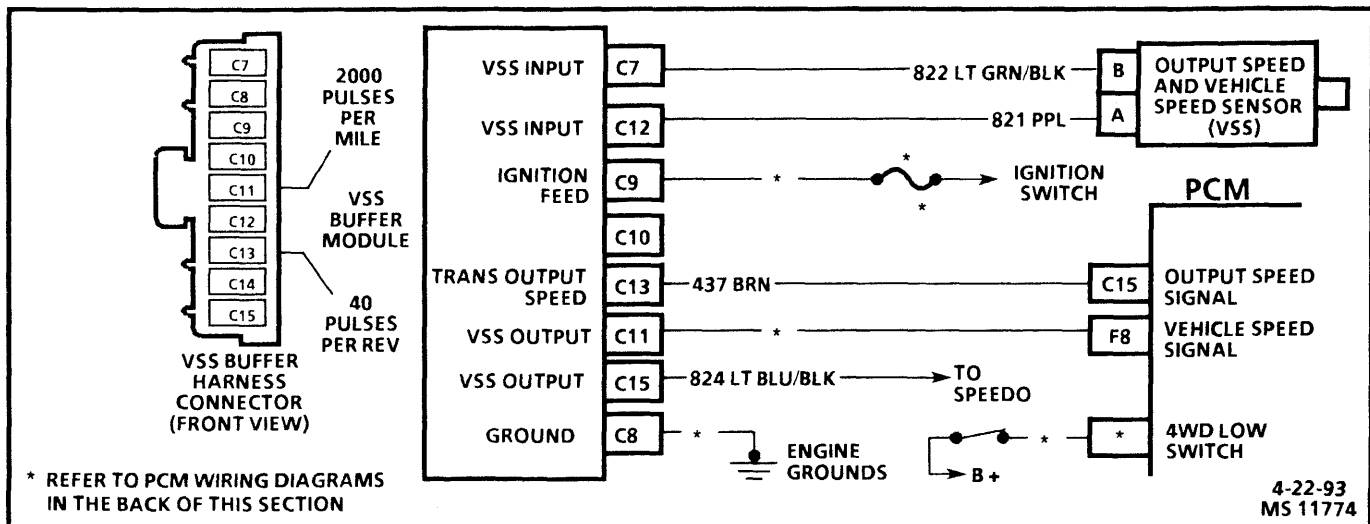
## DTC 69

### TORQUE CONVERTER CLUTCH (TCC) STUCK "ON"



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-8-93  
PS 17052



## DTC 72

### VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS (TRANS OUTPUT SPEED SIGNAL)

#### Circuit Description:

The speed sensor circuit consists of a magnetic induction type sensor, a Vehicle Speed Signal (VSS) buffer module, 4WD low switch (when needed), and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module will also convert the AC VSS signal into a 40 Pulse Per Revolution (PPR) DC signal on CKT 437 to indicate transmission output speed. On 4WD vehicles, the 4WD low signal will also be used for adjustment of the 40 PPR signal to the PCM.

#### DTC 72 Will Set When:

- Not in P/N.
  - Transmission output speed change is greater than 1000 RPM.
  - Engine speed is greater than 200 RPM (4L60E), 300 RPM (4L80E).
  - Conditions met for 2 seconds.
  - No DTC 28 set.
- In P/N.
  - Transmission output speed change is greater than 2050 RPM.
  - Engine speed is greater than 200 RPM (4L60E), 300 RPM (4L80E).
  - Conditions met for 2 seconds.
  - No DTC 28 set.

#### Action Taken (PCM will default to):

- A (soft) delayed landing to second gear.
- Maximum line pressure.

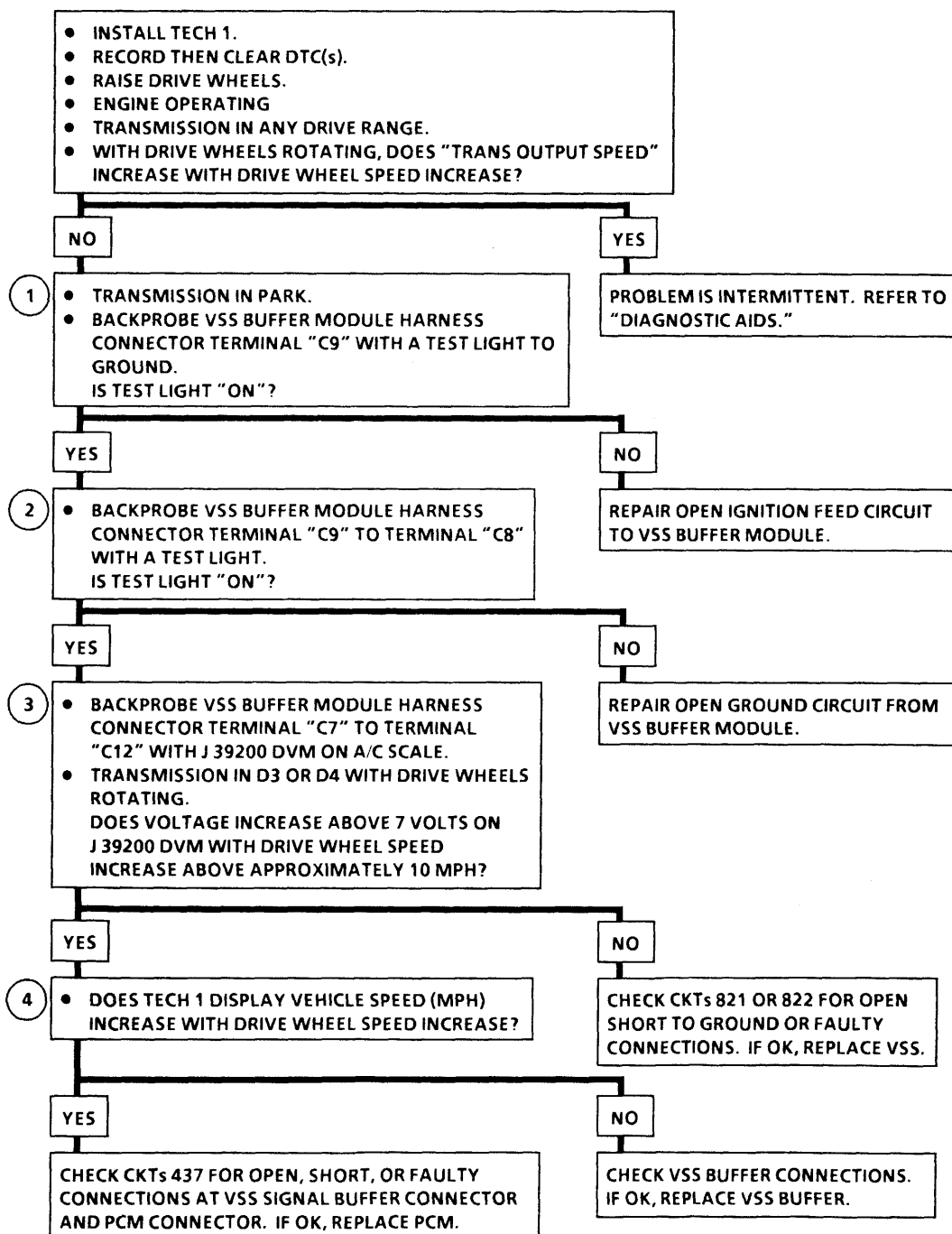
**DTC 72 Will Clear When:** Fault conditions no longer exist and the ignition is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for voltage to the VSS buffer module.
2. This test checks the ground circuit to the VSS buffer module.
3. This test checks the Vehicle Speed Sensor (VSS) circuit at the VSS buffer module.
4. This test checks for an output speed signal from the VSS buffer module.

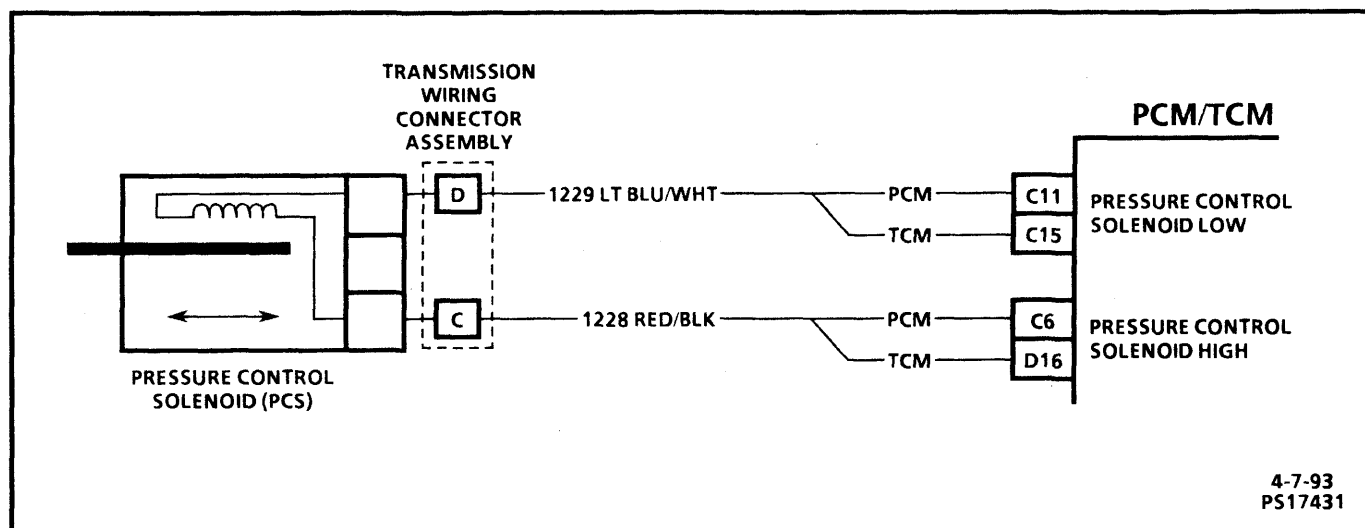
#### Diagnostic Aids:

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

**DTC 72****VEHICLE SPEED SENSOR (VSS) CIRCUIT LOSS  
(TRANS OUTPUT SPEED SIGNAL)**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
MS 13697



## DTC 73

### PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)

#### Circuit Description:

The pressure control solenoid is a PCM controlled device used to regulate transmission line pressure. The PCM compares TP voltage, engine RPM and other inputs to determine the appropriate line pressure for a given load. The PCM will regulate the pressure by applying a varying amperage to the pressure control solenoid. The applied amperage can vary from 0.1 to 1.1 amp. The PCM then monitors the amperage at the return line.

#### DTC 73 Will Set When:

- No DTC 75.
- The return amperage varies greater than 0.16 amp from the commanded amperage.
- All conditions are met for 1 second.

**Action Taken (PCM will default to):** Maximum line pressure.

**DTC 73 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the ability of the PCM to command the pressure control solenoid.
2. This test checks internal transmission harness and the pressure control solenoid for high resistance.

**Diagnostic Aids:** Check for poor connections at PCM and at transmission connector.

# DTC 73

## PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)

- 1
- INSTALL TECH 1.
  - RECORD THEN CLEAR DTC(s).
  - ENGINE OPERATING, TRANSMISSION IN PARK.
  - ENTER MISC TESTS/TRANSMISSION/PCS CONTROL.
  - USING TECH 1, APPLY 1.0 AMPS THRU 0.1 AMPS WHILE OBSERVING DESIRED PCS AND ACTUAL PCS.
- IS ACTUAL PCS READING ALWAYS WITHIN 0.16 AMPS OF DESIRED PCS?

NO

YES

- 2
- IGNITION "OFF."
  - DISCONNECT TRANSMISSION WIRING CONNECTOR ASM.
  - INSTALL J 39775 JUMPER HARNESS/PROBE KIT ON THE TRANSMISSION EXTERNAL WIRING HARNESS CONNECTOR.
  - JUMPER J 39775 CAVITIES "M" AND "R".
  - USING J 39200 DVM ON 10 AMP SCALE, CONNECT (IN SERIES) TO CAVITIES "C" AND "D."
  - ENGINE OPERATING, TRANSMISSION IN PARK.
  - USING TECH 1, APPLY 1.0 AMPS THRU 0.1 AMPS WHILE OBSERVING DESIRED PCS AND J 39200 DVM READING.
  - IS DESIRED PCS ALWAYS WITHIN 0.16 AMPS OF J 39200 DVM READING?

PROBLEM IS INTERMITTENT REFER TO "DIAGNOSTIC AIDS."

YES

NO

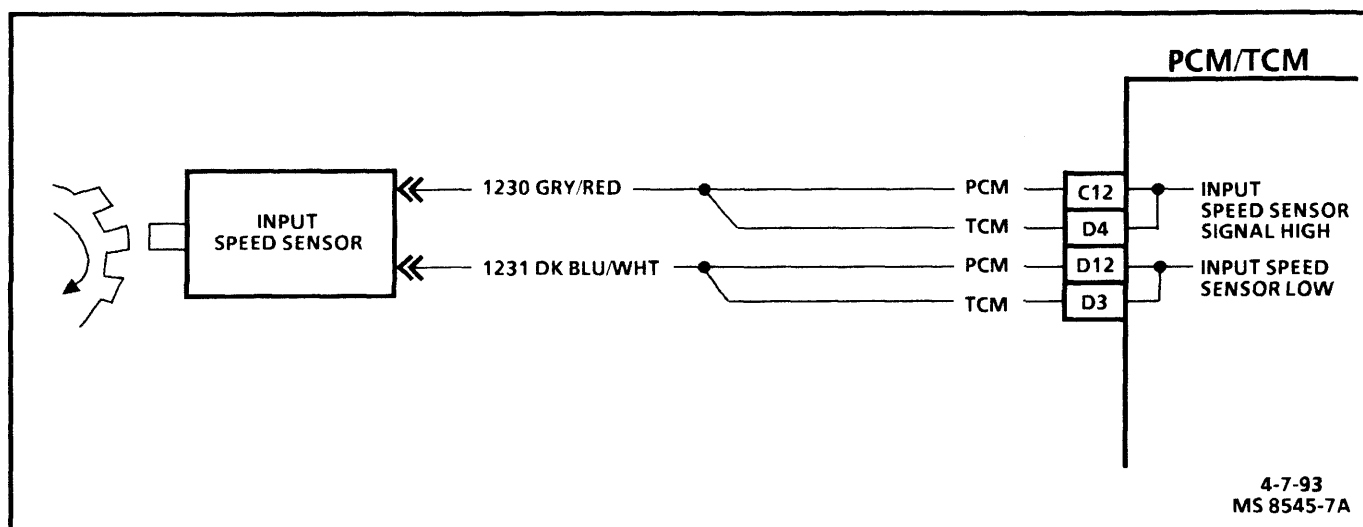
- IGNITION "OFF."
- CK TRANS WIRING CONNECTOR TERMINAL TENSION ON THE PCS CIRCUITS. IF OK, REFER TO SECTION 7A14A (4L60E) OR 7A17A (4L80E) "INTERNAL WIRING HARNESS CHECK" FOR INTERNAL PCS CIRCUIT DIAGNOSIS.

VERIFY CKTs 1228 AND 1229 ARE NOT OPEN OR SHORTED. ALSO VERIFY TERMINAL TENSION ON THESE CIRCUITS AT THE PCM CONNECTOR. IF OK, REPLACE PCM.

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-26-93  
PS 16751





## DTC 74

### TRANSMISSION INPUT SPEED (TIS) SENSOR CIRCUIT

#### Circuit Description:

The TIS sensor consists of a permanent magnet surrounded by a coil of wire. As the forward clutch housing rotates, an AC voltage is induced in the circuit. The signal voltage and frequency vary directly with the forward clutch rotational speed.

#### DTC 74 Will Set When:

- No DTC(s) 24, 28, or 71.
- Trans range not in park or neutral.
- Engine speed greater than 300 RPM.
- Trans output speed greater than 200 RPM.
- Trans input speed less than 50 RPM.
- All conditions met for 2 seconds.

**Action Taken (PCM will default to):** No TCC operation.

**DTC 74 Will Clear When:** The fault condition(s) no longer exist.

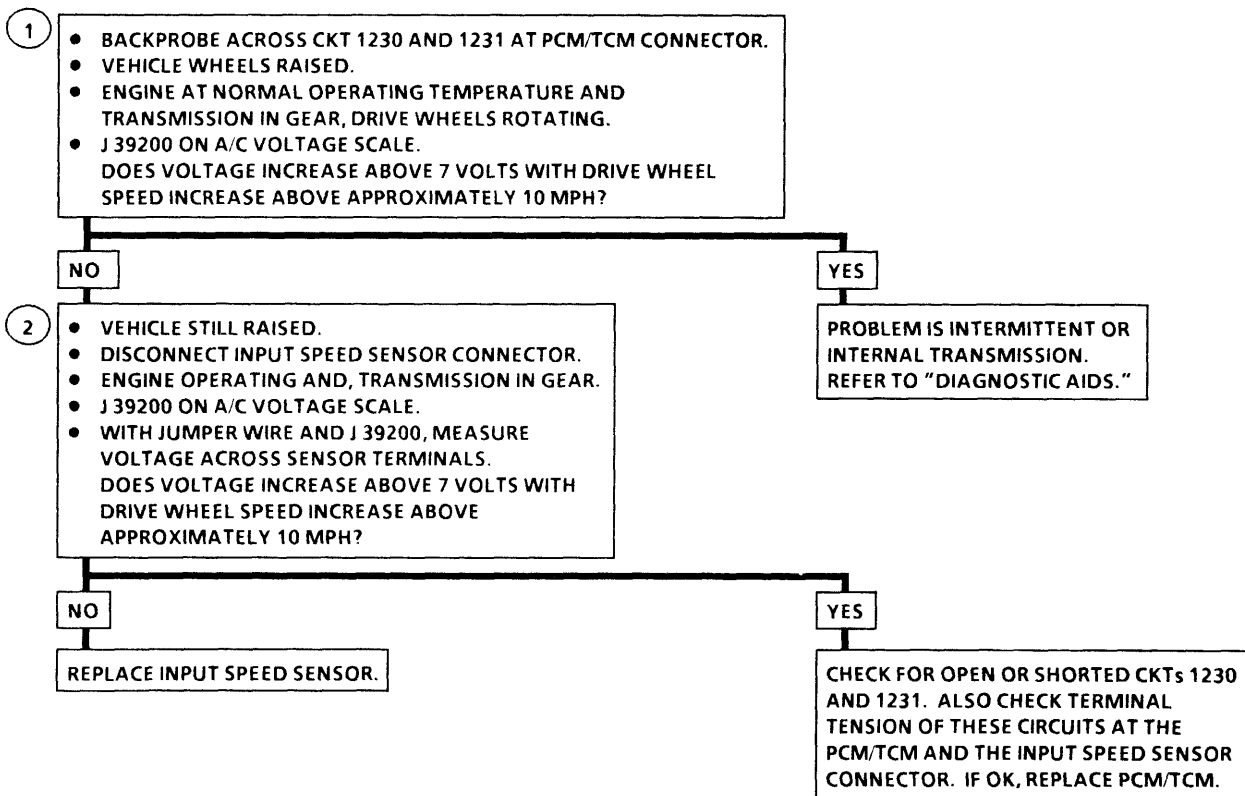
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks the entire circuit for continuity.
2. This checks the output of the input speed sensor.

**Diagnostic Aids:** Refers to PCM/TCM intermittent DTC(s) or performance.

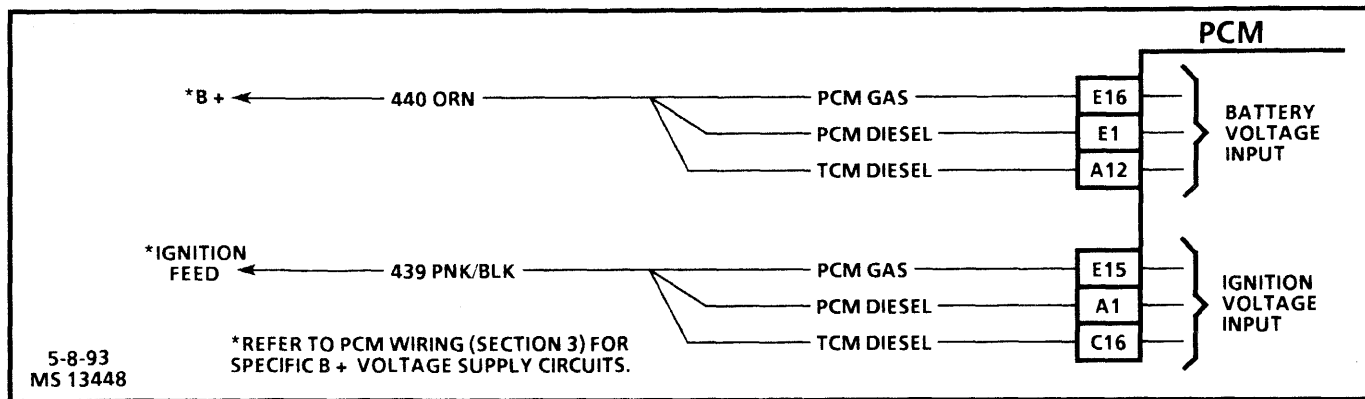
## DTC 74

### TRANSMISSION INPUT SPEED (TIS) SENSOR CIRCUIT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
MS 8857-6E



## DTC 75

### SYSTEM VOLTAGE LOW

#### Circuit Description:

Ignition voltage is supplied to the control module to indicate the ignition status of the ignition switch. Battery voltage is supplied to the control module to, in part, maintain memory of learned functions and parameters.

#### DTC 75 Will Set When:

- The ignition is "ON" battery feed to the control module, voltage is less than the graduated scale of  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) = 7.3 volts,  $90^{\circ}\text{C}$  ( $194^{\circ}\text{F}$ ) = 10.3 volts, or  $150^{\circ}\text{C}$  ( $304^{\circ}\text{F}$ ) = 11.7 volts.
- Engine speed greater than 1000 RPM.
- All conditions are met for 4 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- 2<sup>nd</sup> gear (4L80E), 3<sup>rd</sup> gear (4L60E).
- Inhibit TCC.
- Inhibit 4<sup>th</sup> gear.

**DTC 75 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

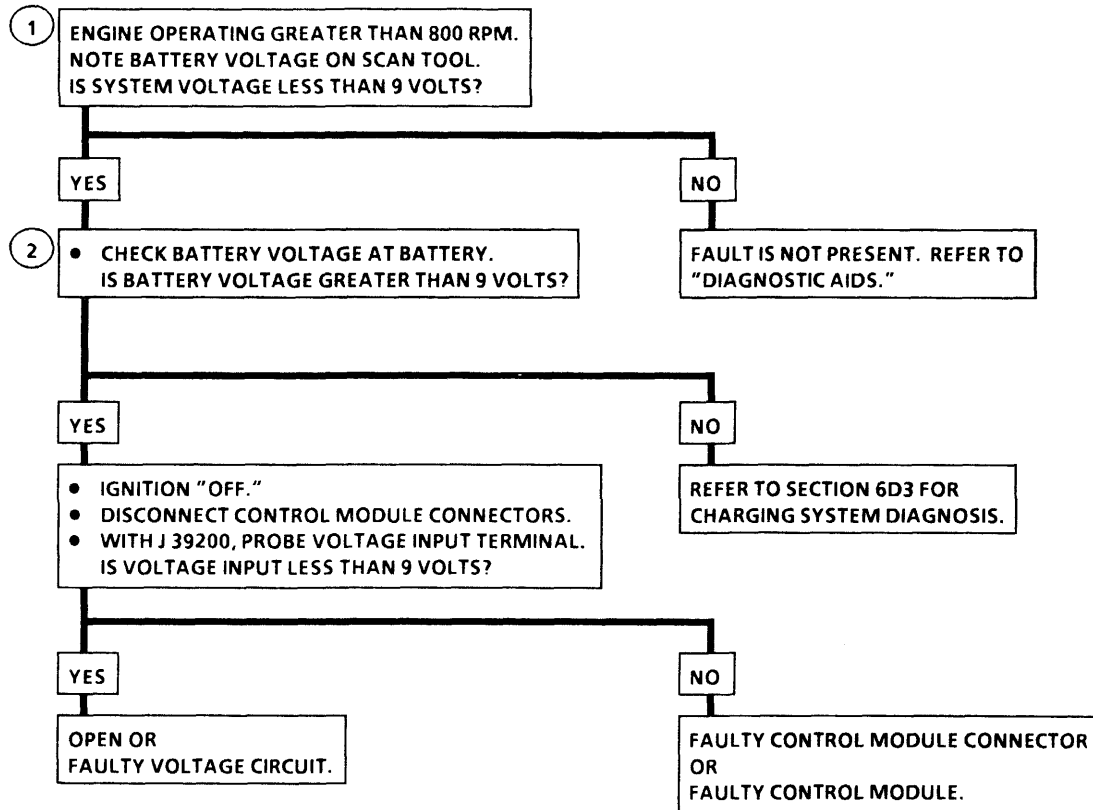
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to SECTION 6D3 of the appropriate service manual.

#### Diagnostic Aids:

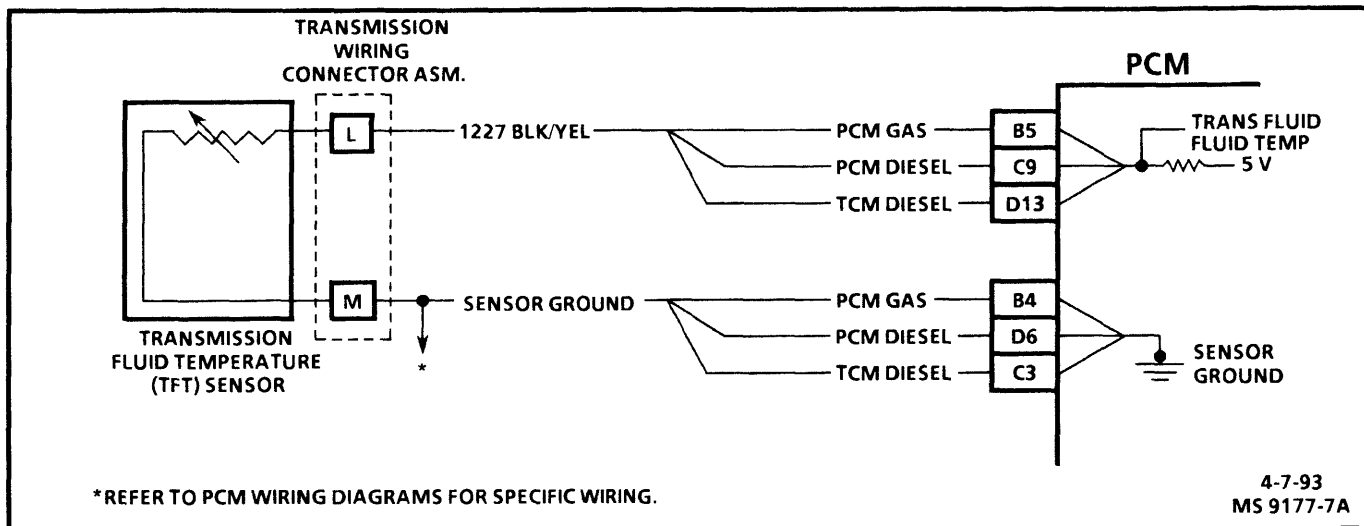
- Charging the battery and jump-starting an engine may set DTC 52/DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to SECTION 6D3 of the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid or fusible link.

# **DTC 75** **SYSTEM VOLTAGE LOW**



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

3-5-93  
PS 17066



## DTC 79

## TRANSMISSION FLUID OVERTEMP

### Circuit Description:

The Transmission Fluid Temperature (TFT) sensor is a thermistor that controls the signal voltage to the PCM. The PCM applies voltage on CKT 1227 to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.

### DTC 79 Will Set When:

- No DTC 58.
- Trans fluid temp greater than 146°C (295°F).
- All conditions met for 30 minutes.

**DTC 79 Will Clear When:** The fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for a "skewed" or shorted circuit.
2. This test simulates a DTC 59.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 1227.

Scan tool TFT displays should rise steadily to about 100°C then stabilize.

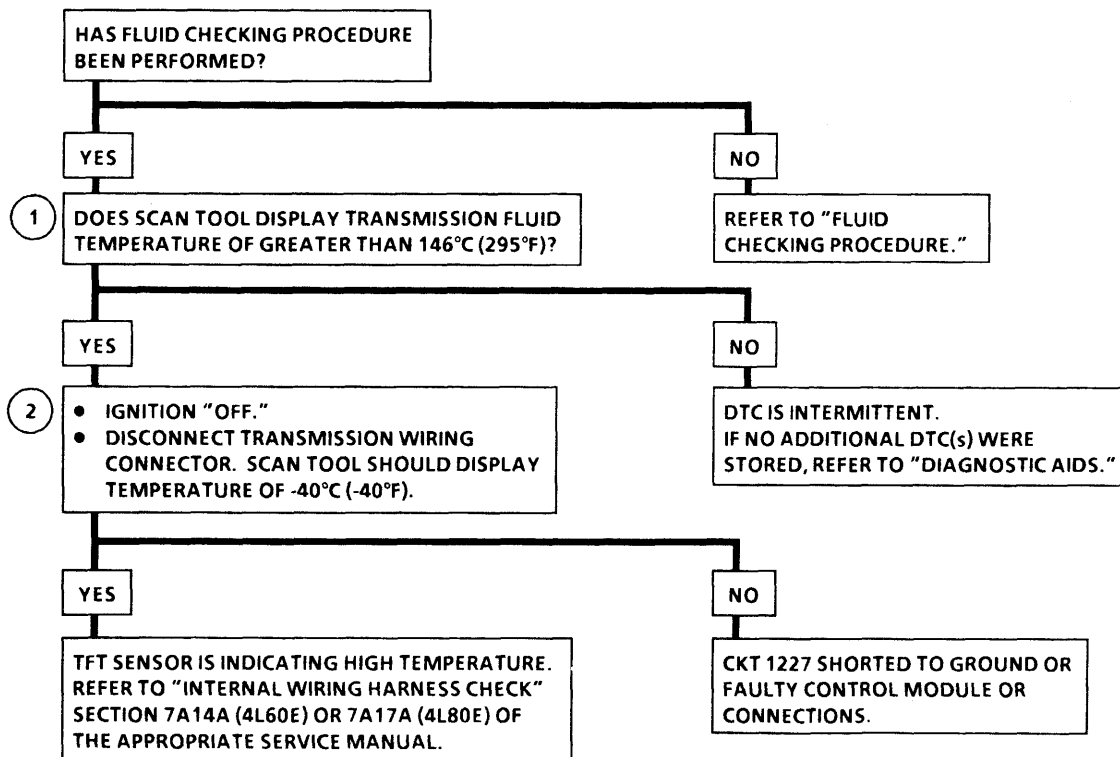
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale in SECTION 7A17A may be used to test the transmission sensor at the various temperature levels to evaluate the possibility of a “skewed” sensor. A “skewed” sensor could result in delayed garage shifts or TCC complaints.

Check transmission fluid. Refer to "Fluid Checking Procedure."

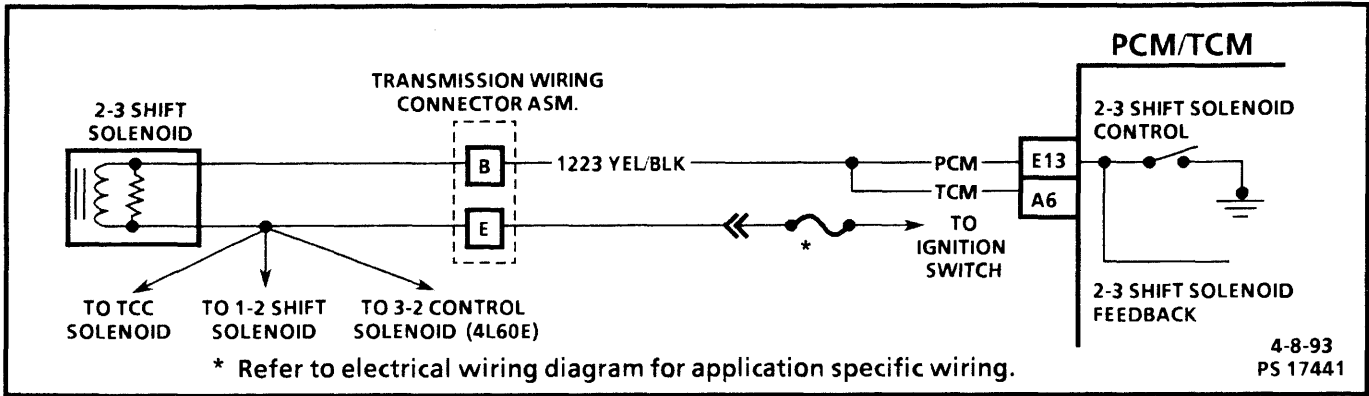
## DTC 79

### TRANSMISSION FLUID OVERTEMP



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
PS 17931



## DTC 81

### 2-3 SHIFT SOLENOID CIRCUIT FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 2-3 shift solenoid. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1223.

#### DTC 81 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high.
- The PCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
- No TCC.
- Second or third gear only.

**DTC 81 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

If the voltage stays up for at least 2 seconds, DTC 81 will set. If the voltage drops for more than 2 seconds, DTC 81 will set.

1. This test checks 2-3 shift solenoid and the internal transmission wiring for shorts.
2. This test checks for power to 2-3 shift solenoid from the ignition through the fuse.

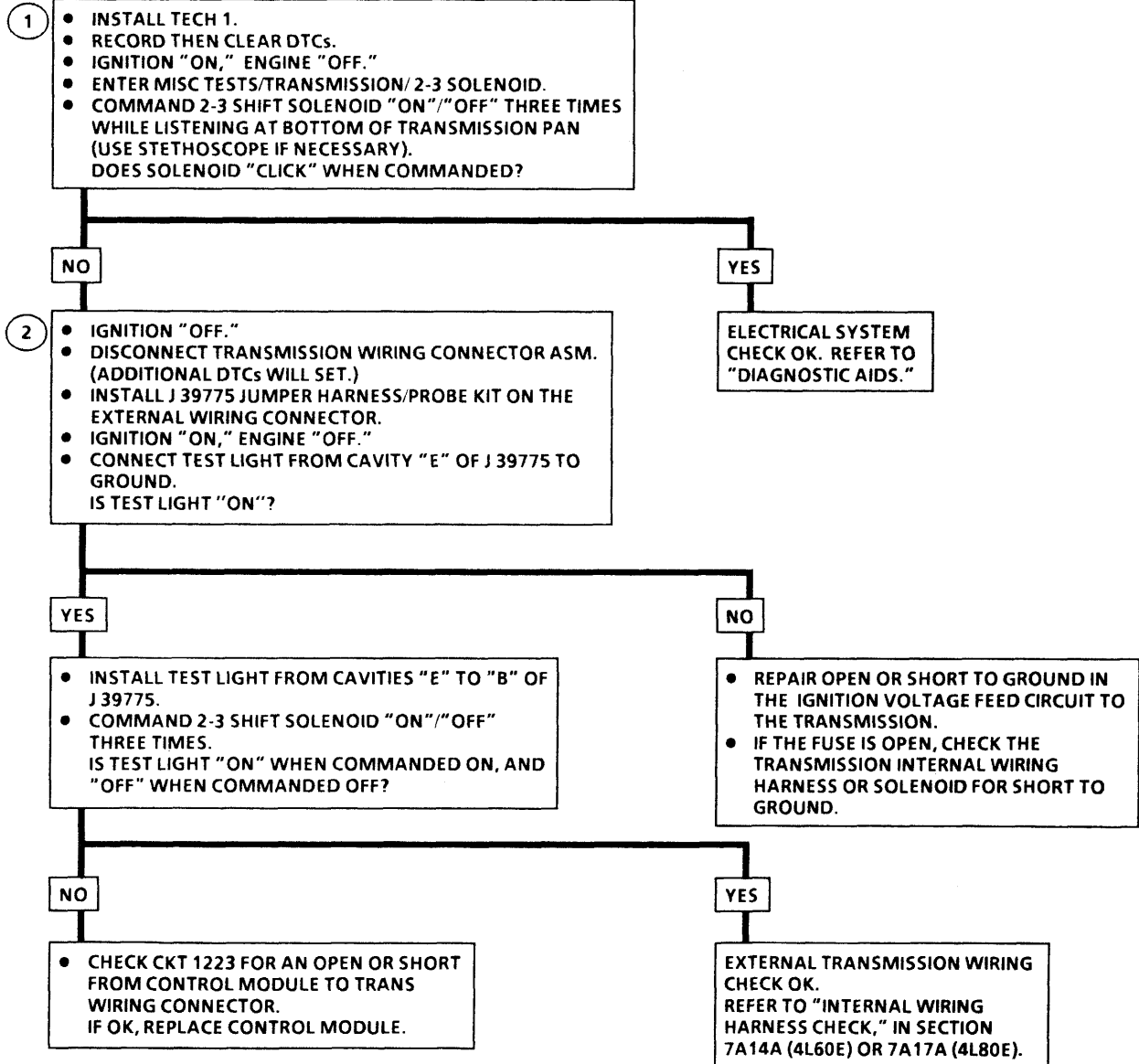
**Diagnostic Aids:** Check all connections at the transmission. Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

| CHART |                    |                    |
|-------|--------------------|--------------------|
| Gear  | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1     | ON                 | OFF                |
| 2     | OFF                | OFF                |
| 3     | OFF                | ON                 |
| 4     | ON                 | ON                 |

# DTC 81

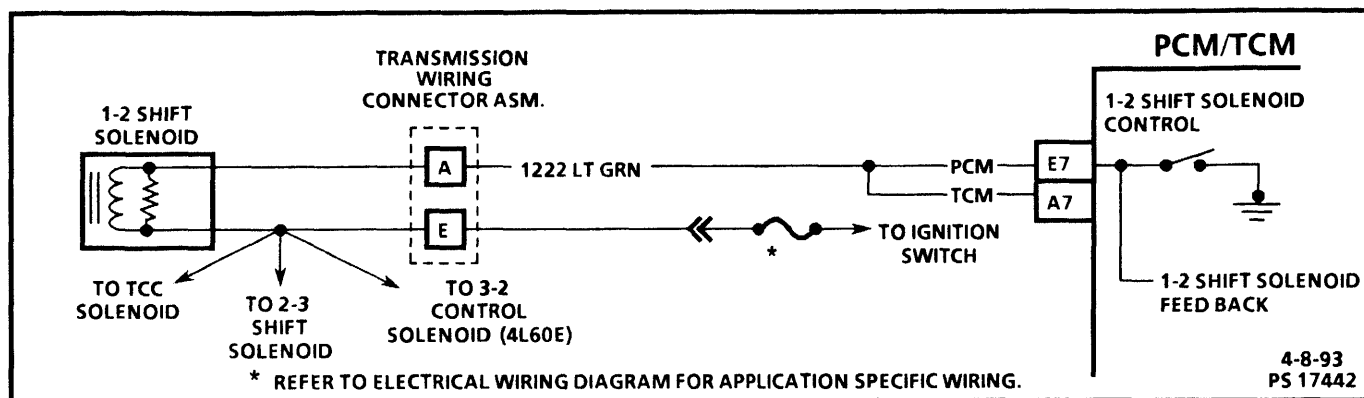
## 2-3 SHIFT SOLENOID CIRCUIT FAULT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-13-93  
PS 17093





## DTC 82

### 1-2 SHIFT SOLENOID FAULT

#### Circuit Description:

Ignition voltage is supplied directly to the 1-2 shift solenoid on CKT 641. The Powertrain Control Module (PCM) controls the solenoid by providing the ground path through CKT 1222.

#### DTC 82 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high.
- The PCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Maximum line pressure.
  - Second or third gear only.
- OR**
- First or fourth gear only.

**DTC 82 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks 1-2 shift solenoid and the internal transmission wiring harness for shorts.
2. This test checks for power to 1-2 shift solenoid from the ignition through the fuse.

**Diagnostic Aids:** Check all connections for the transmission.

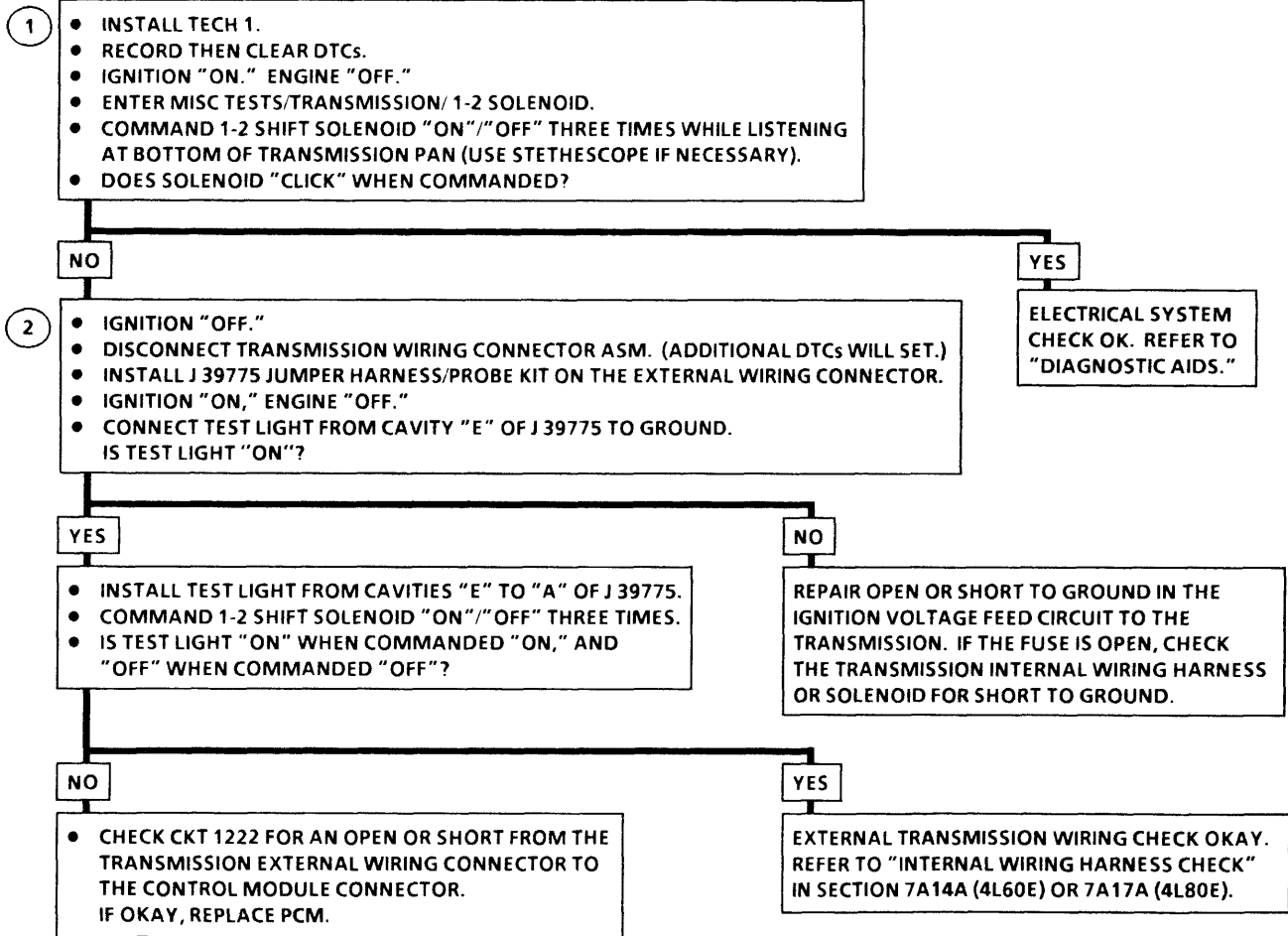
Refer to "PCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

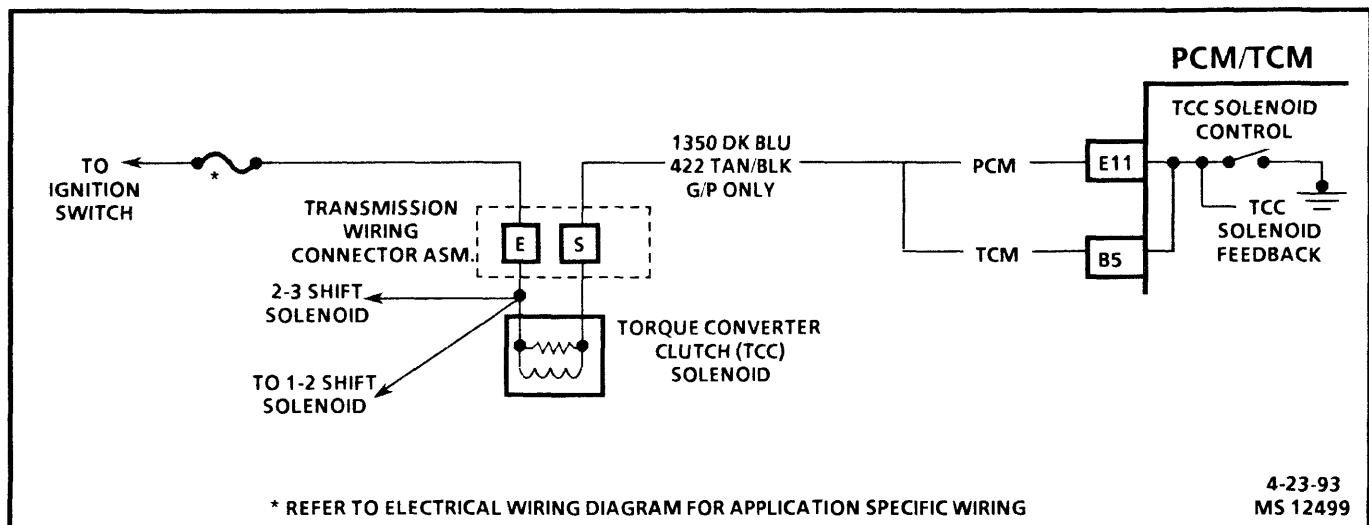
| CHART |                    |                    |
|-------|--------------------|--------------------|
| Gear  | 1-2 Shift Solenoid | 2-3 Shift Solenoid |
| 1     | ON                 | OFF                |
| 2     | OFF                | OFF                |
| 3     | OFF                | ON                 |
| 4     | ON                 | ON                 |

# DTC 82

## 1-2 SHIFT SOLENOID FAULT



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.



## DTC 83

### TCC PWM SOLENOID CIRCUIT FAULT

#### Circuit Description:

The control module supplies a ground through an internal Quad-Driver Module (QDM) allowing current to flow through the solenoid coil according to the duty cycle (percentage of "ON" and "OFF" time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solenoid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows 2-3 drive fluid to feed the TCC signal circuit. The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift valve. When the TCC shift valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch.

#### DTC 83 Will Set When:

- The PCM commands the solenoid "ON" and voltage remains high.
- The PCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

- Inhibit TCC operation.
- Inhibit 4<sup>th</sup> gear operation if in hot mode.

**DTC 83 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will check if the PCM/TCM is commanding the TCC solenoid "ON."
2. This test will check for voltage to the solenoid.

**Diagnostic Aids:** Check all connections at the transmission pass-thru connector.

If they are OK, refer to "PCM/TCM Intermittent DTC(s) or Performance."

**DTC 83****TCC PWM SOLENOID CIRCUIT FAULT**

①

- INSTALL TECH 1.
- RECORD THEN CLEAR DTCs.
- RAISE AND SUPPORT DRIVE WHEELS.
- ENTER MISC TESTS/TRANSMISSION/TCC PWM SOLENOID.
- WITH ENGINE AT NORMAL OPERATING TEMPERATURE, SELECT "D4" AND ACCELERATE TO 25 mph.
- COMMAND THE TCC PWM SOLENOID "ON," AND THEN "OFF." WHILE OBSERVING TCC, SLIP SPEED ON TECH 1 DISPLAY.
- IS TCC SLIP SPEED LESS THAN 10 RPM WHILE COMMANDED "ON," AND IS TCC SLIP SPEED GREATER THAN 10 RPM WHILE COMMANDED "OFF"?

NO

YES

ELECTRICAL SYSTEM  
CHECK OK. REFER TO  
"DIAGNOSTIC AIDS."

②

- IGNITION "OFF."
- DISCONNECT TRANSMISSION WIRING CONNECTOR ASM. (ADDITIONAL DTCs WILL SET.)
- INSTALL J 39775 JUMPER HARNESS/PROBE KIT ON THE EXTERNAL WIRING CONNECTOR.
- IGNITION "ON," ENGINE "OFF."
- CONNECT TEST LIGHT FROM CAVITY "E" OF J 39775 TO GROUND.
- IS TEST LIGHT "ON"?

YES

NO

- INSTALL TEST LIGHT FROM CAVITIES "E" TO "S" (4L80E) OF J 39775.
- COMMAND TCC PWM SOLENOID "ON"/"OFF" THREE TIMES.
- IS TEST LIGHT "ON" WHEN COMMANDED "ON" AND "OFF" WHEN COMMANDED "OFF"?

REPAIR OPEN OR SHORT TO GROUND IN THE  
IGNITION VOLTAGE FEED CIRCUIT TO THE  
TRANSMISSION. IF THE FUSE IS OPEN, CHECK  
THE TRANSMISSION INTERNAL WIRING HARNESS  
OR SOLENOID FOR SHORT TO GROUND.

NO

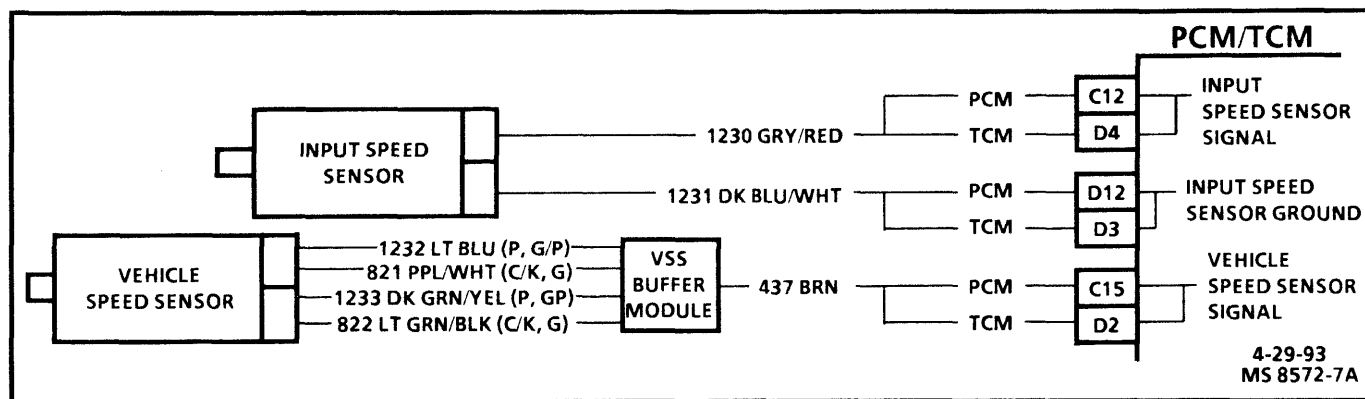
YES

- CHECK CKT 1350 (4L80E) FOR AN OPEN OR SHORT FROM THE CONTROL MODULE TO THE TRANSMISSION WIRING CONNECTOR. IF OKAY, REPLACE CONTROL MODULE.

EXTERNAL TRANSMISSION WIRING CHECKS  
OKAY. REFER TO "INTERNAL WIRING  
HARNESS CHECK" IN SECTION 7A17A (4L80E).

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

5-11-93  
PS 17901



## DTC 85

### UNDEFINED RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 85 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 87.
- TP is greater than 25%.
- Not in P/N or 4<sup>th</sup> gear.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.

|                 | IF CALCULATED RATIO IS |           |
|-----------------|------------------------|-----------|
|                 | LESS THAN              | MORE THAN |
| 1 <sup>st</sup> | 2.38                   | 2.63      |
| 2 <sup>nd</sup> | 1.43                   | 1.58      |
| 3 <sup>rd</sup> | .95                    | 1.05      |
| REV             | 1.97                   | 2.17      |

- All conditions are met for 2 seconds.

#### Action Taken (PCM will default to):

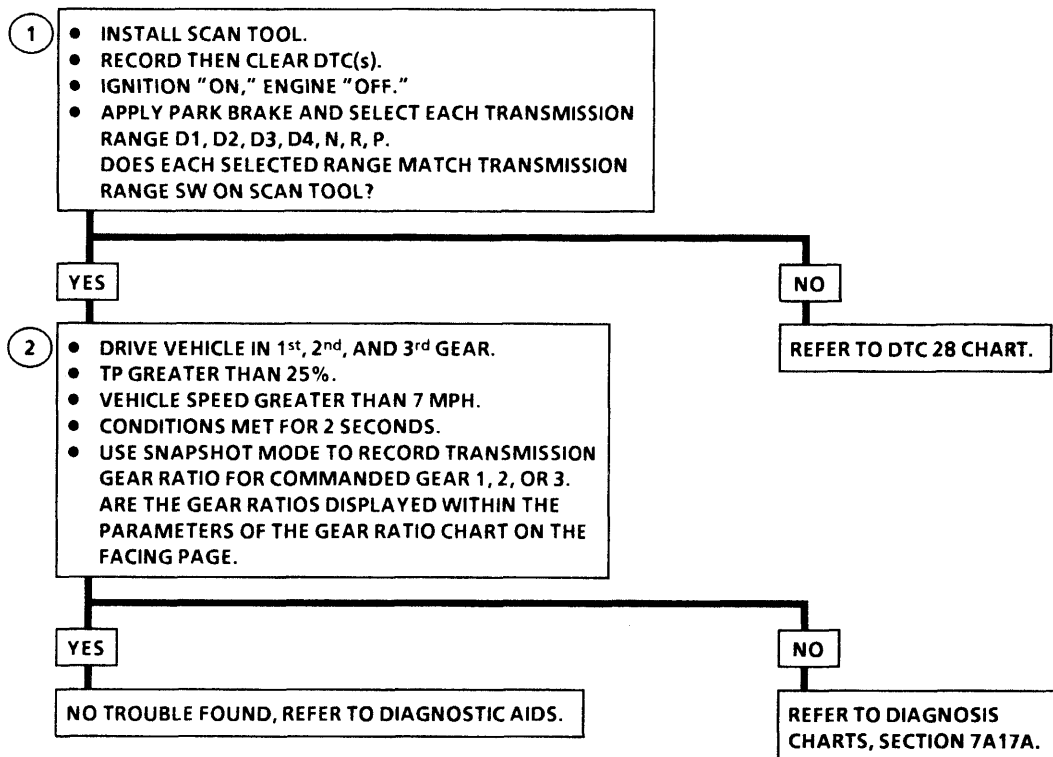
- Line pressure set to maximum.
- Inhibits TCC operation.

**DTC 85 Will Clear When:** The condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

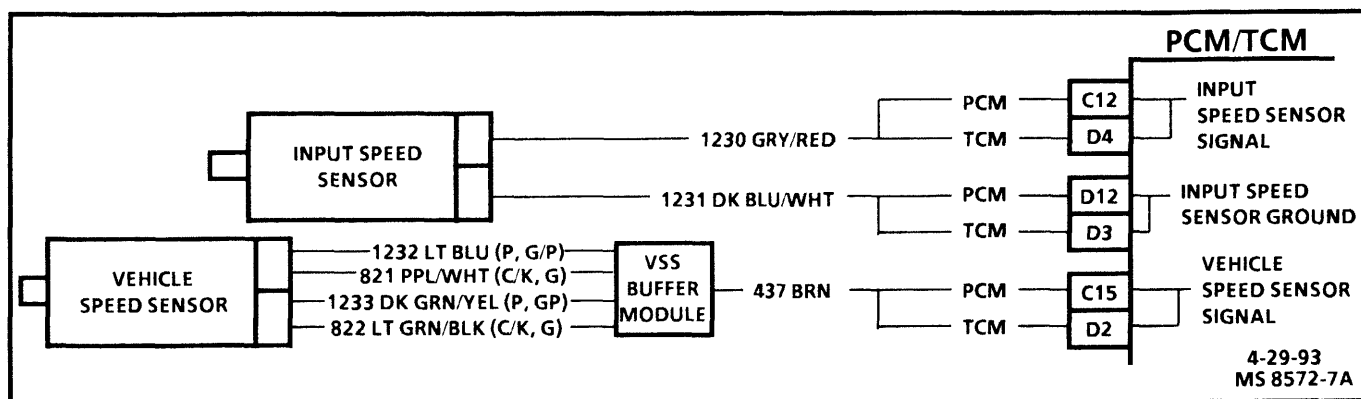
1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test checks the calculated ratio to determine if the ratio is within the parameters.

**Diagnostic Aids:** DTC 85 will set when an unknown gear ratio is detected for any gear but 4<sup>th</sup>. Note commanded gear and incorrect ratio. Refer to symptom diagnosis charts in SECTION 7A17A.

**DTC 85**  
**UNDEFINED RATIO ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17453



## DTC 86

### LOW RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 86 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- Not in P/R/N.
- Engine speed greater than 300 RPM.
- TP greater than 25%.
- Vehicle speed greater than 7 mph.
- Trans gear ratio is less than 1.06 in first or second gear.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

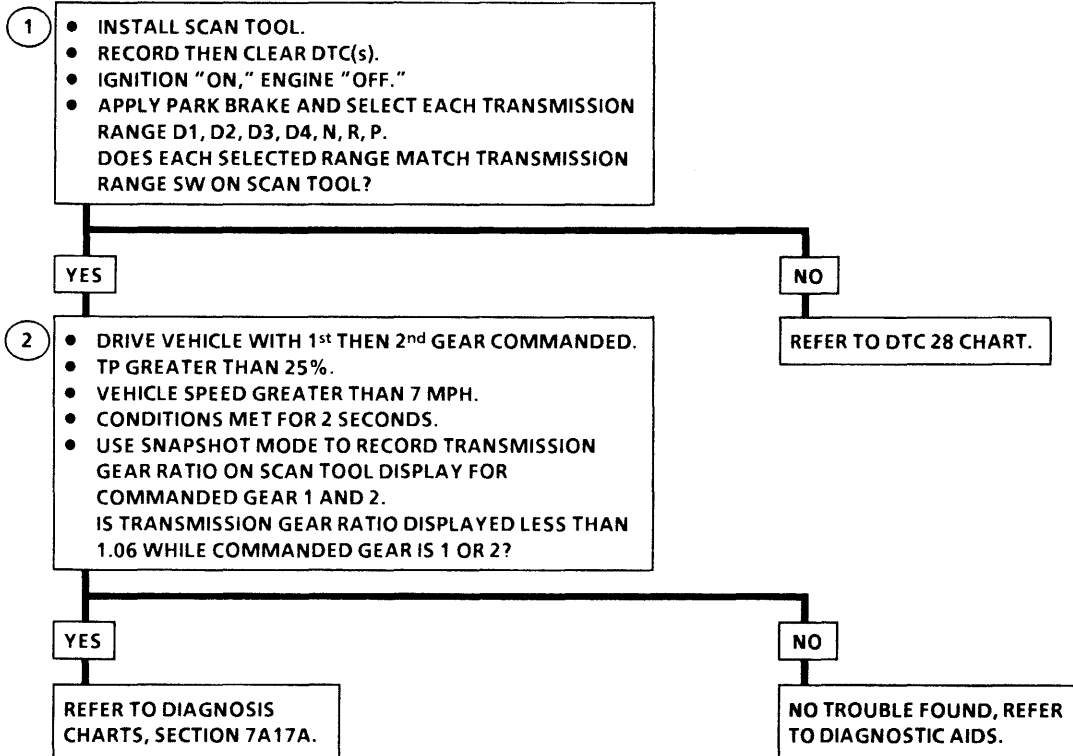
- 2nd gear.
- Line pressure set to maximum.
- Inhibit TCC operation.

**DTC 86 Will Clear When:** The fault no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

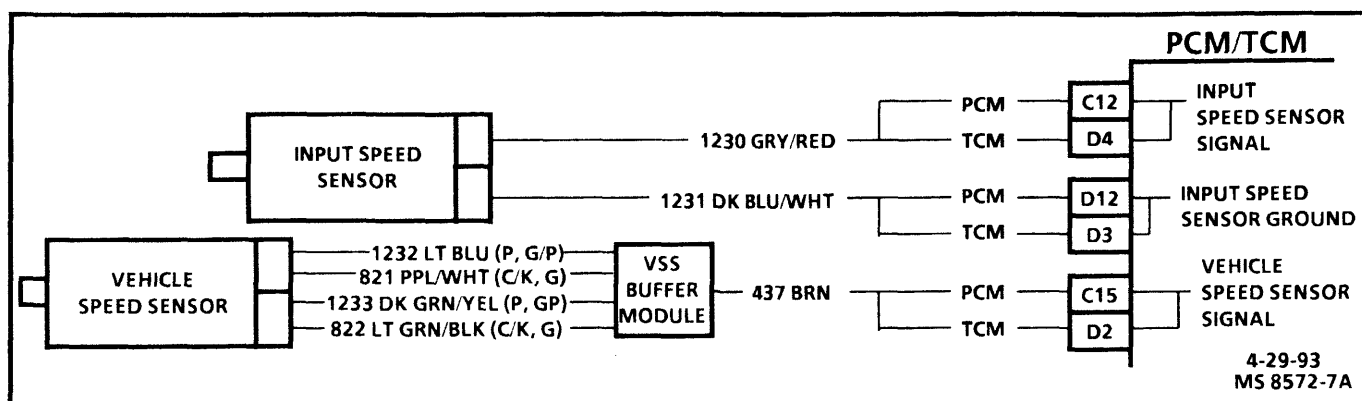
**Diagnostic Aids:** This DTC will set when trans commanded gear is 1 or 2 and trans is mechanically in 3<sup>rd</sup> or 4<sup>th</sup> gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

**DTC 86**  
**LOW RATIO ERROR**

WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17454





## DTC 87

### HIGH RATIO ERROR

#### Circuit Description:

The control module calculates ratio based on the input and output sensor readings. The control module compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

#### DTC 87 Will Set When:

- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- TP is greater than 25%.
- Not in P/R/N.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.
- Transmission temperature is greater than 20°C.
- Trans gear ratio is greater than 1.42 in 3<sup>rd</sup> or 4<sup>th</sup> gear.
- All conditions met for 2 seconds.

#### Action Taken (PCM will default to):

- 2<sup>nd</sup> gear.
- Line pressure set to maximum.
- Inhibit TCC operation.

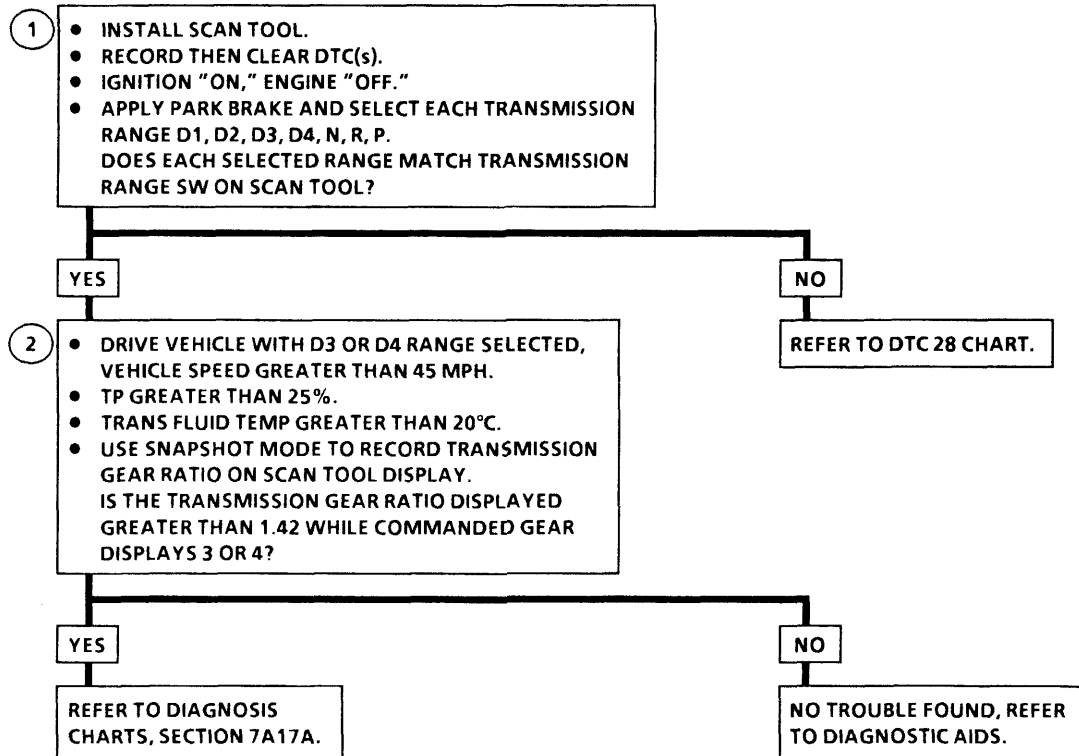
**DTC 87 Will Clear When:** The fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range trans. range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

**Diagnostic Aids:** This DTC will set when trans. commanded gear is 3 or 4 and trans is mechanically in 1<sup>st</sup> or 2<sup>nd</sup> gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

# **DTC 87** **HIGH RATIO ERROR**



WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(s) AND VERIFY PROPER OPERATION.

4-19-93  
PS 17455

## **ON-VEHICLE SERVICE**

### **INTERNAL TRANSMISSION COMPONENTS**

The following list of components will be serviced in SECTION 7A17A of the appropriate service manual.

- 1-2 shift solenoid.
- 2-3 shift solenoid.
- Pressure control solenoid.
- TCC solenoid with internal wiring harness.
- Any service that requires removal of the pan.

### **EXTERNAL TRANSMISSION COMPONENTS**

#### **Engine Coolant Temperature (ECT) Sensor**

The TCM will not use input PROM the ECT sensor. The PCM ECT sensor diagnosis and service will be in SECTION 3.

#### **Throttle Position (TP) Sensor**

#### **PCM**

All PCM TP sensor diagnosis and service will be in SECTION 3.

#### **Vehicle Speed Sensor (VSS)**

Refer to SECTION 7 of the appropriate service manual for Vehicle Speed Sensor (VSS) service, which is located on the transmission or transfer case.

#### **Vehicle Speed Signal (VSS) Buffer Module**

Refer to SECTION 8C for vehicle speed signal buffer. The VSS buffer module is located in the instrument panel near the PCM/TCM.

#### **PCM WIRING DIAGRAMS AND CONNECTOR TERMINAL END VIEWS**

All PCM wiring diagrams and terminal identification will be in SECTION 3.

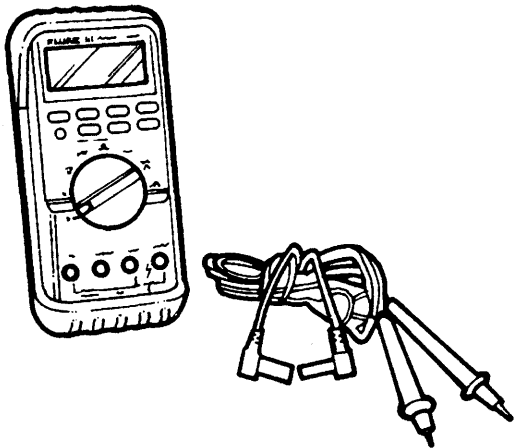
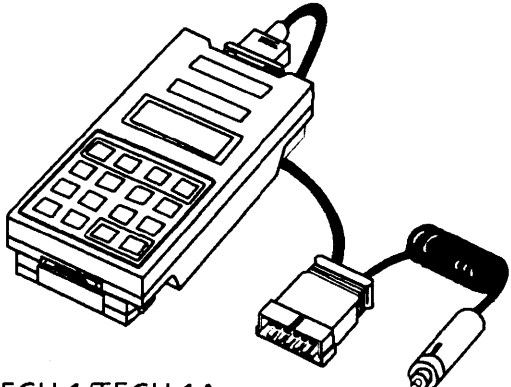
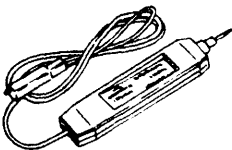
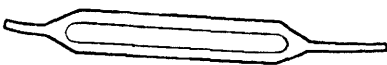
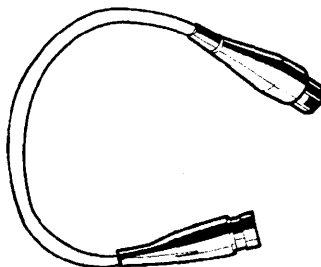
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|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>HIGH IMPEDANCE MULTIMETER<br/>(DIGITAL VOLTMETER-DVM)<br/>J 39200</p> | <p><b>VOLTMETER</b> - Voltage Position measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used when circuits require accurate low voltage readings, and some circuits in the PCM/TCM have a very high resistance.</p> <p><b>AMMETER</b> - When used as ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• Selector must be set properly for both function and range. DC is used for most automotive measurements.</li> </ul> <p><b>OHMMETER</b> - Measures resistance of circuit directly in ohms. Refer to meter instructions for further information.</p> <ul style="list-style-type: none"> <li>• OL display in all ranges indicates an open circuit.</li> <li>• Zero display in all ranges indicates a short circuit.</li> <li>• Intermittent connection in circuit may be indicated by digital reading that will not stabilize.</li> <li>• Range Switch. <ul style="list-style-type: none"> <li>200<math>\Omega</math> - Displays ohms directly.</li> <li>2K,20K,200K<math>\Omega</math> - Displays ohms in thousands.</li> <li>2M and 20M<math>\Omega</math> - Displays ohms in millions.</li> </ul> </li> </ul> |
|  <p>TECH 1/TECH 1A<br/>3000003 MASS STORAGE CARTRIDGE</p>               | <p><b>TECH 1 DIAGNOSTIC SCAN TOOL</b><br/>A hand-held SCAN tool used to analyze and diagnose the PCM/TCM control system.</p> <p>(With GM 81-93 Powertrain Software)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                         | <p><b>TACHOMETER</b><br/>Inductive trigger signal pickup type to check RPM.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  <p>J 35616</p>                                                         | <p><b>CONNECTOR TEST ADAPTER KIT</b><br/>Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.</p> <p>5-18-92<br/>MS 13416</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Figure 10B-15 - Special Tools (1 of 2)

|                                                                                                              |                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>J 34636/BT-8405</p>     | <p><b>CIRCUIT TESTER</b><br/>Used to check all relays and solenoids before connecting them to a new PCM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.</p> |
|  <p>J 35689-A</p>           | <p><b>METRI-PACK TERMINAL REMOVER</b><br/>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors.</p>                                                                                                                                                              |
|  <p>J 28742-A/BT-8234-A</p> | <p><b>WEATHER PACK TERMINAL REMOVER</b><br/>Used to remove terminals from Weather Pack connectors.</p>                                                                                                                                                                                    |
|  <p>J 33095/BT-8234-A</p> | <p><b>PCM CONNECTOR TERMINAL REMOVER</b><br/>Used to remove terminal from Micro-Pack connectors.</p>                                                                                                                                                                                      |
|  <p>J 39775</p>           | <p><b>JUMPER HARNESS</b><br/>Used with J 39200 to measure circuit voltage, amperage, or resistance in the transmission through the transmission connector.</p>                                                                                                                            |
|  <p>J 38125-4</p>         | <p><b>TERMINAL REPAIR KIT</b><br/>Used to replace damaged terminal ends on wiring harnesses.</p>                                                                                                                                                                                          |

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Figure 10B-16 - Special Tools (2 of 2)

## SECTION 11

# CRANKCASE VENTILATION SYSTEM

### CONTENTS

|                           |      |                           |      |
|---------------------------|------|---------------------------|------|
| General Description ..... | 11-1 | On-Vehicle Service .....  | 11-3 |
| Diagnosis .....           | 11-2 | CDR Valve and Hoses ..... | 11-3 |
| CDR Valve Test .....      | 11-2 | Parts Information .....   | 11-3 |

### GENERAL DESCRIPTION

The crankcase ventilation system used on diesel engines is designed to maintain a slightly negative crankcase pressure across the speed range. This lower pressure minimizes oil leaks. The system consists of a Crankcase Depression Regulator (CDR) valve, located on the right valve cover.

The CDR valve is used to regulate (meter) the flow of crankcase gases back into the engine. The valve is designed to limit vacuum in the crankcase as the gases are drawn from the right valve cover, through the valve, and into the intake manifold (air cross-over).

The intake manifold vacuum acts against a spring loaded diaphragm to control the flow of crankcase gases (Figures 11-1 and 11-2). Higher intake vacuum levels pull the diaphragm closer to the top of the outlet tube. This reduces the amount of gases being drawn from the crankcase and decreases the vacuum level in the crankcase. As the intake vacuum decreases, the spring pushes the diaphragm away from the top of the outlet tube allowing more gases to flow to the intake manifold.

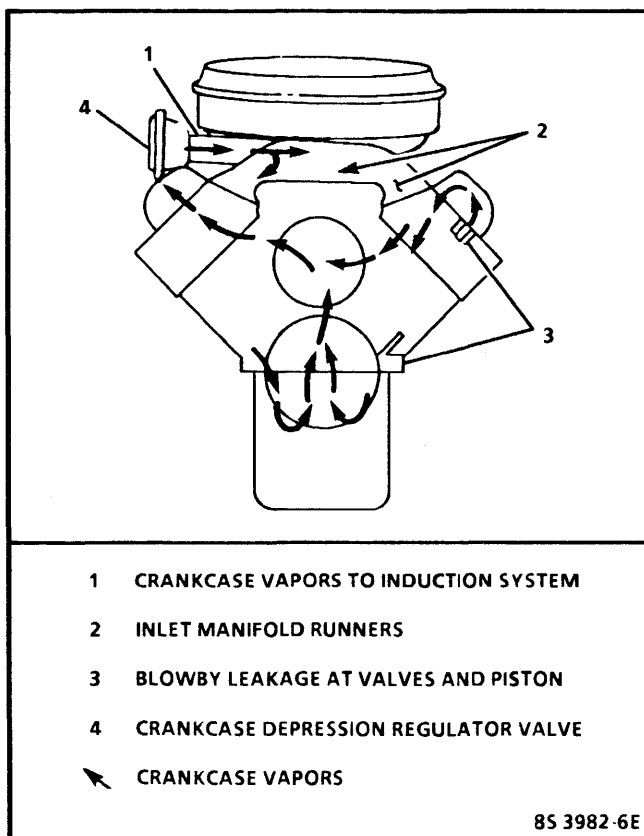


Figure 11-1 - Crankcase Vapor Flow

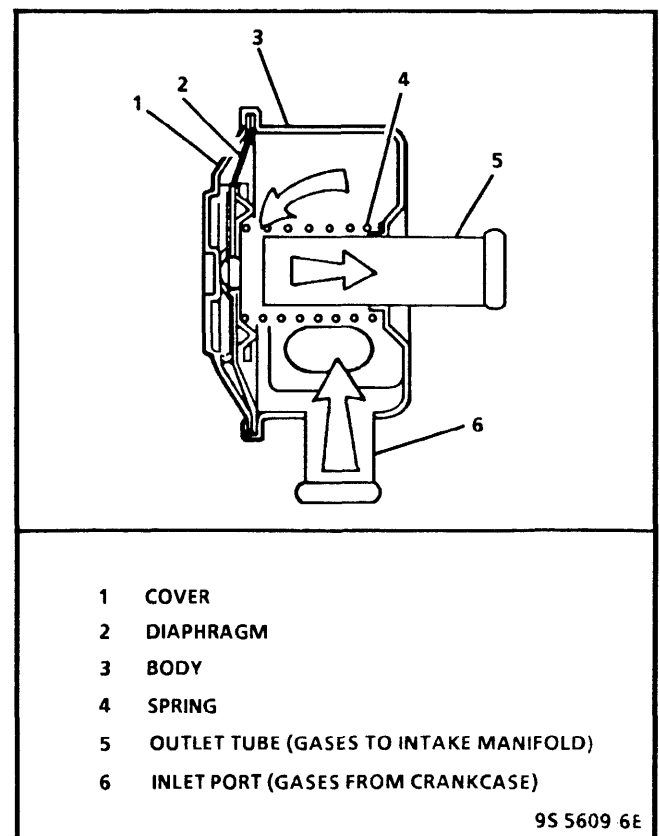


Figure 11-2 - CDR Valve Operation

### DIAGNOSIS

#### CDR VALVE TEST

The purpose of the CDR valve is to maintain 0.75 - 10 kPa (3-4 inches of water) vacuum in the crankcase at 2000 RPM. Too little vacuum will tend to force oil leaks. Too much vacuum will pull oil into the intake manifold.

The CDR valve is checked with a water manometer. The U-tube manometer (Figure 11-3) indicates pressure or vacuum by the difference in the height of the two columns of fluid.

- 1 Connect one end of the manometer to the engine oil dipstick hole. The other end of the manometer is vented to atmosphere.

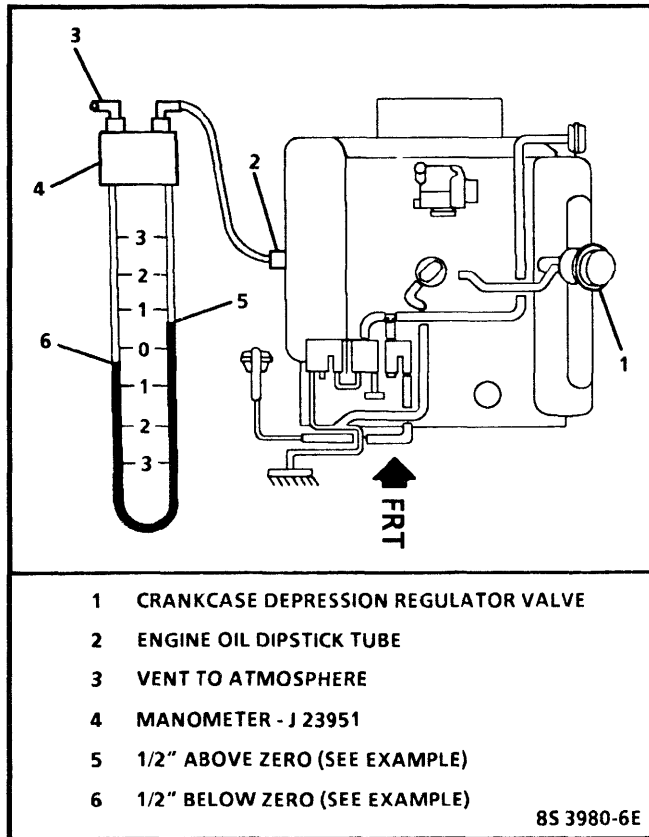


Figure 11-3 - CDR Valve Test

- 2 Install air cleaner.
- 3 Start engine and observe manometer reading. It should read zero to one inch (0-1") of water (vacuum) at idle to approximately 3-4 inches of water (vacuum) at 2000 RPM. Add the amount that the manometer column travels up, to the amount that the column travels down to obtain total water pressure (vacuum). An example of a manometer reading is as follows. One-half inch above zero plus one-half inch below zero equals one inch vacuum reading ( $1/2" + 1/2" = 1"$ ) (Figure 11-3)

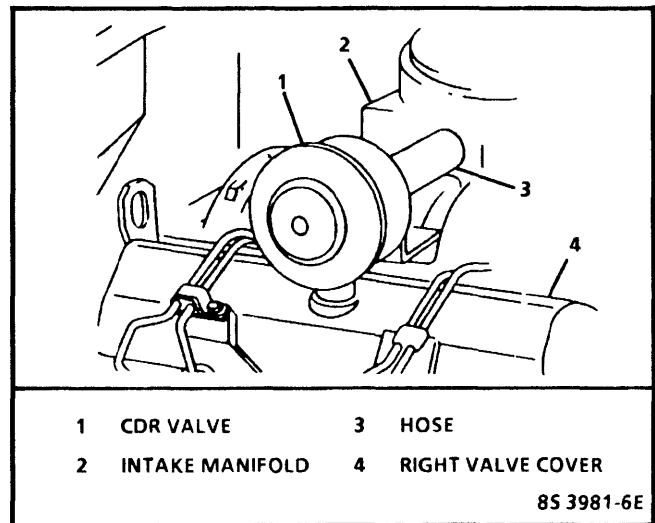


Figure 11-4 - CDR Valve and Hoses (Non-Turbo)

# ON-VEHICLE SERVICE

## CDR VALVE AND HOSES

Figures 11-4 and 11-5

**NOTICE:** Do Not allow any solvent to come in contact with the diaphragm of the crankcase depression regulator valve, because the diaphragm will fail.

The crankcase depression regulator valve is replaced as an assembly. Replace hoses as required, if inspection indicates cracks or decay.

Refer to SECTION 0B in appropriate service manual for diesel crankcase ventilation system maintenance requirements.

## PARTS INFORMATION

| PART NAME                       | GROUP |
|---------------------------------|-------|
| Valve, C/Case Depr Reg .....    | 1.745 |
| Hose, C/Case Depr Reg Vlv ..... | 1.762 |

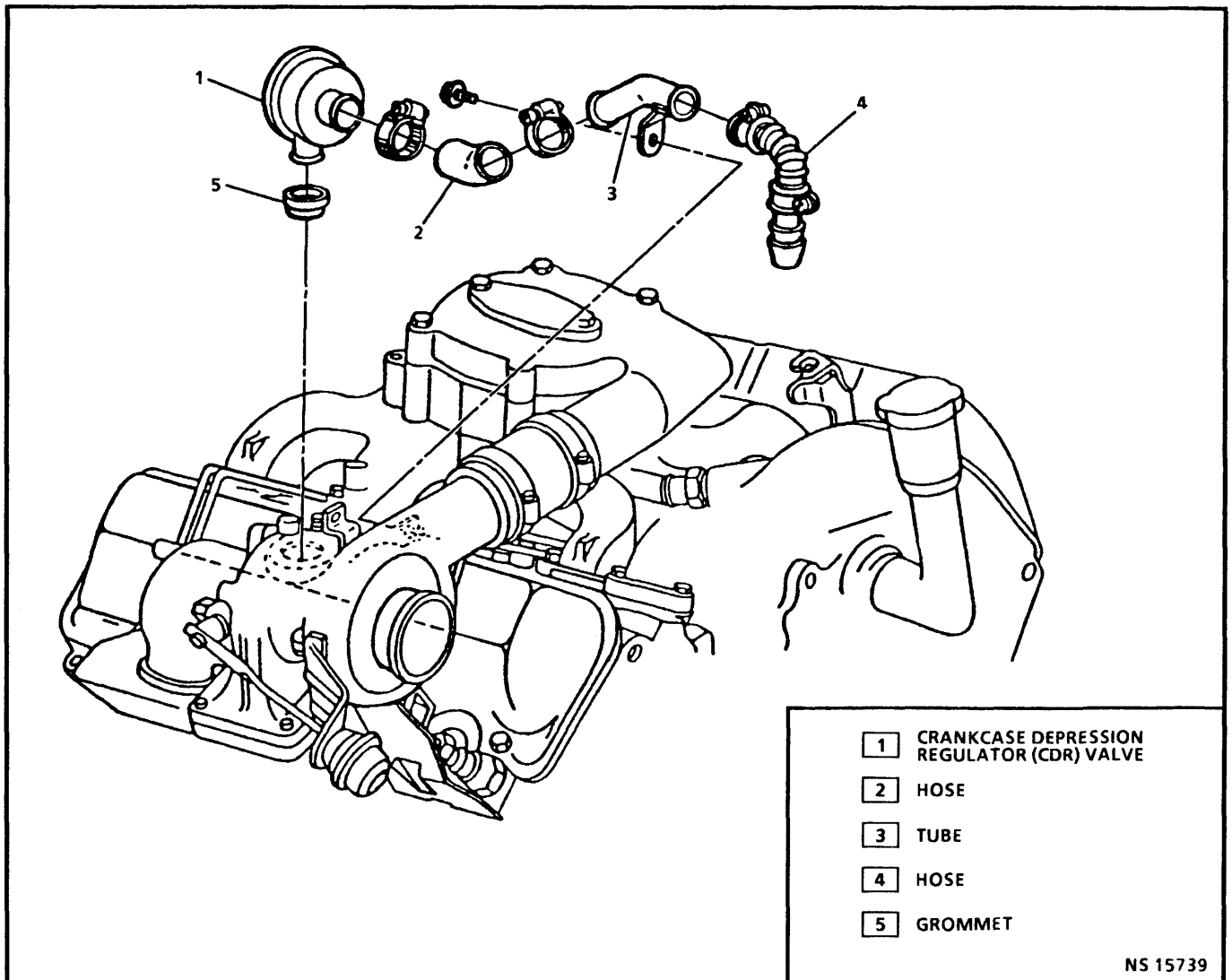


Figure 11-5 - CDR Valve and Hoses (Turbo)



**BLANK**

## SECTION 12

# AIR INTAKE SYSTEM

## CONTENTS

|                                |      |                                           |      |
|--------------------------------|------|-------------------------------------------|------|
| General Description .....      | 12-1 | Air Cleaner Filter Replacement (Turbo) .. | 12-2 |
| Diagnosis .....                | 12-1 | Air Cleaner Replacement                   |      |
| Air Cleaner Filter .....       | 12-1 | (Non Turbo) .....                         | 12-3 |
| On-Vehicle Service .....       | 12-1 | Air Cleaner Replacement (Turbo) .....     | 12-3 |
| Air Cleaner Filter Replacement |      | Resonator Replacement .....               | 12-3 |
| (Non Turbo) .....              | 12-1 | Parts Information .....                   | 12-3 |

### GENERAL DESCRIPTION

The air intake system is used to direct cool air from the exterior of the engine compartment to the intake manifold. An air cleaner is incorporated into the system to keep dirt from entering the engine. Some applications also have a PCM controlled turbocharger to increase power, improve driveability and reduce emissions. Refer to SECTION 6J of the appropriate service manual for more information on the turbocharger.

### DIAGNOSIS

A restricted or leaking air intake system could cause loss of power and engine damage.



#### Inspect

- Air cleaner filter for damage or excessive dirt accumulation. Replace if necessary.
- Air inlet elbow and CDR tube for damage or cracks, replace if necessary.

### AIR CLEANER FILTER

Refer to SECTION 0B of the appropriate service manual for change intervals. Operation of the vehicle in dusty areas will necessitate more frequent replacement.

### ON-VEHICLE SERVICE

**CAUTION:** The air cleaner also functions as a flame arrestor in the event of engine backfire. The air cleaner should be installed at all times unless its removal is necessary for repair or maintenance. To help reduce the risk of personal injury and property damage, be sure that no one is near the engine compartment before starting the engine with the air cleaner removed. If engine backfire

occurs with the air cleaner removed, there could be a burst of flame and possibly other fire in the engine compartment. On vehicles with diesel engines, do not use starting fluids—immediate engine damage can result. Also take care not to let objects fall into the engine if the air cleaner is removed. If the engine is running, suction can pull loose objects into the engine. Objects pulled or dropped into the engine can cause costly engine damage.

### AIR CLEANER FILTER REPLACEMENT (NON TURBO)

**NOTICE:** Extreme care should be taken when removing the air cleaner filter. Remove the air cleaner filter slowly to prevent dirt from falling into the engine. Failure to do so can cause engine damage.



#### Remove or Disconnect

#### Figure 12-1

1. Wing nuts.
2. Air cleaner cover from the base.
3. Air cleaner filter.
4. All accumulated dirt from the base.



#### Inspect

- Air cleaner filter for damage or excessive dirt accumulation. Replace as necessary.
- Seals or gaskets for damage.



#### Install or Connect

#### Figure 12-1

1. Air cleaner filter.
2. Air cleaner cover.
3. Wing nuts.

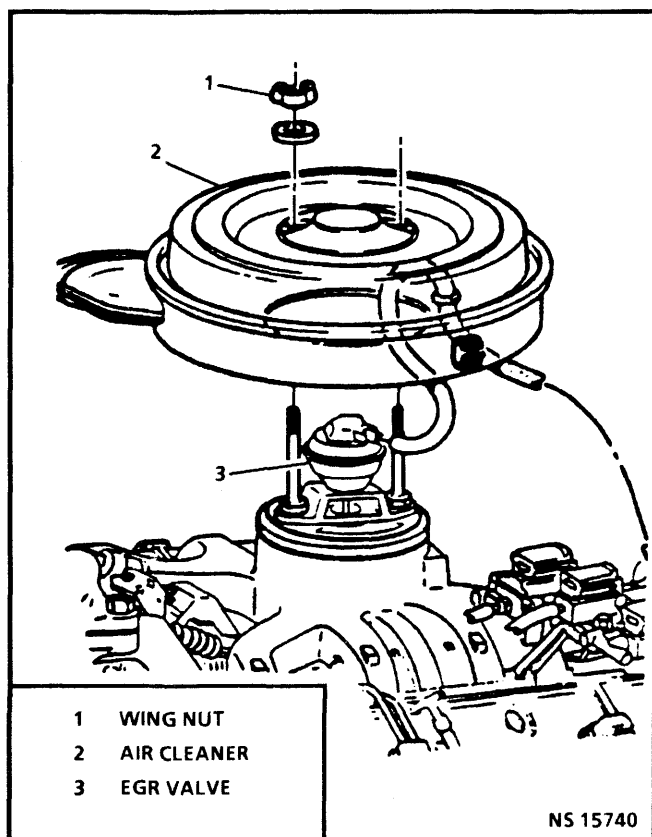


Figure 12-1 - Air Cleaner (Non Turbo)

### AIR CLEANER FILTER REPLACEMENT (TURBO)

#### ↔ Remove or Disconnect

#### Figures 12-2 and 12-5

1. Crankcase Depression Regulator (CDR) hose from air inlet elbow.
2. Air inlet elbow from turbocharger and air cleaner.
3. Clips holding air cleaner cover to the housing.
4. Air cleaner filter.

#### 🔍 Inspect

- Air cleaner filter for damage or excessive dirt accumulation. Replace if necessary.
- Air inlet elbow and CDR tube for damage or cracks, replace if necessary.

#### →+ Install or Connect

#### Figures 12-2 and 12-5

1. Air cleaner filter.
2. Air cleaner cover to housing and clip into place.
3. Air inlet elbow to air cleaner cover and turbocharger.

#### 🔧 Tighten

- Clamps to 1.7 N·m (15 lb. in.).

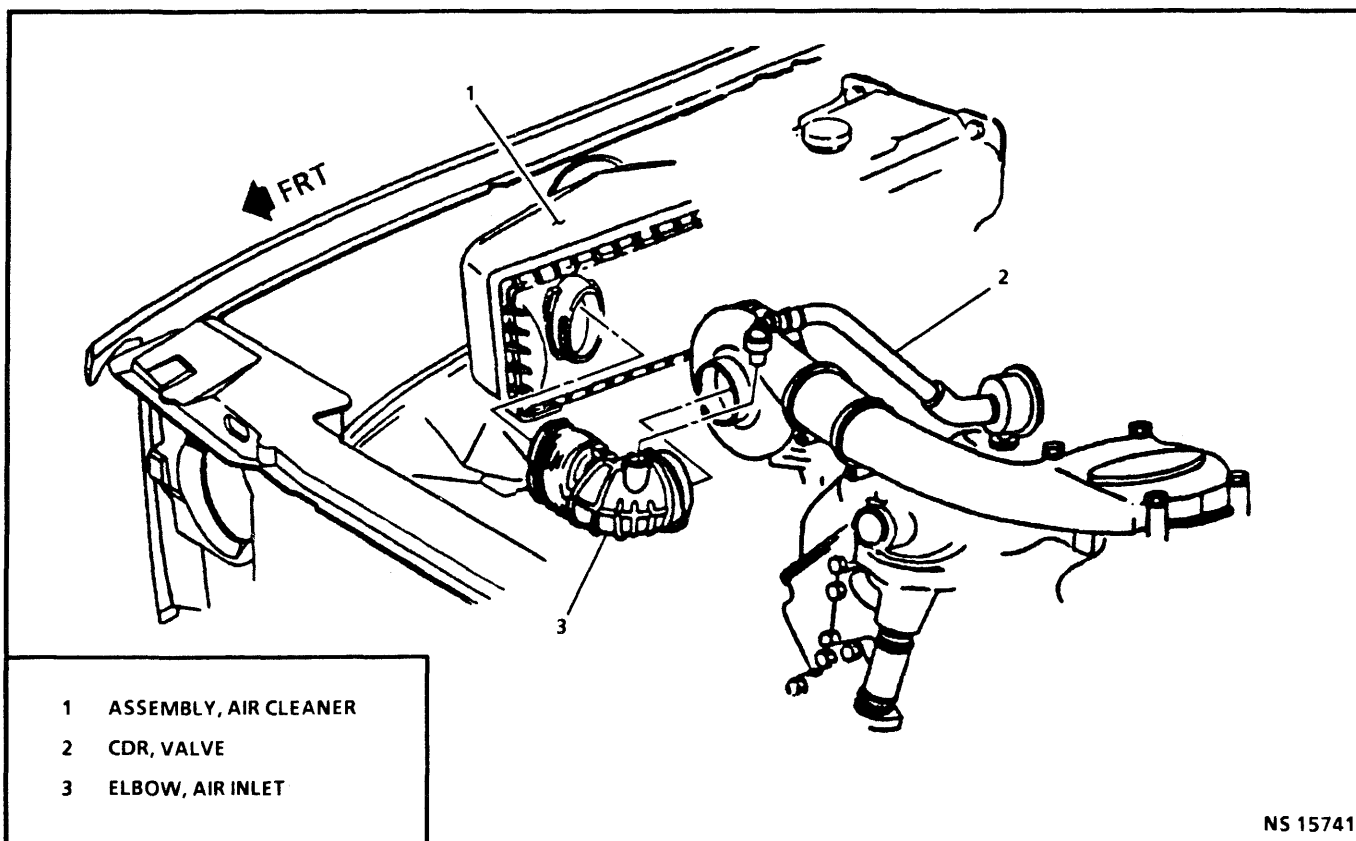


Figure 12-2 - Air Intake (Turbo)

4. CDR valve into air inlet elbow.

## AIR CLEANER REPLACEMENT (NON TURBO)

### Remove or Disconnect

**Figure 12-1**

1. Wing nuts and washer.
2. Air cleaner cover off assembly.
3. Air cleaner filter.
4. Air intake duct off snorkel section of assembly.
5. Lift air cleaner assembly up and disconnect EGR hose from both EGR valve and control valve.
6. Upper seal.
7. Extension.
8. Lower seal.

## AIR CLEANER REPLACEMENT (TURBO)

**Figure 12-2**

1. CDR hose.
2. Air intake duct.
3. Air cleaner mounting bolts.

### Inspect

- EGR hose for cracks or binds.
- Seals for damage.
- Air cleaner filter for damage or excessive dirt accumulation. Replace any part which shows any of the above conditions.

### Install or Connect

1. Air cleaner mounting bolts.

### Tighten

- Bolt to 12 N·m (96 lb. in.).
2. Air intake duct.
  3. CDR hose.

## RESONATOR REPLACEMENT

### Remove or Disconnect

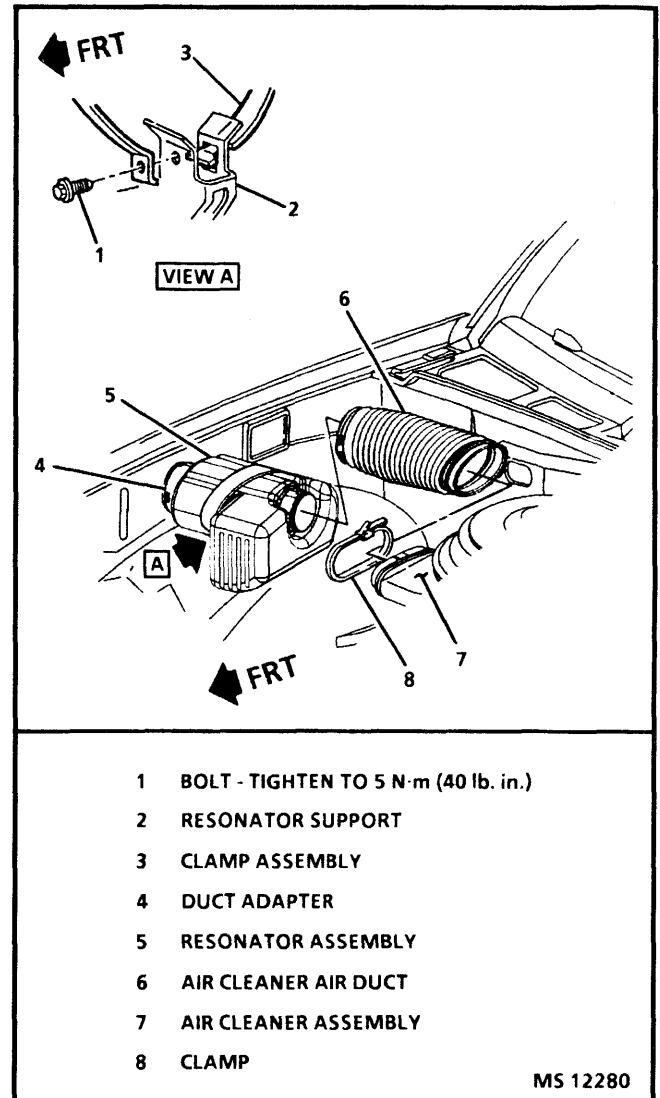
**Figure 12-3**

1. Air intake duct.
2. Resonator clamp bolt.
3. Resonator from the vehicle.

### Install or Connect

**Figure 12-3**

1. Resonator (6) to the vehicle.
2. Resonator clamp bolt (5).



**Figure 12-3 - Air Intake (Non Turbo)**

### Tighten

- Bolt to 10 N·m (89 lb. in.).
3. Air intake duct (4).

## PARTS INFORMATION

| PART NAME               | GROUP |
|-------------------------|-------|
| Air Cleaner .....       | 3.402 |
| Element (Paper) .....   | 3.410 |
| Nut, A/Cl .....         | 3.403 |
| Seal, Air Cleaner ..... | 3.403 |

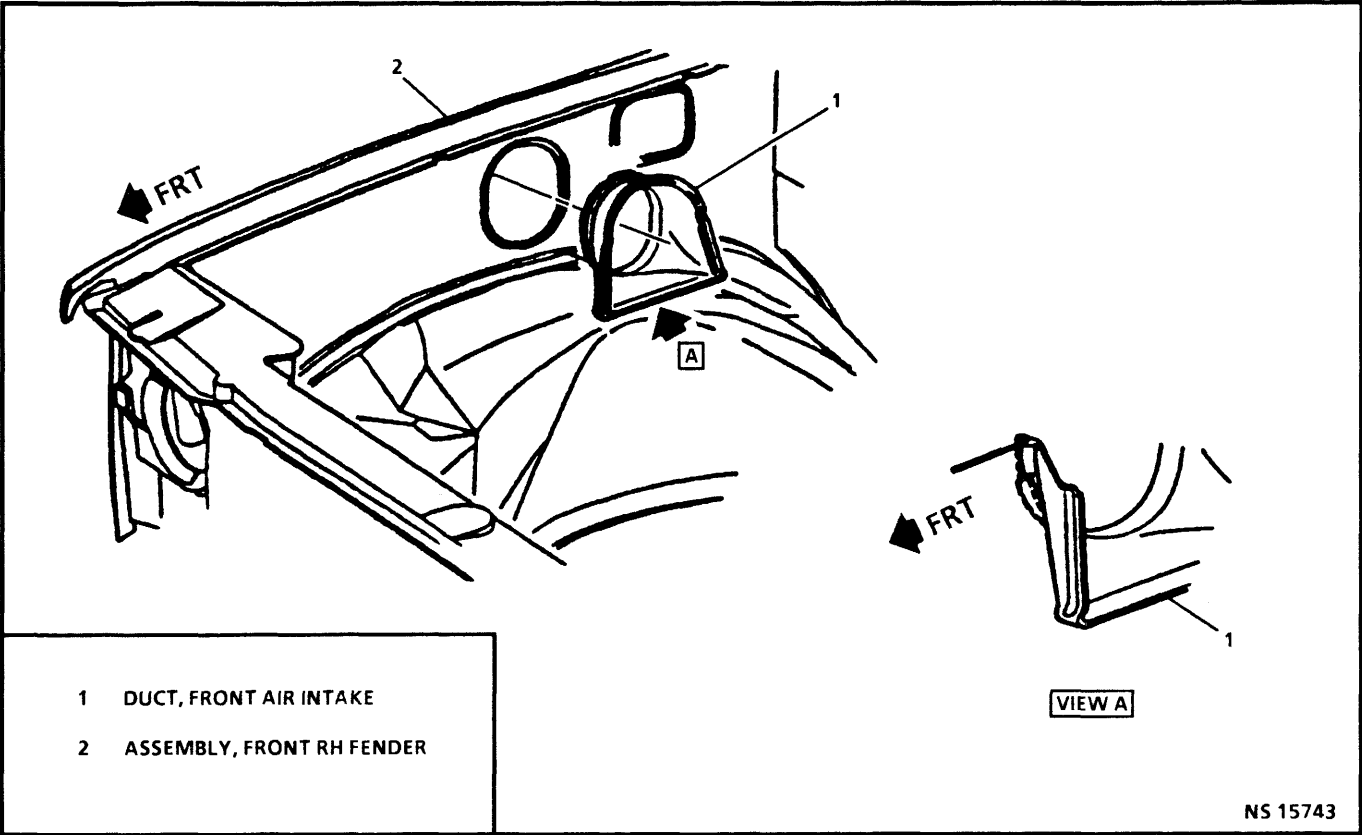


Figure 12-4 - Air Intake Duct Adapter (Turbo)

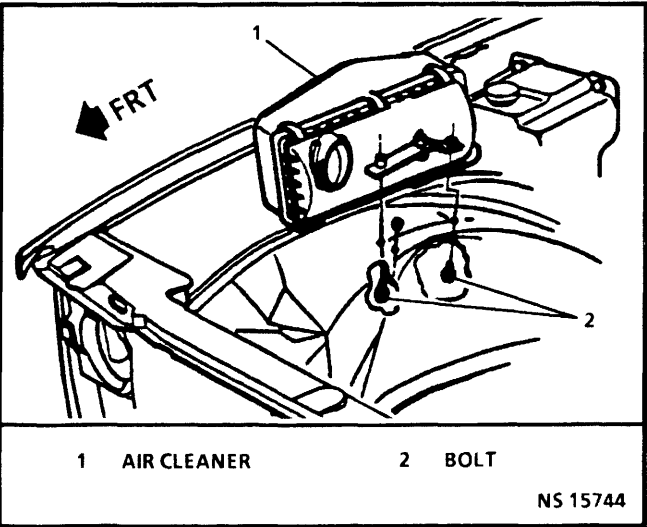


Figure 12-5 - Air Cleaner Mounting (Turbo)

## SECTION 13

# SPECIAL TOOLS

## CONTENTS

|                           |      |                              |      |
|---------------------------|------|------------------------------|------|
| General Description ..... | 13-1 | Special Tools (1 of 3) ..... | 13-2 |
| Scan Tool .....           | 13-1 |                              |      |

## GENERAL DESCRIPTION

The special tools required for service of the fuel and emission systems are illustrated in Figures 13-1 through 13-3. These tools will be needed in specialized procedures listed in other sections. The knowledge of the tool's abilities and limitations must be known before they are used. This knowledge should include scan tool operation, proper use of test lights, use of jumper wires to bypass components for circuit tests and proper usage of a digital multimeter.

## SCAN TOOL

The Data Link Connector (DLC) under the dash near the steering column allows an easy link for connecting scan tools to the system. There are several scan tools available for reading this information.

Scan tools do not replace the use of diagnostic charts or even locate exactly where a problem is in a given circuit. However, with an understanding of the equipment and the circuit involved, the tools can be very useful in obtaining information which could be more time consuming than with other equipment.

**NOTICE:** A scan tool that displays faulty data should not be used and the problem should be reported to the manufacturer. The use of a faulty scan tool can result in misdiagnosis and unnecessary replacement of good parts.

Diagnostic Trouble Code (DTC) charts incorporate diagnosis procedures using a DLC scan tool when possible.

Some electronic control modules use three modes for transmitting information but some only read data in the open mode. For further information on use of the scan tool, refer to SECTION 3. Special service tools that are shown in this service manual that have tool product numbers beginning with "J" or "BT" are available for worldwide distribution from:

Kent-Moore  
SPX Corporation  
29784 Little Mack  
Roseville, MI 48066-2298  
1-800-345-2233  
Mon.- Fri. 8:00 p.m. EST  
Telex: 244040 KMTR VR  
Fax: 313-578-7375

General Motors dealers can purchase Tech 1 scan tools and accessories through Kent-Moore at the above address and phone number. Non-General Motors dealer repair facilities can purchase Tech 1 scan tools and accessories from Kent-Moore at the above address or:

Sun Electric Corporation  
One Sun Parkway  
Crystal Lake, IL 60014  
1-800-CALLSUN (225-5786)  
6:45 a.m. - 7:00 p.m. CST

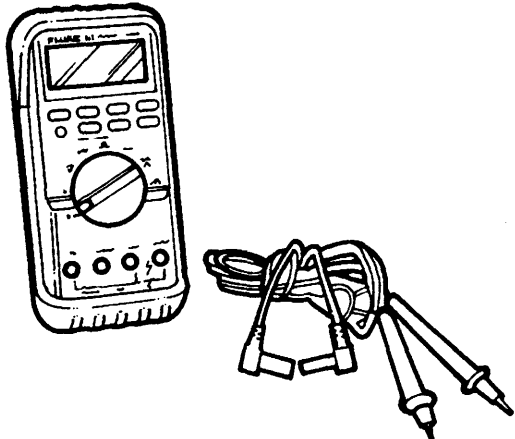
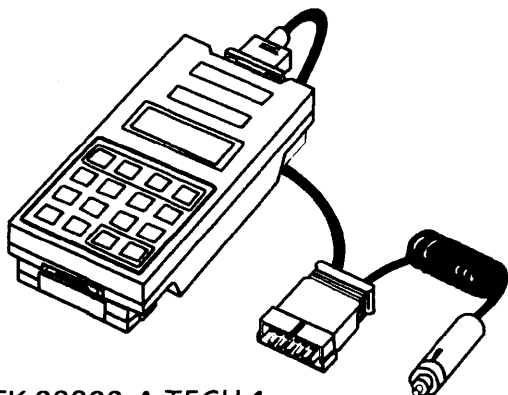
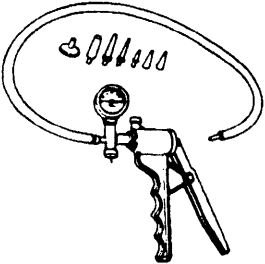
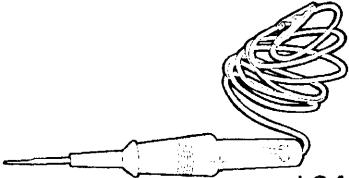
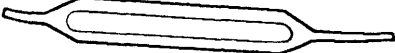
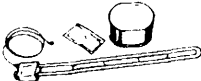
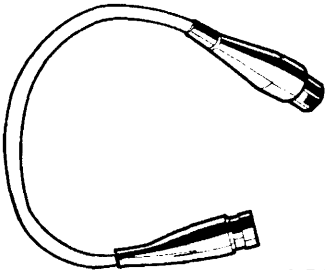
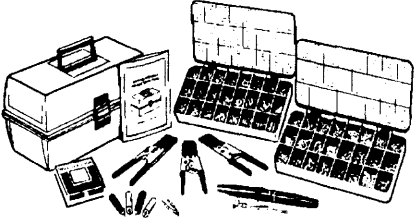
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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>HIGH IMPEDANCE MULTIMETER<br/>(DIGITAL VOLTMETER-DVM)<br/>J 39200</b></p> | <p><b>REFER TO USERS MANUAL FOR COMPLETE INSTRUCTIONS.</b></p> <p><b>VOLTMETER</b> - Voltage position measures magnitude of voltage when connected in parallel to an existing circuit. A digital voltmeter with a 10 megohm input impedance is used because this type of meter will not load down the circuit and result in faulty readings. Some circuits require accurate low voltage readings because they have a very high resistance.</p> <p><b>AMMETER</b> - When used as an ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for more information.</p> <ul style="list-style-type: none"> <li>• Selector must be set properly for both function and range. DC is used for most automotive measurements.</li> </ul> <p><b>OHMMETER</b> - Measures resistance of circuit directly in ohms.</p> <ul style="list-style-type: none"> <li>• OL display in all ranges indicates open circuit.</li> <li>• Zero display in all ranges indicates a short circuit.</li> <li>• An intermittent connection in a circuit may be indicated by a digital reading that will not stabilize on the circuit.</li> <li>• Range Switch - Automatic and Manual. <ul style="list-style-type: none"> <li>400Ω - Reads ohms directly</li> <li>4KΩ, 40KΩ, 400KΩ - Reads ohms in thousands</li> <li>4MΩ, 40MΩ, 400MΩ - Reads ohms in millions</li> </ul> </li> </ul> |
|  <p><b>TK 00000-A TECH 1<br/>and cartridge</b></p>                             | <p><b>TECH 1 DIAGNOSTIC SCAN TOOL<br/>(With 81-94 GM Powertrain Software)</b></p> <p>A hand-held scan tool used to analyze and diagnose fuel and emission system. Also can be used to analyze other systems.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  <p><b>J 35616</b></p>                                                         | <p><b>CONNECTOR TEST ADAPTER KIT</b></p> <p>Used to make electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Figure 13-1 - Special Tools (1 of 3)

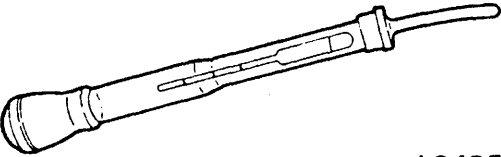
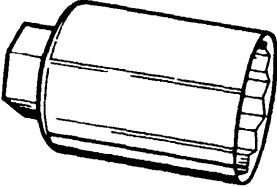
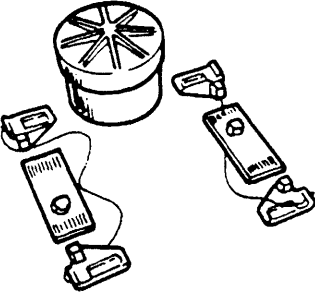
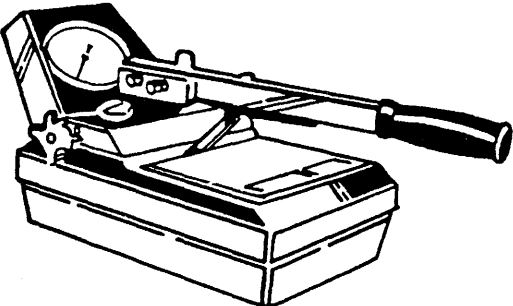
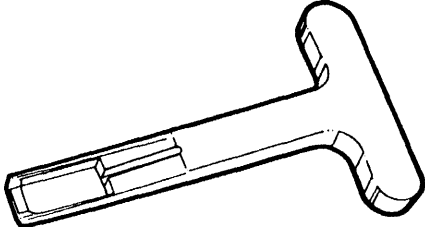
|                                                                                                          |                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>J 23738-A           | <b>VACUUM PUMP (20 IN. HG. MINIMUM)</b><br>Use gage to check vacuum sensors, solenoids and valves, also used to check fuel supply system.                        |
| <br>J 34142-B           | <b>UNPOWERED TEST LIGHT</b><br>Used to check wiring for complete circuit and short to ground or voltage.                                                         |
| <br>J 35689-A           | <b>METRI-PACK TERMINAL REMOVER</b><br>Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors.                                             |
| <br>J 28742-A/BT-8234-A | <b>WEATHER PACK TERMINAL REMOVER</b><br>Used to remove terminals from Weather Pack connectors.                                                                   |
| <br>J 33095/BT-8234-A | <b>PCM CONNECTOR TERMINAL REMOVER</b><br>Used to remove terminal from Micro-Pack connectors.                                                                     |
| <br>J 23951           | <b>MANOMETER</b><br>Used to check the Crankcase Depression Regulation (CDR) valve.                                                                               |
| <br>J 39775           | <b>JUMPER HARNESS</b><br>Used with J 39200 to measure circuit voltage, amperage, or resistance in the automatic transmission through the transmission connector. |
| <br>J 38125-4         | <b>TERMINAL REPAIR KIT</b><br>Used to replace damaged terminal ends on wiring harnesses.                                                                         |

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Figure 13-2 - Special Tools (2 of 3)



## 13-4 DRIVEABILITY AND EMISSIONS (DIESEL)

|                                                                                                  |                                                                                                                       |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <br>J 34352     | <b>FUEL QUALITY HYDROMETER</b><br>This is used to check specific gravity (quality) of diesel fuel.                    |
| <br>J 29873     | <b>NOZZLE SOCKET</b><br>Used to remove and install injection nozzles.                                                 |
| <br>J 29664    | <b>MANIFOLD COVER SET</b><br>Used to cover intake ports whenever intake is removed.                                   |
| <br>J 29075-B | <b>NOZZLE TESTER</b><br>Used to perform injection nozzle tests.                                                       |
| <br>J 29872   | <b>INJECTION PUMP ADJUSTING TOOL</b><br>This tool is used to easily rotate injection pump to correct timing position. |
| <br>J 39083   | <b>GLOW PLUG CONNECTOR REMOVER/INSTALLER</b><br>This tool is used to remove glow plug terminal connector.             |

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Figure 13-3 - Special Tools (3 of 3)

## SECTION 14

# ABBREVIATIONS AND GLOSSARY OF TERMS

Abbreviations used in this manual are listed below in alphabetical order with an explanation of the abbreviation. All the terms listed below subscribe fully to the S.A.E. requirements for 1994.

**AMPERAGE OR CURRENT** - The rate of flow of electrons is similar to gallons of water per minute flowing in a water pipe.

**ANALOG SIGNAL** - An electrical signal which varies in voltage within a given parameter.

**B +** - Battery positive terminal (12 volts).

**BARO** - Sensor which measures atmospheric pressure.

**CAPACITOR** - An electrical device used to store a temporary charge.

**CATALYTIC CONVERTER** - Containing platinum and palladium to speed up conversion of HC and CO.

**CID - CUBIC INCH DISPLACEMENT** - Used to describe engine size.

**CO - CARBON MONOXIDE** - One of the pollutants found in engine exhaust.

**CONTROL MODULE SYSTEM** - Utilizes one of three control modules (ECM, PCM and VCM) to control air/fuel and emission systems.

**CONTROL SOLENOID** - An electrical switching device used to operate another system.

**CRANKCASE VENT VALVE** - Prevents fumes in crankcase from passing into atmosphere.

**DIAGNOSTIC TERMINAL** - Grounding terminal "B" of Data Link Connector (DLC) will flash or display a DTC. When grounded with the engine operating the vehicle will enter the "Field Service Mode."

**DIAGNOSTIC TROUBLE CODE (DTC)** - A specific set of numbers obtained from flashing the MIL (Service Engine Soon), or displaying on a scan tool. These DTC(s) are used to determine the system malfunctions.

**DIODE** - An electrical device that restricts current flow in one direction.

**DLC - DATA LINK CONNECTOR** - Used at the assembly plant to evaluate the vehicle's control module system and for service for diagnostic trouble codes. Also can be used by scan tools to obtain control module serial data, for service diagnosis.

**DVM (10 Meg.)** - Digital voltmeter with 10 million ohms resistance - used for measurement in electronic systems.

**EMI OR NOISE** - An unwanted signal interfering with another needed signal; like an electrical razor upsets a television picture, or driving under high voltage power lines upsets the AM radio in a vehicle.

**ENERGIZE/DE-ENERGIZE** - When current is passed through a coil (energized) such as a solenoid, a plunger is pulled or pushed. When the voltage to the solenoid is turned "OFF," (de-energized), a spring raises or lowers the plunger.

**ENGINE COOLANT TEMPERATURE (ECT) SENSOR** - Device that senses the engine coolant temperature, and passes that information to the control module system.

**EXHAUST GAS RECIRCULATION (EGR)** - Method of reducing NOx emission levels.

**FEDERAL** - Vehicle/engine available in all states except California.

**GROUND** - A wire shorted to ground. A common return path for an electrical circuit. A reference point from which voltage measurements may be made.

**HC - HYDROCARBONS** - One of the pollutants found in engine exhaust. Hydrogen and carbon in gasoline.

**HIGH IMPEDANCE DVM** - Has high opposition to the flow of electrical current. Used for reading circuits with low current flow found in electronic systems.

**IGN - IGNITION** - Refers to switched ignition voltage.

**INPUTS** - Information from sources (such as, engine coolant temperature sensors, exhaust oxygen sensor, etc.) which tell the control module how the systems are performing.

**INSTRUMENT PANEL (I/P)** - Contains instrument gages and indicator lights to indicate performance of the vehicle.

## 14-2 DRIVEABILITY AND EMISSIONS (DIESEL)

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**INTAKE AIR TEMPERATURE (IAT)** - The control module converts the resistance of the Intake Air Temperature (IAT) sensor into degrees. IAT is used by the control module to adjust fuel delivery and spark based on oncoming air density.

**INTERMITTENT** - Occurs now and then; not continuously. In electrical circuits, refers to occasional open, short, or ground.

**KILOMETER PER HOUR (km/h)** - A metric unit measuring distance (1000 meters) in one hour.

**LITER (L)** - A metric unit of capacity.

**MALFUNCTION** - A fault that causes the system to operate incorrectly. Typical malfunctions are; wiring harness opens or shorts, failed sensors, or circuit components.

**MALFUNCTION INDICATOR LAMP (MIL)** - Lights when a malfunction occurs in the control module system.

**MERCURY (Hg)** - A calibration material used as a standard for vacuum measurement.

**MILES PER HOUR (MPH)** - A unit measuring distance (5280 feet) in one hour.

**MODE** - A particular state of operation.

**NEWTON METERS (N·m)** - A metric unit of force.

**NITROGEN NO<sub>x</sub>** - One of the pollutants found in engine exhaust. Nitrogen that combines with oxygen to form oxides of nitrogen.

**ON-BOARD DIAGNOSTIC SYSTEM CHECK** - The control module will detect malfunctions in the system. If a malfunction occurs, the control module turns "ON" the MIL (Service Engine Soon). A diagnostic trouble code can be obtained from the control module through the MIL (Service Engine Soon) lamp or scan tool. This DTC will indicate the area of the malfunction.

**OUTPUT** - Functions, typically solenoids, which are controlled by the control module.

**PORT - EXHAUST OR INTAKE PORT**

**POWERTRAIN CONTROL MODULE (PCM)** - Used on some vehicles to control and monitor not only fuel/air ratio and emissions, but also to control the electronic transmission operation.

**PRESSURE CONTROL SOLENOID (FORMERLY FORCE MOTOR)** - A solenoid used in the transmission to control shift quality.

**PROGRAMMABLE READ ONLY MEMORY (PROM)** - An electronic component which is specifically programmed to each vehicle model for control of fuel and emissions. The PROM is located in the control module.

**PULSE WIDTH MODULATED (PWM)** - A device operated by a digital signal controlled by the time duration the device is turned "ON" or "OFF."

**QUAD-DRIVER** - A "chip" device that is capable of operating four separate outputs. Some have digital and some have pulse width modulated control.

**RESISTANCE** - The ability of a circuit to limit current flow; like a restriction in a water pipe.

**REVOLUTIONS PER MINUTE (RPM)** - A measure of rotational speed.

**TACHOMETER (TACH)** - A device for indicating rotational speed of the crankshaft.

**TORQUE CONVERTER CLUTCH - TCC** - Control module controlled solenoid in transmission which positively couples the transmission to the engine.

**V8 - EIGHT CYLINDER ENGINE** - Arranged in a "V".

**VACUUM** - Less than atmospheric pressure.

**VEHICLE SPEED SENSOR (VSS)** - Sensor which sends vehicle speed information to the control module.

**VIN - VEHICLE IDENTIFICATION NUMBER** - Appears on a plate attached to the windshield pillar.

**VOLT (V)** - A measurement of electrical pressure.

**VOLTAGE** - The pressure of force pushing the current in a circuit; like pressure in a water pipe.

**VSS BUFFER** - An electrical signal that is either "ON" or "OFF" with no in between.

**WIDE OPEN THROTTLE (WOT)** - Refers to the throttle plate or accelerator pedal when fully open.

**1-2 SHIFT SOLENOID** - Used to shift gears when commanded by the control module. Used on 4L60E and 4L80E electronic transmissions.

**2-3 SHIFT SOLENOID** - Used to shift gears when commanded by the control module. Used on 4L60E and 4L80E electronic transmissions.

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**SECTION 8A**

**ELECTRICAL DIAGRAMS**

**AND**

**DIAGNOSIS**





## **INTRODUCTION**

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## HANDLING ELECTROSTATIC DISCHARGE (ESD) SENSITIVE PARTS

Many solid-state electrical components can be damaged by electrostatic discharge (ESD). Some will display a label, but many will not (figure 1).

**NOTICE:** *In order to avoid possibly damaging any components, observe the following:*

1. *Body movement produces an electrostatic charge. To discharge personal static electricity, touch a ground point (metal) on the vehicle. This should be done anytime you:*
  - *Slide across the vehicle seat.*
  - *Sit down or stand up.*
  - *Do any walking.*
2. *Do not touch exposed electric terminals or components with your fingers or tools. Remember, the connector you are checking might be tied into a circuit that could be damaged by electrostatic discharge.*
3. *When using a screwdriver or similar tool to disconnect a connector, never let the tool come into contact with or come between exposed terminals.*
4. *Never jumper, ground, or use test equipment probes on any components or connectors unless specified in diagnosis. When using test equipment, always connect the ground lead first.*
5. *Do not remove the solid-state component from its protective packaging until you are ready to install the part.*
6. *Always touch the solid-state component's package to ground before opening. Solid-state components can also be damaged if:*
  - *They are bumped or dropped.*
  - *They are laid on any metal benches or components that operate electrically such as a TV, radio, or oscilloscope.*

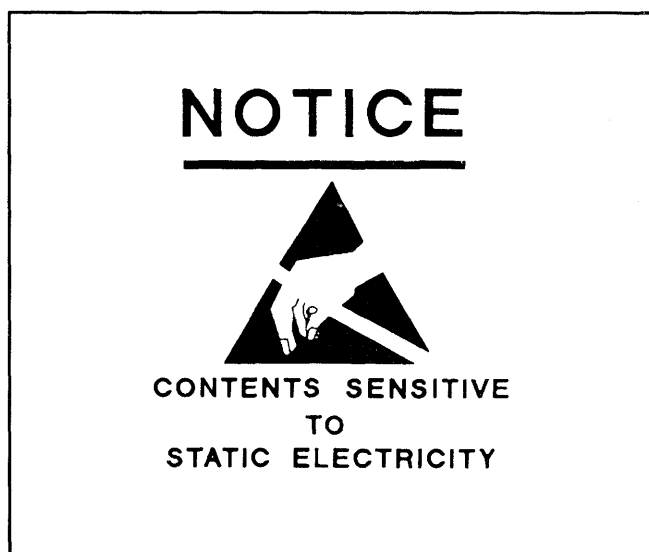


Figure 1 — Electrostatic Discharge (ESD) Symbol

### VEHICLE IDENTIFICATION NUMBER (VIN)

The vehicle identification number (VIN) is the 17 digit legal identifier of the vehicle. It is located on a plate which is attached to the left top of the instrument panel and can be seen through the windshield from outside the vehicle (figure 2). To find the manufacturer, model and chassis type, engine type, GVW (Gross Vehicle Weight) range, model year, plant code, and sequential number, refer to figure 3. Body styles are illustrated in figure 4.

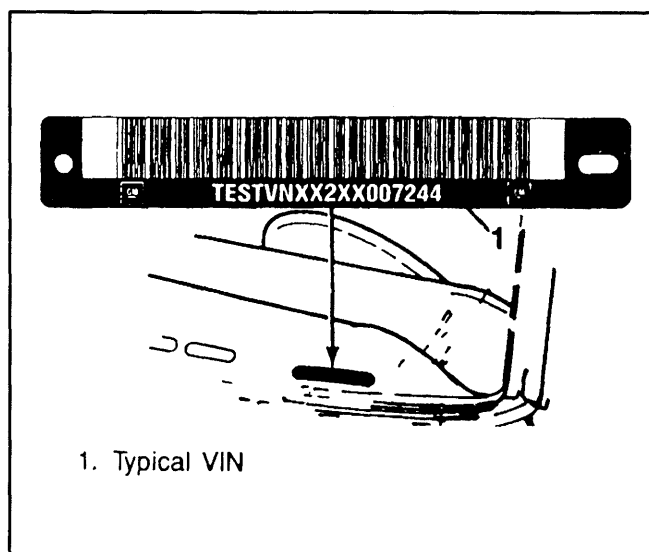


Figure 2 — Vehicle Identification Number (VIN) Location

## 8A-2-2 GENERAL INFORMATION

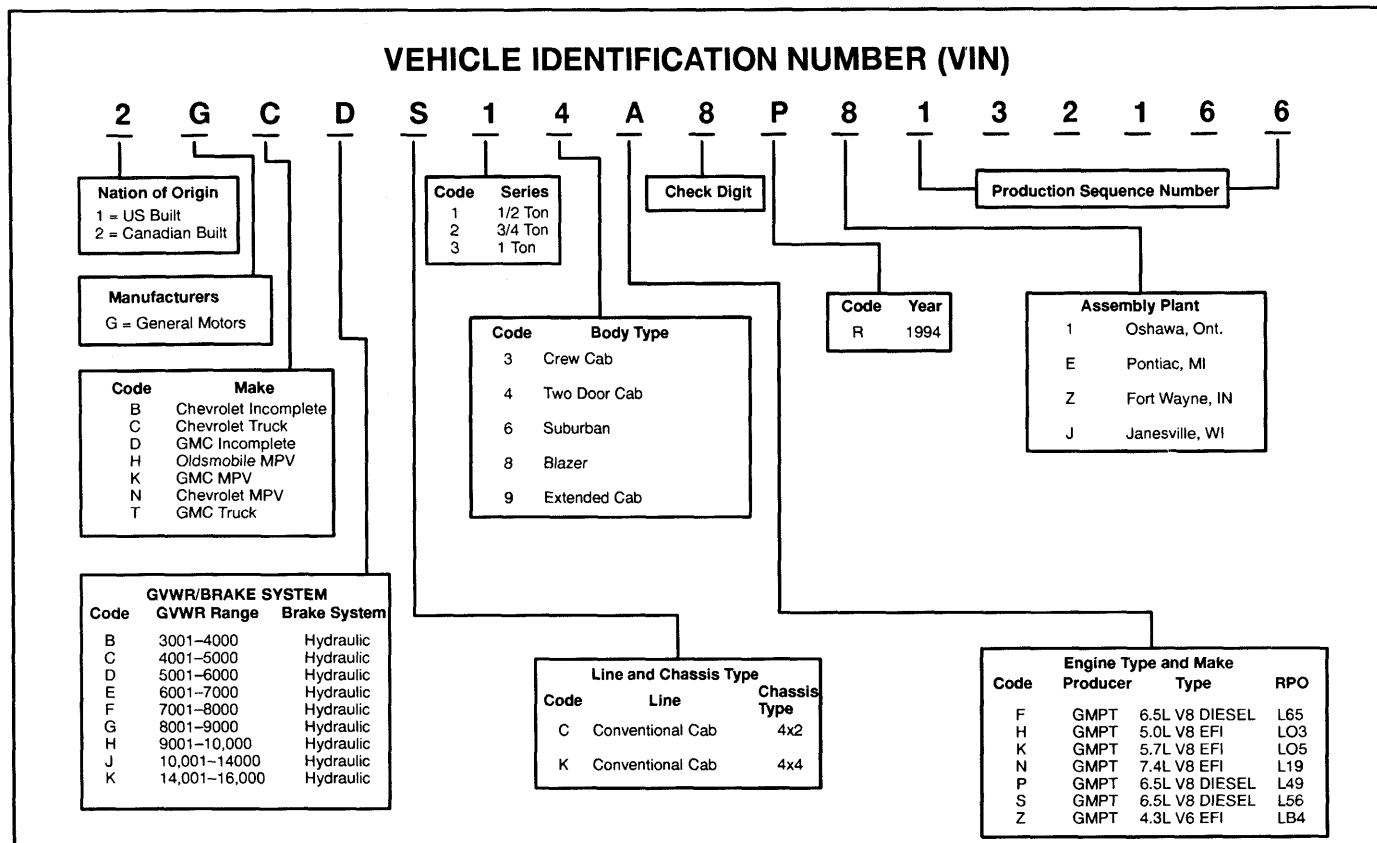


Figure 3 — Vehicle Identification Chart

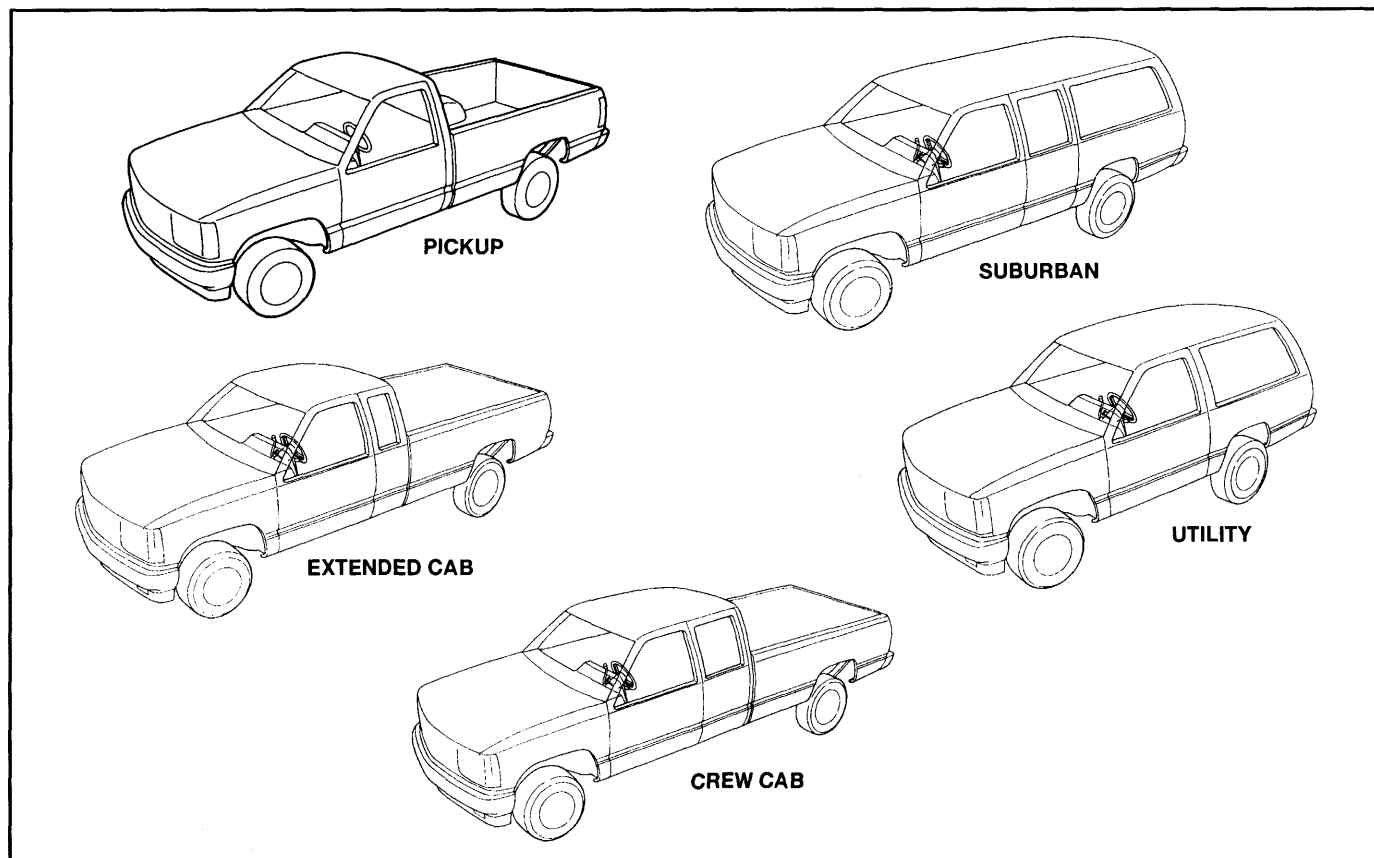


Figure 4 — Body Styles

## HOW TO USE THIS MANUAL

This manual contains the following types of information to help you in the diagnosis of your vehicle.

**PAGE NUMBERING** — This manual is organized into individual sections with most sections containing a circuit schematic and the text for that circuit. This makes the section easy to use, since the page number (figure 5) will normally stay the same from year to year, and it will also be the same for all truck lines. For example, the Vehicle Speed Sensor Buffer will always be section 33 while Cruise Control will always be section 34.

### 8A-2-33-1 VEHICLE SPEED SENSOR BUFFER

**Figure 5 — Page Numbering**

Some sections have more than one circuit schematic, such as Power Distribution and Interior Lights. The circuit schematic you want can be located by using the index, or by a quick look through the related section.

All the engine circuits for a particular engine VIN type are in the same section. This makes the section easy to use, since schematics for other engines are not in your way. The instrument panel schematics are organized in the same fashion.

If you are working on a vehicle with a Digital Cluster, only the schematics that apply to that vehicle's Digital Cluster will be in that section. Information applying to other clusters will be located in the applicable sections.

**CIRCUIT OPERATION** — The circuit operation provides a simplified discussion of what is happening within each circuit. The discussion includes voltage source, ground paths, and component operation for each system in the vehicle. The explanation is tied to the circuit diagram, and in some cases, to specific components.

**COMPONENT LOCATIONS** — When you are ready to locate the schematic components on the vehicle, use the Component Location List (figure 6).

Listed in the left-hand column are the components shown on the schematic. The center column lists the physical location of the component on the vehicle. The right-hand column lists the page and figure that the component is shown on.

References to LH and RH are made as though you are seated in the driver's seat. In addition to components, connectors, grounds, grommets, splices and diodes are listed to help you locate their position on the vehicle.

### COMPONENT LOCATION

#### Components:

|                             |                                                  | Page/Fig |
|-----------------------------|--------------------------------------------------|----------|
| Data Link Connector (DLC)   | Below LH side of I/P, RH side of steering column | 33-2-A   |
| Cruise Control Module       | Behind LH side of I/P, left of steering column   | 33-2-A   |
| Engine Control Module (ECM) | Behind RH side of I/P                            | 33-3-B   |
| Fuse Block                  | Behind LH side of I/P                            | 33-2-A   |
| Vehicle Speed Sensor Buffer | Below RH side of I/P                             | 33-2-B   |
| Vehicle Speed Sensor (VSS)  | LH rear of transmission or transfer case         | 33-2-A   |

#### Connectors:

|                    |                                    |        |
|--------------------|------------------------------------|--------|
| C100 (36 Cavities) | LH cowl (engine compartment)       | 33-3-A |
| C104 (10 Cavities) | Behind RH side of I/P              | 33-3-A |
| C299               | LH side of transmission (4WD only) | 33-3-B |
| C321               | At vehicle speed sensor            | 33-3-A |

#### Grounds:

|      |                     |        |
|------|---------------------|--------|
| G102 | Top front of engine | 33-3-B |
|------|---------------------|--------|

#### Splices:

|      |                                              |        |
|------|----------------------------------------------|--------|
| S205 | LH I/P harness                               | 33-3-A |
| S207 | Behind LH side of I/P, above steering column | 33-2-A |

**Figure 6 — Component Location List**

8A-2-4 GENERAL INFORMATION

**SCHEMATICS** — Schematics break the entire electrical system down into individual circuits. You are not distracted by wiring which is not part of the circuit you're working on. Whenever possible the power source is shown at the top of the page. All wires, connectors, splices, switches, and other components are shown in the flow of current to ground at the bottom of the page. Switches and other components are shown in the "at rest" position, with the Ignition Switch in OFF and all doors and compartments closed.

It is important to realize that no attempt is made on the schematic to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differently in a schematic from one which is only a few inches long.

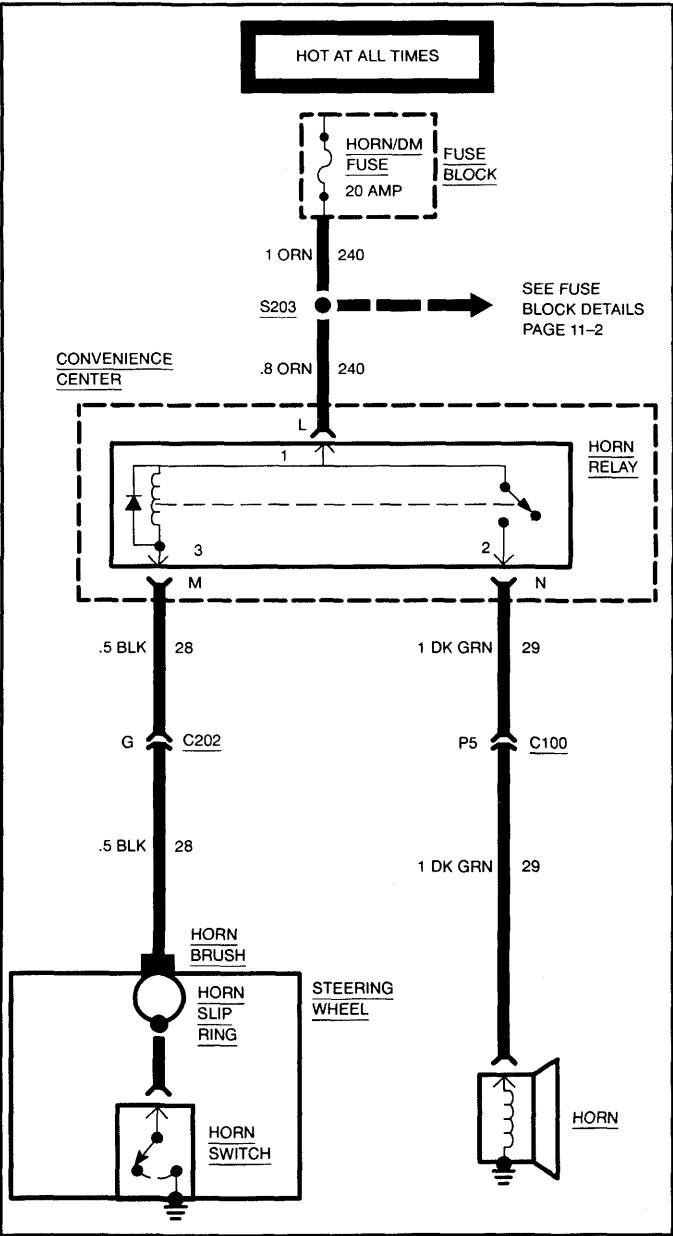


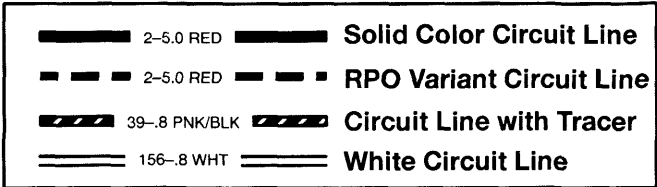
Figure 7 — Typical Horn Schematic

Switches and other components are shown as simply as possible, with regard to function only.

Figure 7 shows a typical horn schematic. Locate the horn schematic using the Index. The circuit schematic will look somewhat like the one shown. The schematic is read from top to bottom.

Voltage is supplied to the Horn Relay at all times. When the relay coil is grounded by closing the Horn Switch, the relay contacts close. When the relay contacts close, the Horn is energized.

There are four types of lines used to depict circuits throughout the circuit diagrams. They are as shown:



Each wiring circuit is identified by circuit number, size (in mm<sup>2</sup>) and color. Wire colors are shown in the abbreviated form. Figure 8 shows how the circuit numbers and color abbreviations are identified in this manual.

Connectors are identified with a three digit number preceded with a C (ie C100). Splices are preceded with an S, grounds with a G, Grommets with a P, and Diodes with a D.

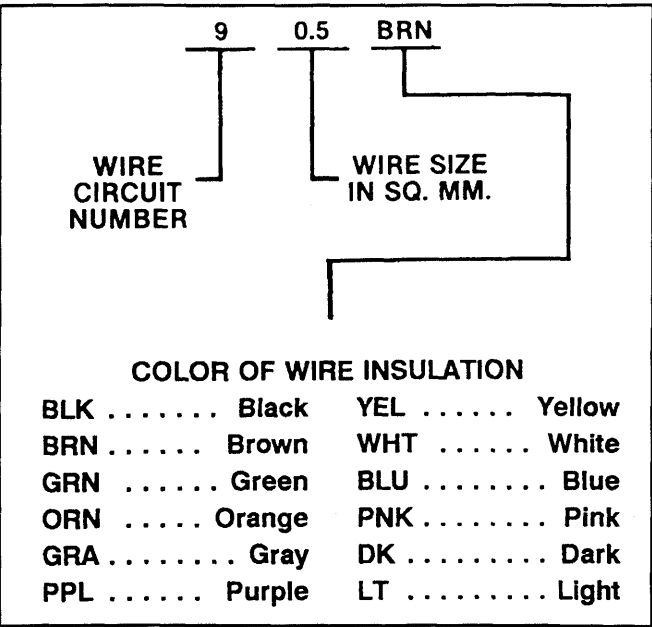


Figure 8 — Wire Coding

**COMPONENT LOCATER VIEWS** – These appear within each section. Components, connectors, grounds, grommets, and splices are illustrated in their immediate environment. Figure 9 illustrates a typical component locater view.

**CONNECTOR FACES** – Connector faces are shown to aid in the identification of connectors and cavities within a connector. They are shown from the mating end unless otherwise marked. Each connector has its own unique number for reference to component locater and diagnosis charts. Part numbers are also provided to save time when ordering replacement parts. Figure 10 shows connector faces.

**DIAGNOSIS CHARTS** – Symptom driven diagnosis charts are provided for nearly all systems. These charts can be used to locate the cause of a failure and greatly speed up the repair process. Figure 11 shows a typical symptom driven diagnosis chart.

**HARNESS ROUTING VIEWS** – These are “phantom views” of the vehicles that enable the technician to see the location and routing of entire harnesses.

**SYMPTOM INDEX** – This is an alphabetical listing of all the symptoms covered in the manual, to assist you in going to the correct system. It is located at the end of the introductory portion of the manual, just before the diagrams.

**VACUUM SYSTEM SCHEMATICS** – Description of operation, diagnosis, component locations, and a schematic are also provided for the vacuum system. Check the table of contents or the index at the front of the manual for their exact location.

**FUSE BLOCK DETAIL** – This shows an enlarged view of the fuse block, lists the systems and components that operate through each fuse and circuit breaker, and provides a page reference to where those systems are covered in the book. It also lists the size in amperes and color of each fuse.

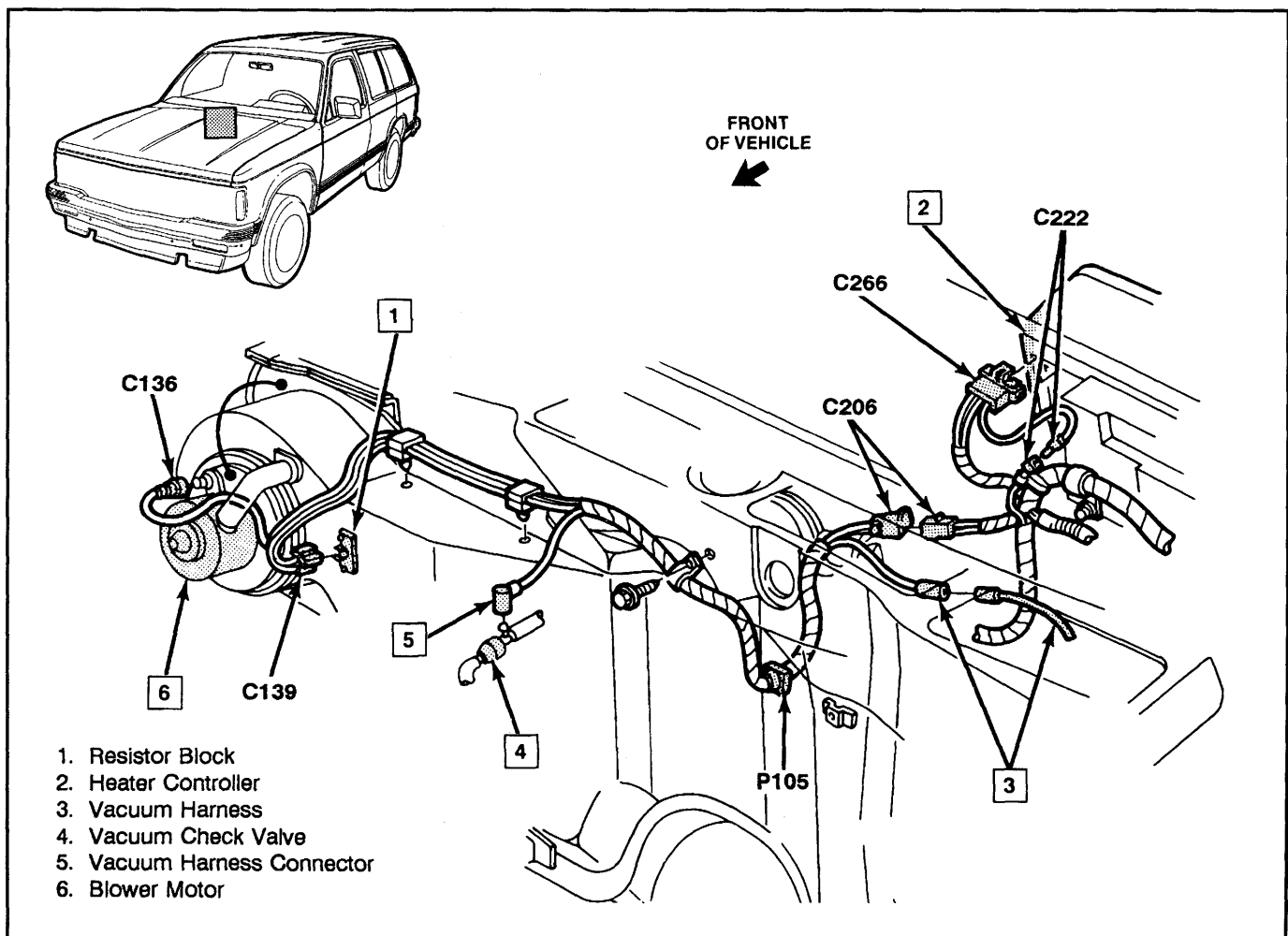


Figure 9 — Typical Component Locater View



## 8A-2-6 GENERAL INFORMATION

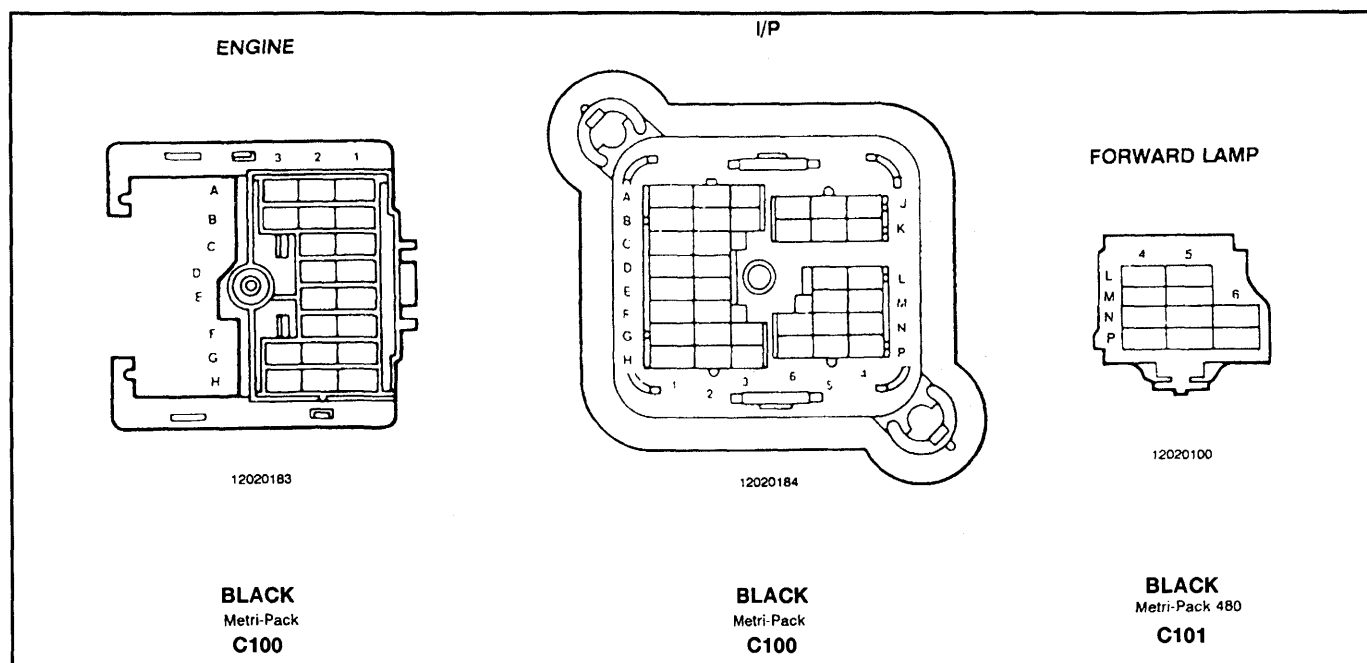


Figure 10 — Typical Connector Faces

### SPEED SENSOR COMPONENTS DO NOT OPERATE PROPERLY

| TEST                                                                                                                                                                                                                                             | RESULT               | ACTION                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and disconnect Vehicle Speed Sensor Buffer module connector C228A. Connect voltmeter from PNK/WHT (350) wire at Vehicle Speed Sensor Buffer module connector C228A to ground.                           | Battery voltage.     | GO to step 2.                                                                                                                                        |
|                                                                                                                                                                                                                                                  | No voltage.          | CHECK condition of BRAKE fuse. If fuse is good, LOCATE and REPAIR open in PNK/WHT (350) wire.                                                        |
| 2. Connect voltmeter from PNK/WHT (350) wire to BLK (150) wire at Vehicle Speed Sensor Buffer module connector C228A.                                                                                                                            | Battery voltage.     | GO to step 3.                                                                                                                                        |
|                                                                                                                                                                                                                                                  | No voltage.          | LOCATE and REPAIR open in BLK (150) wire from Vehicle Speed Sensor Buffer module to ground terminal G102.                                            |
| 3. Properly support vehicle so drive wheels are off the ground. Have engine running and gear selector in DRIVE. Connect an A/C voltmeter from PPL/WHT (821) wire to LT GRN/BLK (822) wire at Vehicle Speed Sensor Buffer module connector C228A. | A/C voltage reading. | GO to step 4.                                                                                                                                        |
|                                                                                                                                                                                                                                                  | No voltage.          | CHECK for open in PPL/WHT (821) and LT GRN/BLK (822) wires. If wires are good, REPLACE speed sensor.                                                 |
| 4. Connect Vehicle Speed Sensor Buffer module connector C228A. Connect A/C voltmeter from LT BLU/BLK (824) wire at connector C228A to BLK (150) wire at connector C228A.                                                                         | A/C voltage reading. | LOCATE and REPAIR open in LT BLU/BLK (824) wire from Vehicle Speed Sensor Buffer module to I/P cluster. If wire is good, REPLACE instrument cluster. |
|                                                                                                                                                                                                                                                  | No voltage.          | REPLACE Vehicle Speed Sensor Buffer module.                                                                                                          |

Figure 11 — Typical Diagnosis Chart

**GENERAL INDEX** – This is an alphabetical listing of components and where they can be found in the manual,

including those components which do not appear in the table of contents.

## BASIC ELECTRICITY

Electrical power flows from the power source to a load device and then back to the source of power. The electrical circuit should contain a device to open or close the circuit, such as a switch or relay, and a protective device (in case of an overload), such as a circuit breaker or a fusible link. Electrical circuits can be set up as series circuits, parallel circuits, or series/parallel circuits. The circuits in this vehicle are normally parallel circuits.

### CIRCUITS

**SERIES CIRCUITS (Figure 12)** – In a series circuit, the electrical devices are connected to form one current path to and from the power source. In a series circuit the voltage is shared equally by all the devices in the circuit.

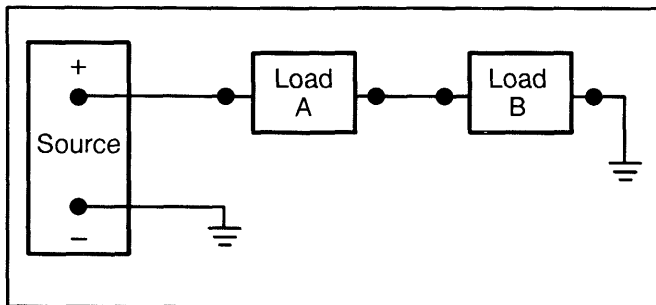


Figure 12 — Series Circuit

**PARALLEL CIRCUITS (Figure 13)** – In a parallel circuit, the electrical devices are connected to form more than one current path to and from the power source. In a parallel circuit the voltage is constant and equal for each current path.

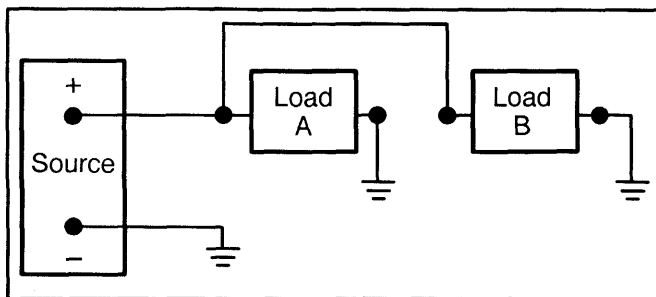


Figure 13 — Parallel Circuit

**SERIES/PARALLEL CIRCUITS (Figure 14)** – A series/parallel circuit consists of a single current path and a circuit with more than one current path to and from the power source.

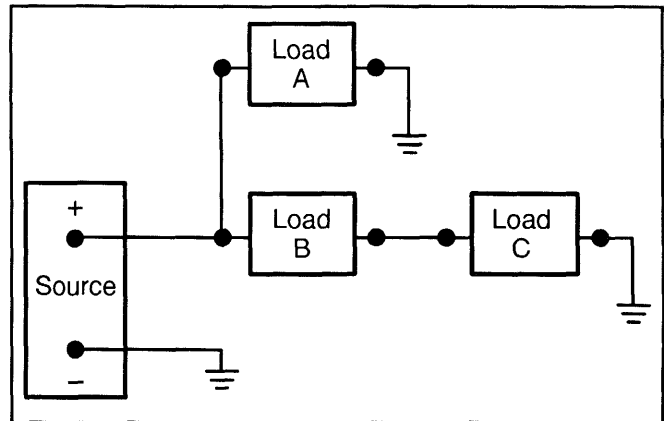


Figure 14 —Series/ Parallel Circuit

### CIRCUIT COMPONENTS

Circuit components (figure 15) include power sources, circuit protection devices, circuit controllers, and circuit loads. Power sources are the battery or generator which provide the power for the circuit. Circuit protection devices are components such as fuses, circuit breakers and fusible links and provide overload protection for the circuit. Circuit controllers are used to control the power flow within a circuit and are usually switches and relays. Circuit loads are the actual component that provides a specific function. Circuit loads can be lights, motors, and solenoids.

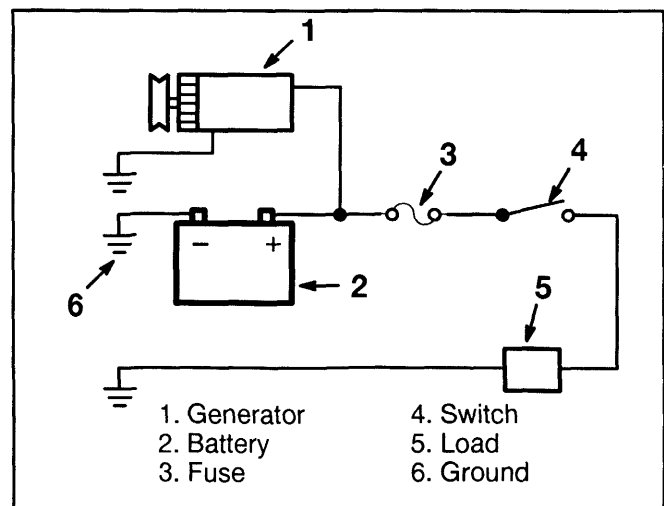


Figure 15 — Circuit Components

8A-2-8 GENERAL INFORMATION

Relays

Battery and load location may require that a switch be placed some distance from either component. This means a longer wire and a higher voltage drop (figure 16). The installation of a relay between the battery and the load reduces the voltage drop, because the switch controls the relay, the switch can be compact (figure 17). Refer to Fuse, Circuit Breaker, Lamp Bulb, and Relay Data for a listing of relays used in this vehicle.

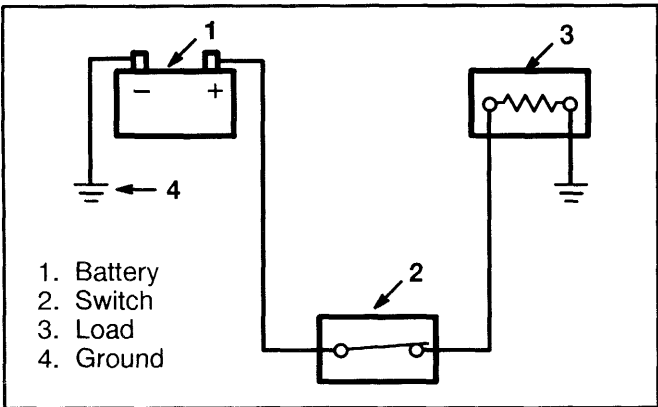


Figure 16 — Relayless Circuit

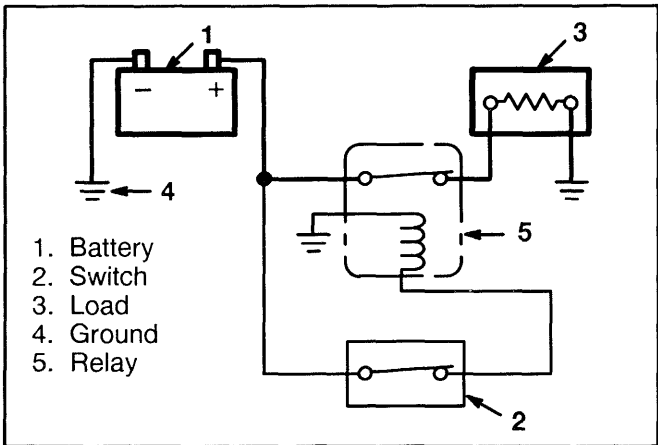


Figure 17 — Relay Circuit

Diodes

Many of the electrical systems in this vehicle use diodes to isolate certain circuits and protect them from voltage surges. Diode specifications and replacement part numbers are listed in figure 18. To identify the Peak Inverse Voltage (PIV) rating of the diode that will be replaced refer to figure 19. Replacement procedures are as follows:

1. If the diode is taped to the harness, remove all of the tape.
2. Paying attention to the direction of current flow, remove the faulty diode from the harness with a suitable soldering tool. If the diode is located next to a connector terminal, remove the terminal(s) from

the connector to prevent damage from the soldering tool.

3. Carefully strip away a section of insulation next to the old soldered portion of the wire(s). Do not remove any more than is necessary to attach the new diode.
4. Check the current flow direction of the new diode, being sure to install the diode with the correct bias. Attach the new diode to the wire(s) using 60/40 rosin core solder. Use a heat sink (aluminum alligator clip) attached across the diode leads to protect it from excessive heat. Follow the manufacturer's instructions for the soldering equipment you are using.
5. Install terminal(s) into the connector body, if removed in step 2.
6. Tape the diode to the harness or connector using electrical tape. To prevent shorts to ground and water intrusion, completely cover all exposed wire and diode attachment points.

| DIODE BRAND | RATING NUMBER | PART NUMBER | SPECIFICATIONS                                                                              |
|-------------|---------------|-------------|---------------------------------------------------------------------------------------------|
| GMSPO       | 1N4001        | 8907496     | 1-amp, 50 PIV<br>All applications except A/C compressor clutch.                             |
| GMSPO       | 1N4004        | 16039386    | 1-amp, 400 PIV<br>A/C compressor clutch. Will need to remove diode from connector assembly. |

Figure 18 — Diode Specifications and Configurations

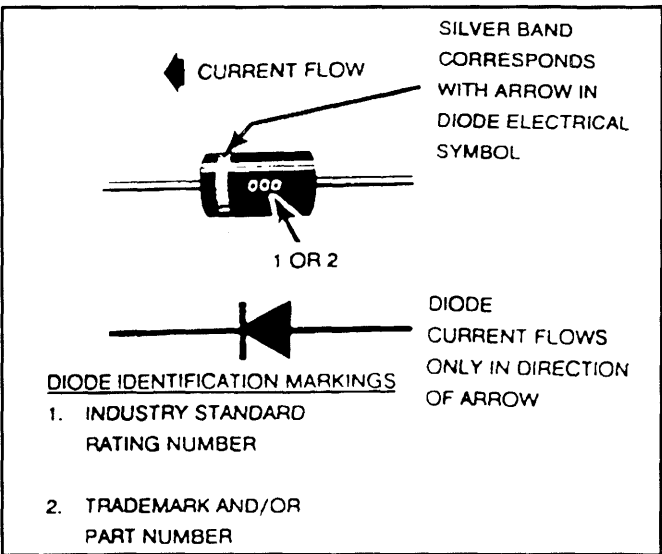


Figure 19 — Diode Markings

## CIRCUIT MALFUNCTIONS

There are three electrical conditions that can cause a non-working circuit: an "Open Circuit," a "Short Circuit" or a "Grounded Circuit." These conditions can also be caused by intermittent or poor connections.

**OPEN CIRCUIT (Figure 20)** – An open circuit occurs whenever there is a break in the circuit. The break can be corrosion at the connector, a wire broken off in a component, a wire that burned open from too much current or a component not operating as it should.

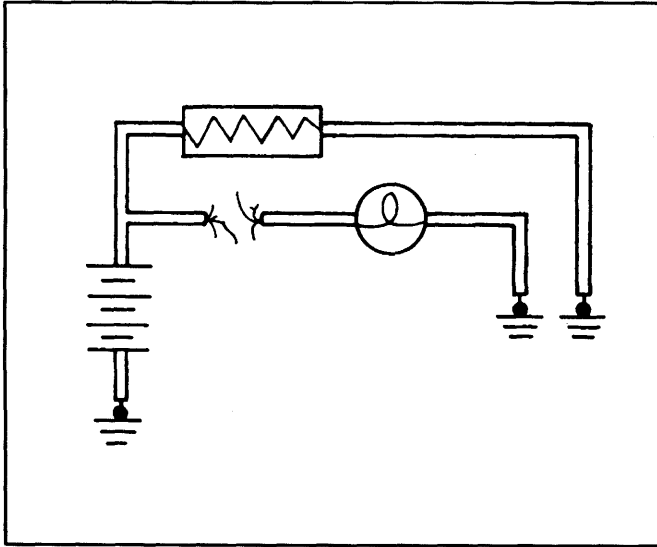


Figure 20 — Open Circuit

**SHORT CIRCUIT (Figure 21)** – A short circuit happens when the current bypasses part of the normal circuit. This bypassing is usually caused by wires touching, salt water in or on a component such as a switch or a connector, or solder melting and bridging conductors in a component.

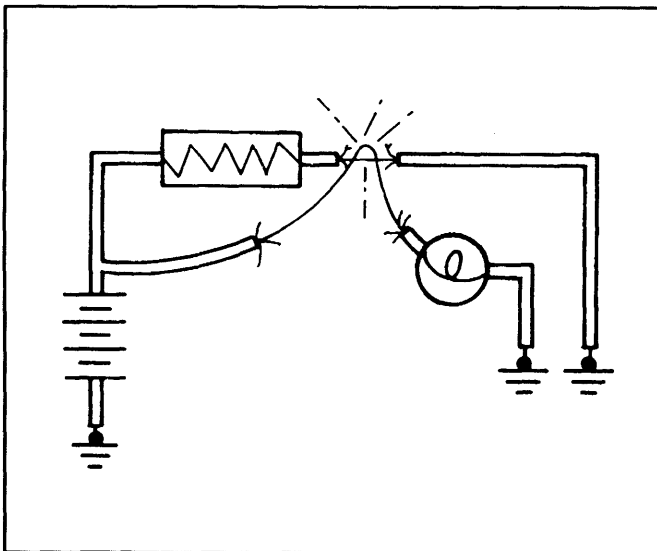


Figure 21 — Short Circuit

**GROUNDING CIRCUIT (Figure 22)** – A grounded circuit is like a short circuit but the current flows directly into a ground circuit that is not part of the original circuit. This may be caused by a wire rubbing against the frame or body. Sometimes a wire will break and fall against metal that is connected electrically to the ground side of the voltage supply. A grounded circuit may also be caused by deposits of oil, dirt, or moisture around connections or terminals, which provide a good path to ground.

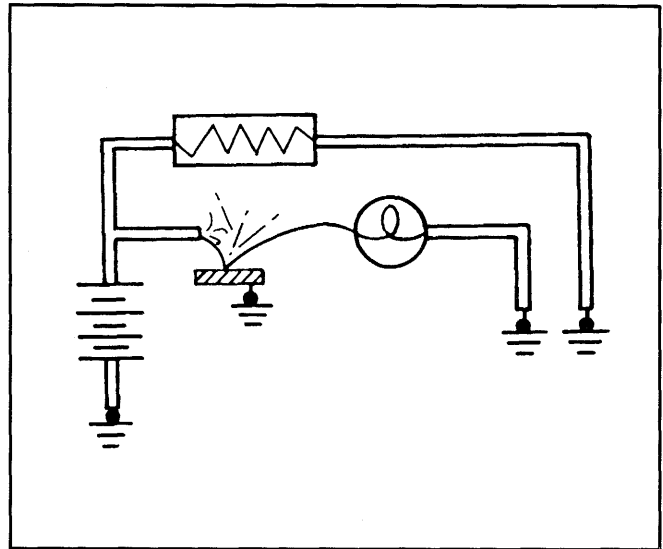


Figure 22 — Grounded Circuit

**INTERMITTENTS AND POOR CONNECTIONS** – Most intermittents are usually caused by faulty electrical connections or wiring, although occasionally a sticking relay, solenoid, or loose ground point can be a problem.

# DIAGNOSTIC TEST EQUIPMENT

The following test equipment comes in a variety of styles and are adequate for simple tests. However, when accuracy becomes important, the value of a reading obtained using a meter is critical to the diagnosis procedure. Make sure any electrical test meter used is of sufficient quality and accuracy to make the measurements required in the electrical testing.

**JUMPER WIRES** – Jumper wires allow “jumping” across a suspected open or break in a circuit.

- If the circuit works properly with the jumper wire in place, but does not work when the jumper wire is removed, the circuit has an open spot.
- A circuit without any opens or breaks has continuity and needs no further testing.

The jumper is usually a long wire with alligator clips. A version of the jumper has a fuse holder in it with a 10-amp fuse. This will prevent damaging the circuit if the jumper is connected in the wrong way.

The jumper is used to locate opens in a circuit. One end of the jumper is attached to a voltage source and the other end is attached to the load in the circuit, i.e. lamps or motors. If the load works, try “jumping” to circuit points that are progressively closer to the voltage supply. When the circuit load stops working, the open has been located.

The jumper is also used to test components in the circuit such as connectors, switches and suspected high resistance points.

**UNPOWERED TEST LAMP** – This tool consists of a 12-volt lamp with leads. The ends of the leads usually have alligator clips, but various kinds of probes, terminal spades and special connectors also are used.

The 12-volt test lamp continuity tester uses the vehicle's battery to provide voltage to the circuit being tested. 12-volt testers are manufactured with a variety of tips to permit touching them to connectors, bare wires, insulated wires, or even wires within wiring harnesses. To check the tester before use, briefly touch the clip to one side of the battery and the probe to the other. 12-volt testers are NOT sensitive to polarity in a circuit and can be connected either way.

The 12-volt test lamp generally has a sharp probe tip so it can be inserted into connector terminals or through the wire insulation for testing. It is important to keep the probe tip sharp to minimize damage to wire insulation. When the test is complete at a particular point, be sure to tape any holes made in wire insulation.

The unpowered test lamp is used on an open circuit. One lead of the test lamp is grounded and the other lead is

moved around the circuit to find the open. Depending on the physical layout of the circuit, sometimes it is easier to start at the voltage supply, and other times it is easier to start at the circuit load or ground circuit.

Once one becomes familiar with the test lamp and the brilliance of the bulb in a normal circuit, high-resistance circuits can be recognized by the effect they have on the bulb. As the current drops in a high-resistance circuit, the bulb in the test lamp glows less brightly. Although the 12-volt test lamp cannot be used as a foolproof test for high resistance, a less than normal brilliance of the lamp is an indication of circuit high resistance. Further testing will verify the condition and locate the cause.

*NOTICE: Test lamps are to be used only on circuits that do not contain solid-state devices. If a test lamp is used in a circuit containing a solid-state device, the current that the test lamp would draw would be above the current that the solid-state device would be able to handle. Using a test lamp on a solid-state device may damage the device.*

**SELF-POWERED TEST LAMP** – This lamp is a pencil-shaped unit with a self-contained battery, a 1.5-volt lamp bulb, a sharp probe, and a ground lead fitted with an alligator clip.

This test is used mainly for testing components that are disconnected from the vehicle voltage supply. The powered test lamp is also useful for testing suspected high resistance points in a circuit such as connectors and ground circuits that are corroded or loose.

## METERS

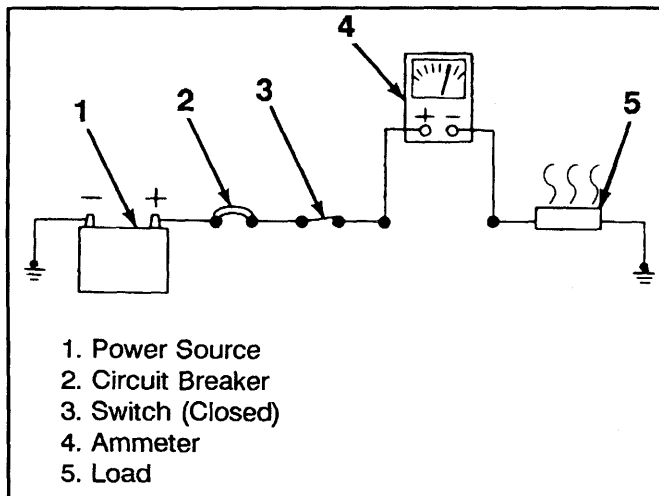
The following three types of meters are generally used for diagnosis: ammeter, ohmmeter, and voltmeter.

These meters are available in two designs: analog (needle-type) and digital (electronic display-type).

*NOTICE: The correct type of meter must be used when diagnosing circuits containing solid-state devices. Incorrect use of the meters will result in damage to the solid-state device.*

*Analog meters may be used for any circuit not containing a solid-state device, while a digital meter MUST be used to diagnose any circuit with a solid-state device. Circuits which contain a solid-state device, such as the engine control module, should be tested only with a 10-megohm or higher impedance digital multimeter (J 39200 or equivalent).*

**AMMETER (Figures 23 and 26)** – An ammeter is used to measure current flow (amperage) in a circuit. Amperes are units of electron flow which indicate how many electrons are passing through the circuit. Current flow in a circuit is equal to the circuit voltage divided by total circuit resistance.



**Figure 23 — Ammeter**

At normal operating voltage, most circuits have a characteristic amount of current flow, referred to as normal current draw. Current draw is measured in amperes (amps) with an ammeter. Comparing measured current draw with the specified current draw rating provides useful diagnostic information.

Disconnect the circuit from the voltage source before connecting the ammeter. The ammeter must be placed in series with the circuit being tested. Be sure that the ammeter's positive terminal is connected to the positive (battery) side of the circuit and its negative terminal to the negative (ground) side of the circuit.

**NOTICE:** Never connect an ammeter across a circuit like a voltmeter. The ammeter could be damaged by the vehicle electrical system.

Excessive current draw is responsible for blowing fuses and, in some cases, draining the battery. An ammeter helps diagnose these conditions by locating the cause of the excessive current draw. On the other hand, there are times when a reduced current draw at a component (a power window motor for example) causes unsatisfactory performance of an electrical system.

**OHMMETER (Figures 24 and 26)** – The ohmmeter is used to read resistance (ohms) or to check for opens or shorts in a circuit or component. There are both analog-type and digital-type ohmmeters.

- An analog ohmmeter shows the actual resistance on a scale by the movement of a needle.

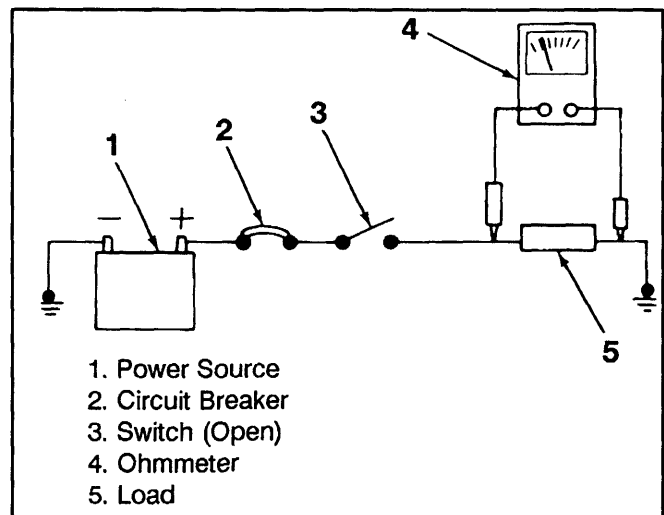
- On a digital ohmmeter, the resistance measured is converted inside the meter to a numerical output which is shown on a display panel.

Ohmmeters use a small battery to supply the voltage and current which flow through the circuit being tested. The current flows through the circuit, positions the needle on analog-type ohmmeters or converts to a digital readout on digital-type ohmmeters.

Although there are several different styles of analog ohmmeters, all usually have the following features in addition to the meter movement:

- A range selector switch which permits the selection of different ranges of resistance.
- A set adjust control which allows the meter to be set at zero for accurate measurements.
- Some model ohmmeters also have a built-in feature that allows the ohmmeter to be used as a self-powered test lamp.

Digital meters do not have to be zeroed. They have various ranges just like the analog meters.



**Figure 24 — Ohmmeter**

**NOTICE:** Like a self-powered test lamp, the ohmmeter can only be used on circuits where voltage has been removed. It is designed to be operated on its own voltage and current levels for the meter to make resistance measurements. The 12-volt electrical system voltage in the vehicles circuits could damage the meter.

Electrical circuits can be checked for opens using basically the same procedure as previously described for the self-powered test lamp. The circuit must be separated from all voltage sources. The ohmmeter is connected across the two open ends of the circuit to be checked. A high reading (infinity) is an indication of an open circuit. A low reading (near zero) is an indication of a continuous circuit.

## 8A-2-12 GENERAL INFORMATION

Checks for short circuits are made in a similar manner to that used for open circuits, except that the circuit being checked must be isolated from both voltage and normal ground.

Connecting the ohmmeter between an isolated circuit and a good ground point allows checking the circuit for shorts to ground.

A short to ground in the circuit is indicated on the meter by a near zero reading. A good circuit (no short to ground) shows up as infinity (very high resistance) indicated on the meter.

To measure the resistance of a component or a circuit, the component or circuit must be isolated from all other components (or circuits). The ohmmeter leads are then placed across the component or circuit and the resistance is read on the ohmmeter.

**VOLTMETER (Figures 25 and 26)** – The voltmeter (properly observed) will give the technician more information than the ammeter, ohmmeter, and test lamp combined. Its application for diagnosis here is to measure the electrical pressure (voltage) drop in a resistance circuit. Voltage drop is a reduction or “using up” of the voltage to push electricity through a resistance. It can be compared to the pressure of water flowing through a metering valve.

Low voltage to a lamp makes the lamp glow dimly. This can be caused by low source voltage (battery discharge or low alternator output) or by high resistance in the circuit due to a poor connection. Before making any meter measurements, it is important to review the relationship between current, voltage and resistance.

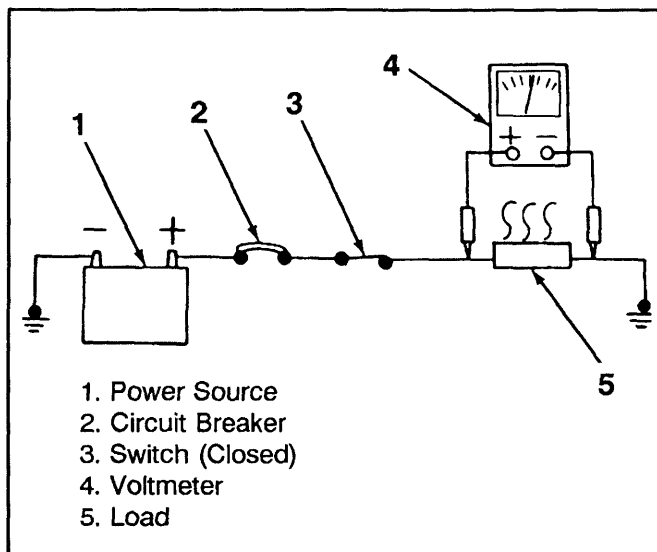


Figure 25 — Voltmeter

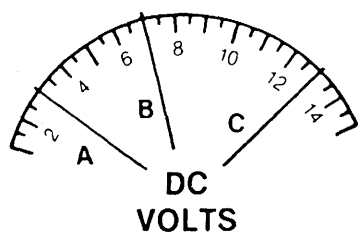
Determining voltage drop is important because it provides the following information:

- Too high of a voltage drop indicates excessive resistance. If, for instance, a blower motor runs too slowly or a lamp glows too dimly, one can be sure there is excessive resistance in the circuit. By taking voltage drop readings in various parts of the circuit, the problem (corroded terminals, for example) can be isolated.
- Too low of a voltage drop indicates low resistance. If, for instance, a blower motor runs too fast, the problem could be isolated to a low resistance in a resistor pack by taking voltage drop readings.
- Maximum allowable voltage drop under a load is critical, especially if there is more than one high resistance problem in a circuit. It is important because, like all resistances, all voltage drops are cumulative. Corroded terminals, loose connections, and similar problems reduce the voltage available across the key circuit components. The current flow is reduced in the circuit, and all of the affected components operate at less than peak efficiency. A small drop across wires (conductors), switches, connectors, etc., is normal. This is due to the resistance of the conductors but should be less than 10 percent of the total drop.

When using a voltmeter:

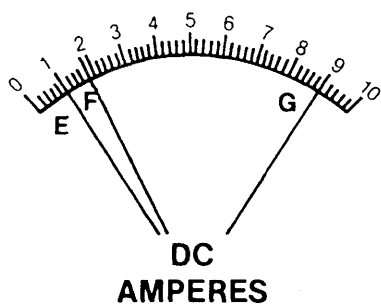
- Be sure to connect the positive lead to the battery side and the negative lead to the ground side of the component being checked.
- Voltage drop occurs when electricity (current) flows through a resistance. Make sure the voltage drop being measured is only through the component being checked, not through the component and a poor connection.
- The circuit must be operating (lamp ON or motor running, for example) to measure voltage drop.

The instrument panel voltmeter in the vehicle should also be observed for monitoring proper operation of the generator, battery, cranking motor, and cranking circuit. In this application, battery voltage drop can be monitored while the engine is cranking; after the engine is running, generator output voltage can be monitored. This can be a valuable first step before diagnosing other electrical problems.



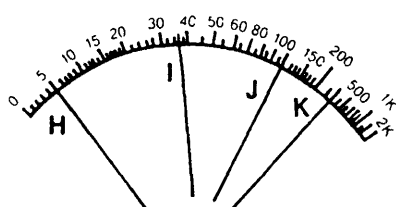
VOLTMETER SCALE: 0 Volts through 15 Volts

A = 3 Volts  
B = 7 Volts  
C = 13 Volts



AMMETER SCALE: 0 Amperes through 10 Amperes

E = 1 Ampere  
F = 1.8 Amperes  
G = 9 Amperes



OHMMETER SCALE: 0 Ohms through Infinity ( $\infty$ )

H = 5 Ohms  
I = 36 Ohms  
J = 115 Ohms  
K = 350 Ohms

Figure 26 — Meter Scales



# DIAGNOSIS PROCEDURES

## SIX STEP PROCESS OF ELECTRICAL DIAGNOSIS

To correctly isolate and repair electrical problems, view the video **Electrical Diagnosis (T-9067-1)** and follow these six electrical diagnosis steps:

### Step 1: Verify the Problem

Review the work order, operate the system, and list symptoms in order to:

- Check the accuracy and completeness of the complaint.
- Re-create the problem.

### Step 2: Narrow the Choice of Possible Causes of Failure

Refer to the circuit diagram for clues to the problem. Location and identification of circuit components may give some idea of where the problem is.

The circuit diagrams are designed to make it easy to identify common points in circuits. This knowledge can help narrow the problem to a specific area. For example, if several circuits fail at the same time, check for a common power or ground connection. If part of a circuit fails, check the connections between the part that works and the part that does not work.

For example, if the low beam headlamps work, but the high beams and the indicator lamps do not, then voltage and ground paths are good. Since the headlamp dimmer switch is the component which switches this voltage, it is most likely the cause of the failure.

### Step 3: Identify the Failed Circuit

Read the circuit operation for the problem circuit identified in the previous step. By studying the circuit diagram and circuit operation, enough information should be learned to narrow the cause to one component or one portion of the circuit.

### Step 4: Locate the Failed Component or Element

The diagnosis charts are a step-by-step approach to diagnose a symptom. Each chart covers one symptom. For example, "HORN(S) WILL NOT OPERATE."

The charts are divided into three columns: Test, Result, and Action.

The test procedures are listed in numerical sequence and must be followed in that order. Each test step describes what must be done to the circuit, what test equipment to use and where to connect the test equipment.

After the test procedure has been performed, refer to the result column. This lists possible results of the test. Once the result has been found, follow it directly over to the action column.

The action column instructs what must be done to correct the problem or lists the next test step to be performed.

It is important to remember that a problem in one system could result in a symptom in another system.

### Step 5: Make the Repair

Repair the problem circuit as directed in the diagnosis charts.

### Step 6: Verify that the Repair is Complete

Operate the system, and check that the repair has removed all symptoms and has not caused any new symptoms.

## INTERMITTENTS AND POOR CONNECTIONS

Most intermittents are caused by faulty electrical connections or wiring, although occasionally a sticking relay or solenoid can be a problem. Some items to check are:

- Poor mating or connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.
- Improperly formed or damaged terminals. All connector terminals in problem circuits should be checked carefully to ensure good contact tension. Use a corresponding mating terminal to check for proper tension. Refer to "Checking Terminal Contact" in this section for the specific procedure.

- The J 35616-A Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the adapter will ensure that no damage to the terminal will occur, as well as giving an idea of whether contact tension is sufficient. If contact tension seems incorrect, refer to "Checking Terminal Contact" in this section for specifics.

### Wiring Problems

- Poor terminal-to-wire connection. Some conditions which fall under this description are poor crimps, poor solder joints, crimping over wire insulation rather than the wire itself, corrosion in the wire-to-terminal contact area, etc.
- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause a continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.

To avoid any of the above problems when making wiring or terminal repairs, always follow the instructions for wiring and terminal repair outlined in the following procedure.

### FINDING A SHORT CIRCUIT OR GROUND (FIGURE 27)

- Remove the blown fuse and disconnect all loads of the fuse.
- Connect a test light in place of the fuse.
- Establish conditions in which the test light comes on.

Example:

A – Ignition SW on

B – Ignition SW and SW 1 on

C – Ignition SW, SW 1 and Relay on (Connect the Relay) and SW 2 off (or Disconnect SW 2)

- Disconnect and reconnect the connectors while watching the test light. The short lies between the connector where the test light stays lit and the connector where the light goes out.
- Find the exact location of the short by lightly shaking the problem wire along the body.

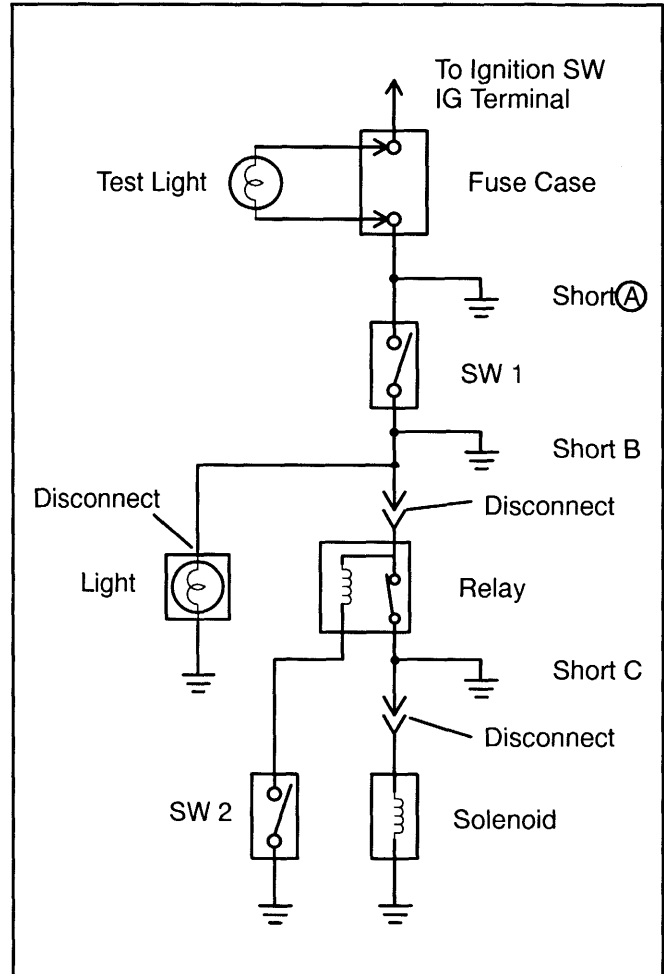


Figure 27 — Short and Grounded Circuits

## CIRCUIT WIRING

### MAINTENANCE AND REPAIR

All electrical connections must be kept clean and tight. Loose or corroded connections may cause a discharged battery, difficult starting, dim lamps and possible damage to the generator and regulator. Wires must be replaced if insulation becomes burned, cracked, or deteriorated.

Always use rosin flux solder to splice a wire or repair one that is frayed or broken, and use insulating tape to cover all splices or bare wires.

When replacing wire, it is important that the correct size wire be used as shown on applicable wiring diagrams or in parts books. Each harness or wire must be held securely in place to prevent chafing or damage to the insulation due to vibration.

Wire size in a circuit is determined by the amount of current, the length of the circuit, and the voltage drop allowed. Wire size is specified using the metric gage. The metric gage describes the wire size directly in a cross section area measured in square millimeters.

### Wire Repair

The wire is very important for the continued reliable operation of the vehicle. This repair must be done as described in the following procedures.

### Twisted Wires (Figure 28)

#### Remove or Disconnect

1. Jacket (1).
2. Twisted wires (2).
3. Insulation from the wire.

#### Install or Connect

1. Splice clip (3).
2. Crimp and solder the splice clips (4).
3. Electrical tape wrap (5) on the splices.
4. Outer jacket electrical tape wrap (6).

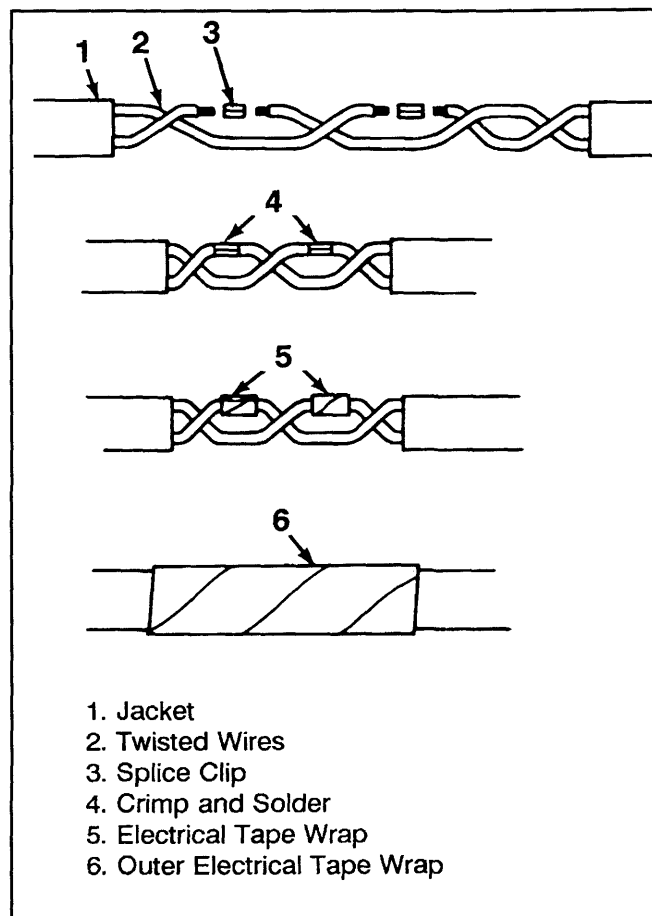


Figure 28 — Twisted Wire Repair

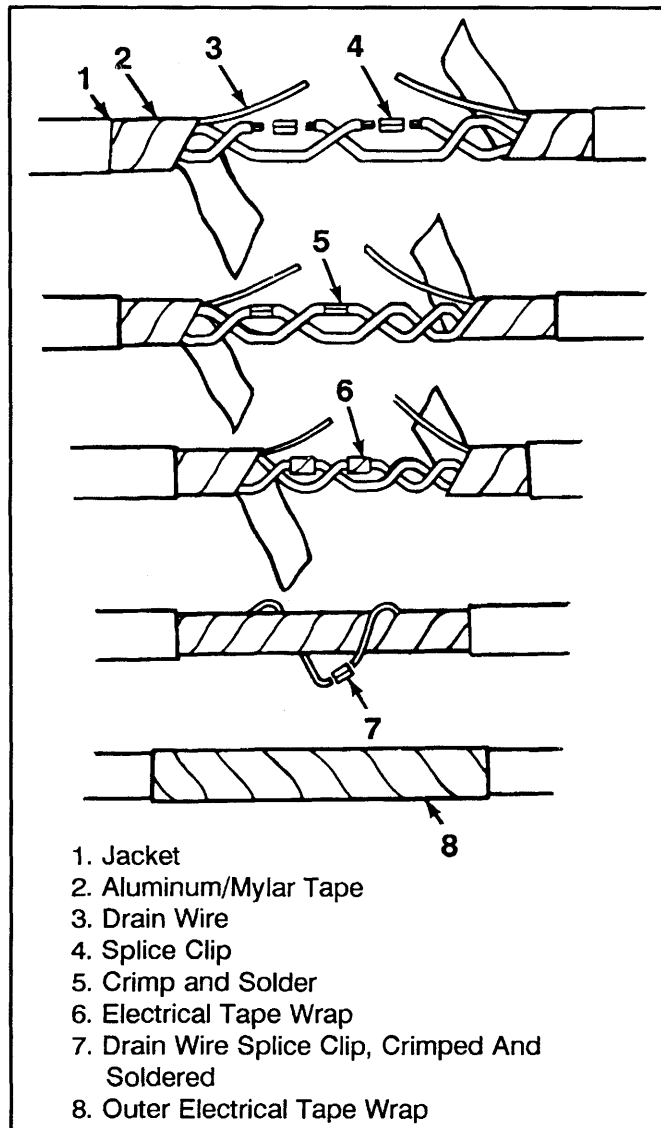
### Twisted Wires/Shielded Cable (Figure 29)

#### Remove or Disconnect

1. Jacket (1).
2. Unwrap aluminum/Mylar tape (2).
3. Drain wire (3).
4. Leads.
5. Insulation on the leads.

**Install or Connect**

1. Splice clips (4).
2. Crimp and solder the splice clips (5).
3. Electrical tape wrap (6) on the splices.
4. Aluminum/Mylar tape by wrapping and taping.
5. Drain wire with a splice clip (7). Crimp and solder the splice clip.
6. Outer jacket electrical tape wrap (8).

**Figure 29 — Twisted/Shielded Wire Repair****Solderless Wiring Repair**

Solderless wiring repair can be accomplished by the use of crimp and seal splice sleeves. Crimp and seal splice sleeves may be used on all types of insulation except tefzel and coaxial to form a one-to-one splice. They are to be used where there are special requirements such as moisture sealing. Crimp and seal splice sleeves are included in the J 38125 Terminal Repair Kit. Use the following procedure for solderless wiring repair:

**1. Open the Harness**

If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing "seam ripper" to cut open the harness (available from sewing supply stores). The crimp and seal splice sleeves may be used on all types of insulation except tefzel and coaxial and may only be used to form a one-to-one splice.

**2. Cut the Wire**

Begin cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire to change the location of the splice. You may have to adjust splice locations to make certain that each splice is 40 mm (1.5 in) away from other splices, harness branches, or connectors. This will help prevent moisture from bridging adjacent splices and causing damage.

**3. Strip the Insulation**

If it is necessary to add length of wire to the existing harness, be certain to use the same size as the original wire.

To find the correct wire size either find the wire on the schematic page and convert the metric size to the equivalent AWG size or use an AWG wire gage. If unsure about the wire size, begin with the largest opening in your wire stripper and work down until you get a clean strip of the insulation. Strip approximately 7.5 mm (5/16 in) of insulation from each wire to be splices. Be careful to avoid nicking or cutting any of the wires. Check the stripped wire for nicks or cut strands. If the wire is damaged, repeat this procedure after removing the damaged section.

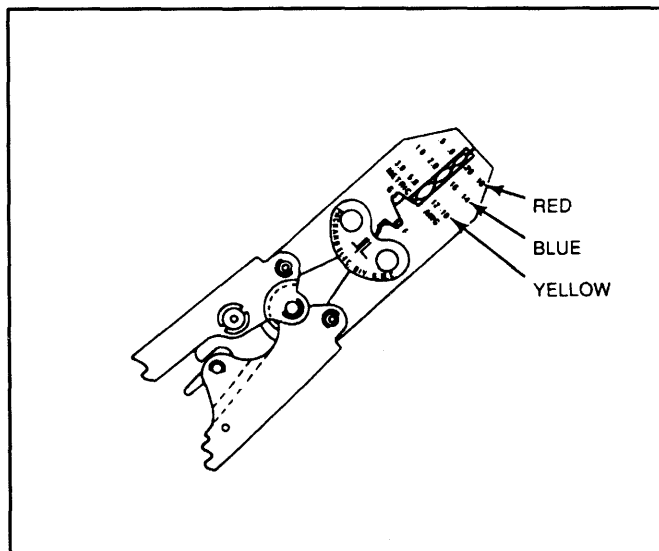
**4. Select and Position the Splice Sleeve**

Select the proper splice sleeve according to wire size. The splice sleeves and tool nests are color coded. Use figure 30 to determine the correct splice sleeve.

| Splice Sleeve Color     | Crimp Tool Nest Color | Wire gage AWG/Metric  |
|-------------------------|-----------------------|-----------------------|
| Salmon (Yellowish-pink) | Red                   | 20, 18/<br>(0.5, 0.8) |
| Blue                    | Blue                  | 16, 14/<br>(1.0, 2.0) |
| Yellow                  | Yellow                | 12, 10/<br>(3.0, 5.0) |

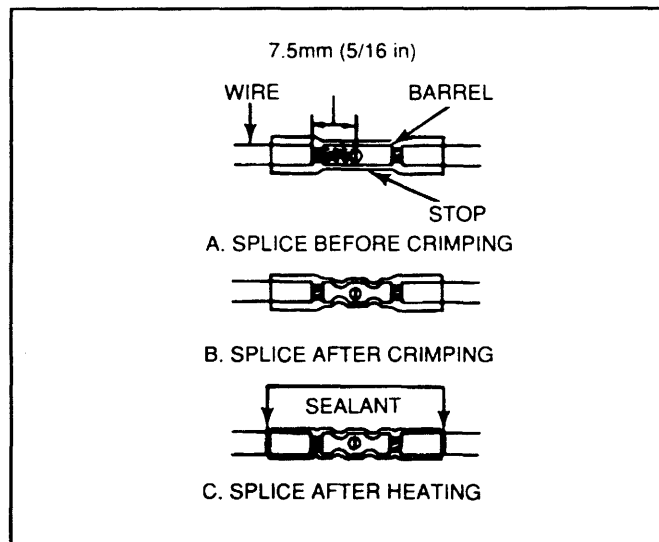
**Figure 30 — Crimp and Seal Splice Sleeve Chart**

Using the J 38125-8 splice crimp tool (figure 31), position the splice sleeve in the proper color nest of the hand crimp tool. Place the splice sleeve in the nest so that the crimp falls midway between the end of the barrel and the stop.



**Figure 31 — Hand Crimp Tool**

The splice sleeve has a stop in the middle of the barrel to prevent the wire from going further (figure 32). Close the handles slightly to hold the splice sleeve firmly in the proper nest.



**Figure 32 — Seal Splice Sequence**

## 5. Insert the Wires into the Splice Sleeve and Crimp

Insert the wire into the splice sleeve until it hits the barrel stop and close the handles of the crimp tool tightly until the crimper handles open when released. The crimper handles will not open until the proper amount of pressure has been applied to the splice sleeve. Repeat steps 4 and 5 for the opposite end of the splice. Figure 32 shows the condition of the splice sleeve after crimping.

## 6. Shrink the Insulation Around the Splice

Using a heat torch, apply heat to the center of the splice sleeve. Gradually move the heat to the open end of the tubing, shrinking the tubing as the heat is moved along the insulation. A small amount of sealant will come out of the end of the tubing when sufficient shrinking has been

achieved. Figure 32 shows the condition of the splice when the tubing is completely shrunk.

## CHECKING TERMINAL CONTACT

When diagnosing an electrical system that utilizes Metri-Pack 150/280/480/630 series terminals (refer to Terminal Repair Kit, J 38125-A, instruction manual, J 38125-4 for terminal identification), it is important to check terminal contact between a connector and component, or between in-line connectors, before replacing a suspect component.

Frequently, a diagnostic chart leads to a step that reads: "Check for poor connection." Mating terminals must be inspected to assure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination is caused by the connector halves being improperly connected, a missing or damaged connector seal, or damage to the connector itself, exposing the terminals to moisture and dirt. Contamination, usually in underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter, improperly joining the connector halves or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact, causing an open or intermittently open circuit.

Follow the procedure below to check terminal contact.

1. Separate the connector halves. Refer to Terminal Repair Kit, J 38125-A, instruction manual, J 38125-4.
2. Inspect the connector halves for contamination. Contamination will result in a white or green build-up within the connector body or between terminals, causing high terminal resistance, intermittent contact or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals and connector body.
3. Using an equivalent male terminal from the Terminal Repair Kit, J 38125-A, check the retention force of the female terminal in question by inserting and removing the male terminal to the female terminal in the connector body. Good terminal contact will require a certain amount of force to separate the terminals.

- Using an equivalent female terminal from the Terminal Repair Kit, J 38125-A, compare the retention force of this terminal to the female terminal in question by joining and separating the male terminal to the good female terminal, and then joining and separating the male terminal to the female terminal in question. If the retention force is significantly different between the two female terminals, replace the female terminal in question, refer to Terminal Repair Kit, J 38125-A.

If a visual (physical) check does not reveal the cause of the problem, the vehicle may be able to be driven with a DVM connected to the suspected circuit. An abnormal voltage reading when the problem occurs indicates the problem may be in that circuit.

### Wiring Connector Terminal Replacement (Twin Lock-Type)

#### Remove or Disconnect (Figure 33)

##### Tool Required:

J 22727 Terminal Remover

- Connector lock tangs.
- Terminal locks using J 22727 (3).
- Wire terminal (1).

#### Install or Connect

- Pry out the tangs.
- Terminal (1) into the connector (2).

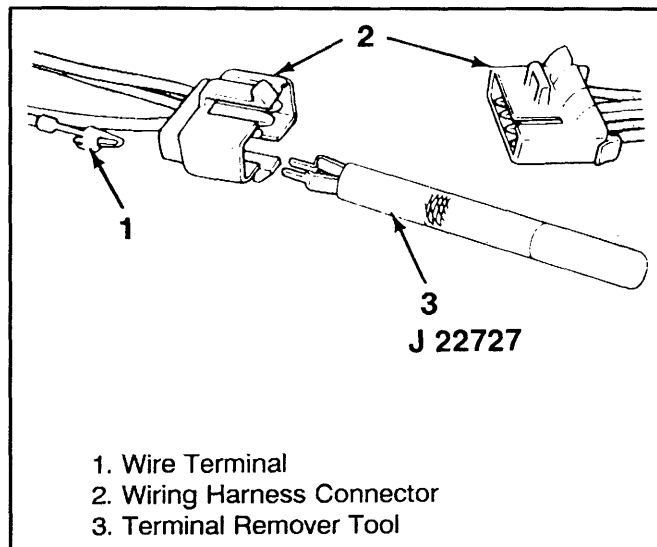


Figure 33 — Twin Lock Connector Terminal

### Wiring Connector Terminal Replacement (Blade-Type)

#### Remove or Disconnect (Figure 34)

- Terminal lock tang.
- Terminal (1).

#### Install or Connect (Figure 35)

- Pry up on the terminal lock tang (1).
- Terminal into the connector.

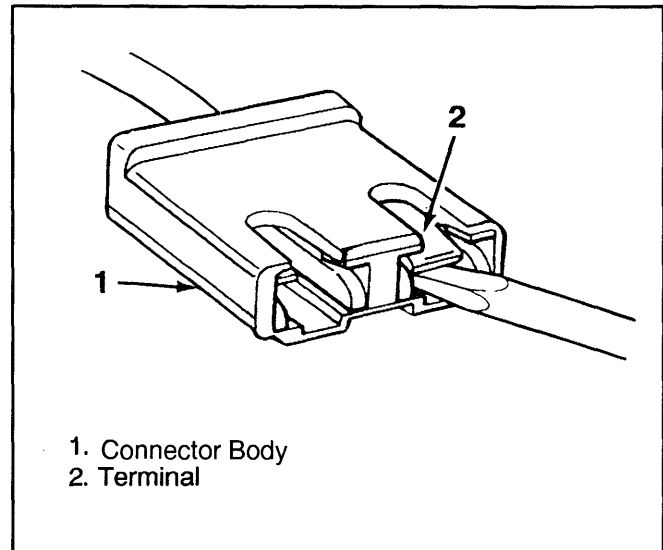


Figure 34 — Removing the Terminals from the Connector

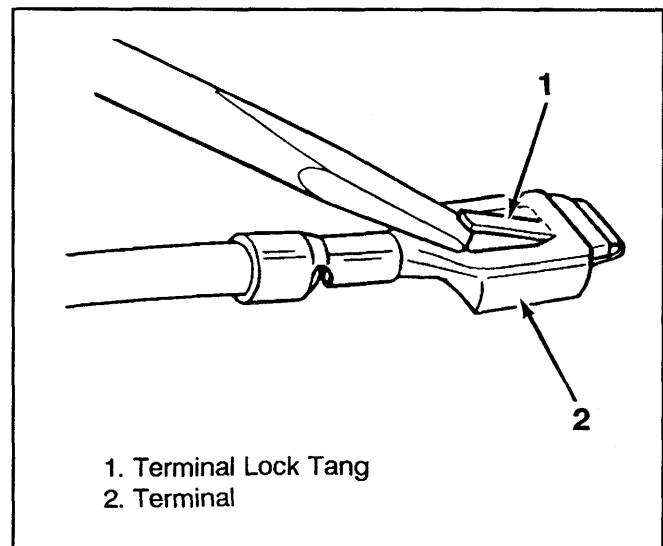


Figure 35 — Resetting the Terminal Lock Tang

### WEATHER-PACK CONNECTORS

Special connectors known as Weather-Pack connectors require special tool J 28742 for servicing. This special tool is required to remove the pin and sleeve terminals. If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent or deformed. Unlike standard blade-type terminals, these terminals cannot be straightened once they are bent.

## 8A-2-20 GENERAL INFORMATION

Make sure that the connectors are properly seated and all of the sealing rings (1) are in place when connecting the leads. The hinge-type flap (4) provides a back-up, or secondary locking feature for terminals. They are used to improve the connector reliability by retaining the terminals if the small terminal lock tangs are not positioned properly.

Molded-on connectors require complete replacement of the connection. This means splicing a new connector assembly into the harness. Environmental connections cannot be replaced with standard connections. Instructions are provided with the Weather-Pack connector and terminal packages.

With the low current and voltage levels found in some circuits, it is important that the best possible bond at all wire splices be made by soldering the splices.

Use care when probing the connections or replacing terminals in them. It is possible to short between two terminals. If this happens, damage may be done to certain components. Always use jumper wires between connectors for circuit checking. Never probe through the Weather-Pack seals.

When diagnosing for possible open circuits, it is often difficult to locate them by sight because oxidation or terminal misalignment is hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may pinpoint the open circuit condition. This should always be considered when an open circuit is indicated while diagnosing. Intermittent problems may also be caused by oxidized or loose connections.

### Weather-Pack Connector Replacement

#### Remove or Disconnect (Figure 36)

##### Tool Required:

J 28742 Terminal Remover (Figure 36)

1. Primary lock (2) by lifting.
2. Connector section.
3. Secondary lock (6) by spreading the sides of the hasp, thus clearing the staples and rotating the hasp (8).
4. Terminal (12) by using J 28742 (9).
  - Snip off the old terminal assembly.
5. 5mm (0.2 inch) of the wire insulation (11).

##### Clean

- Terminal barrel (5).

#### Install or Connect (Figure 36)

1. Terminal insulator (15) on the wire. Slide the insulator back on the wire about 8 cm (3 inches).
2. Terminal (12) on the wire.

- Roll crimp (13) and solder the terminal.

3. Terminal insulator (15) and the roll crimp (14).
4. Terminal into the connector.
5. Secondary lock (6).
6. Connector sections until the primary lock (2) engages.

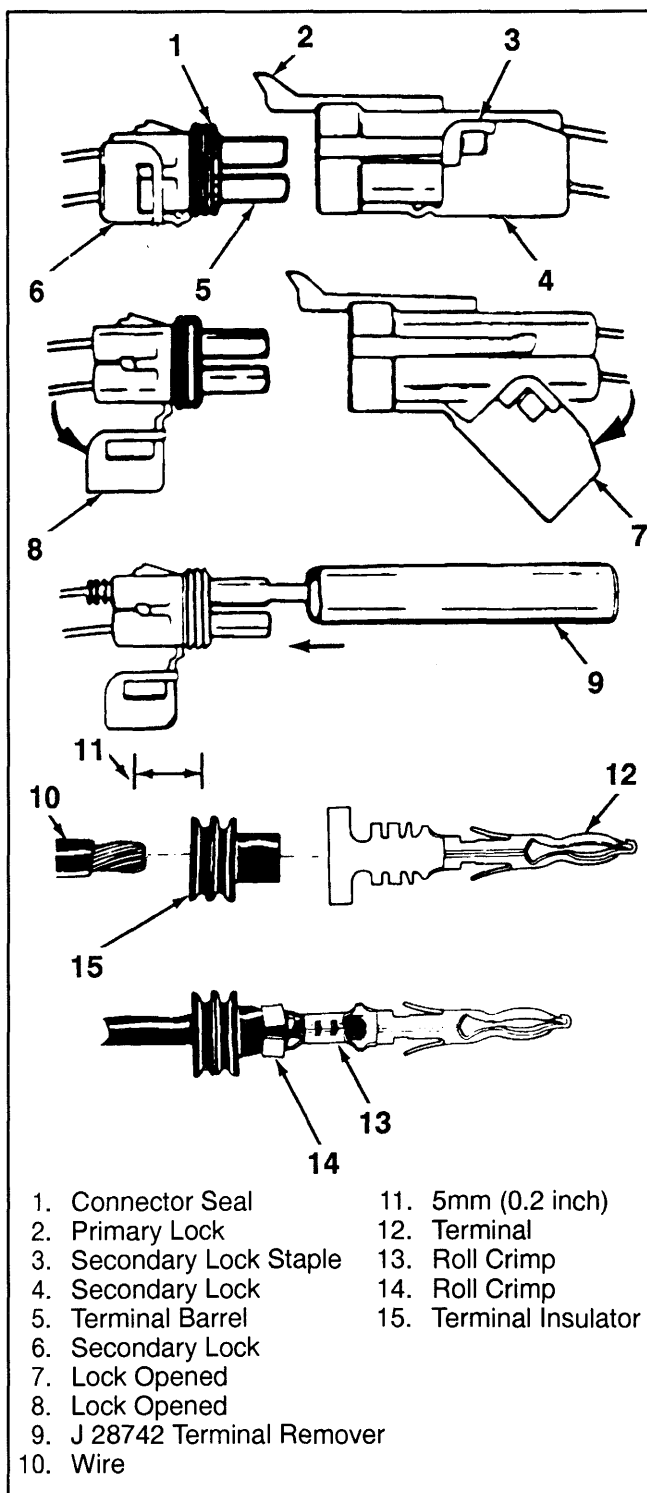


Figure 36 — Weather Pack Connector

## METRI-PACK CONNECTORS

The Metri-Pack connectors use a pull-to-seat type terminal. The special tool required to remove the terminal is J 35689-A terminal remover (figure 37). If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent or deformed (figure 38).

### Metri-Pack Connector Replacement Remove or Disconnect (Figure 37)

#### Tool Required:

J 35689-A Terminal Remover

1. Primary lock (2) by lifting.
2. Connector body (17).
3. Connector seal (1) by pulling the seal back onto the wires away from the connector body (17).
4. Terminal (16) by inserting J 35689-A (19) into the connector body (17) to depress the locking tang (18), then push the wire and terminal through the connector body (figure 37).
  - Snip off the old terminal unless the terminal is to be reused; reshape the locking tang.
5. 5mm (0.2 inch) of the wire insulation.

#### Clean

- Terminal cavity of the connector body.

### Install or Connect (Figure 37)

1. Terminal (16) on the wire.
  - Crimp and solder the terminal.
2. Terminal (16) into the connector cavity by pulling the wire on the seal side of the connector until the locking tang (18) is fully seated.
3. Seal (1) by pressing the seal into the connector body (17) until it is fully seated.
4. Connector sections until the primary lock (2) engages.

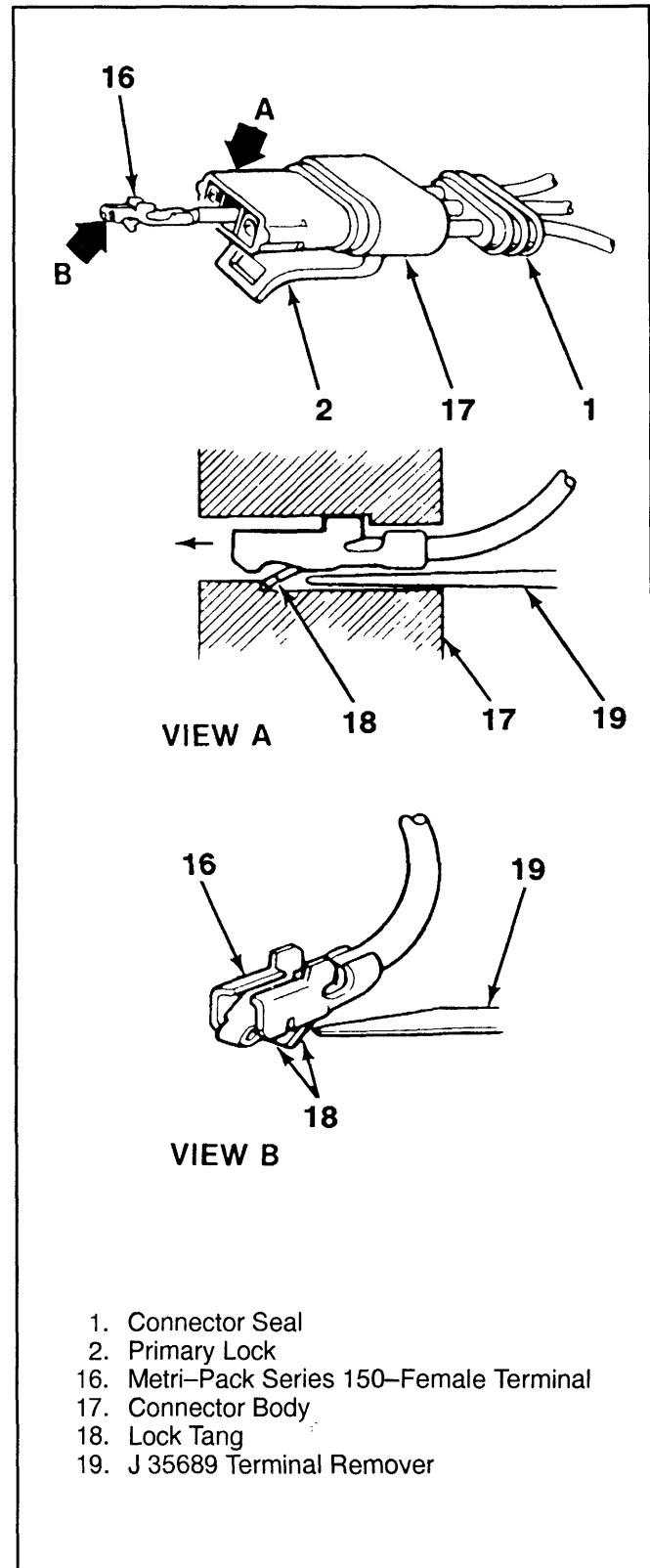
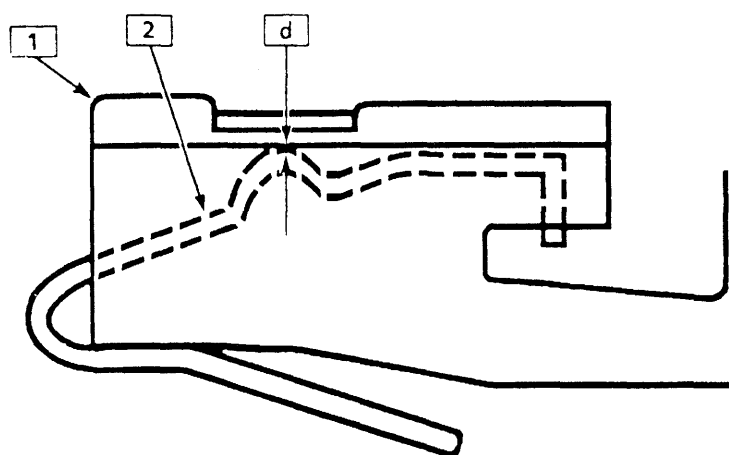
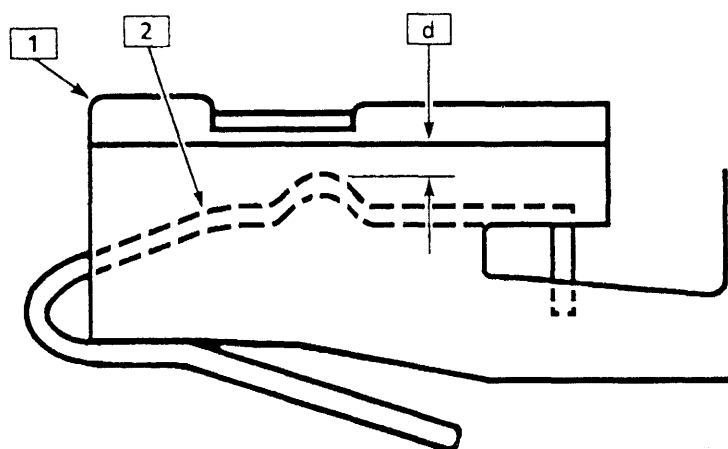


Figure 37 — Metri-Pack Connector





d ABOUT EQUAL TO 0, GOOD TERMINAL CONTACT

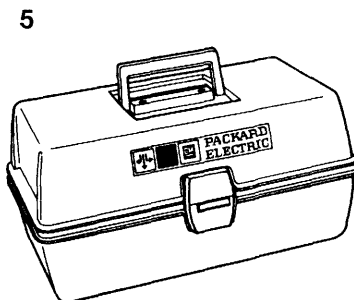
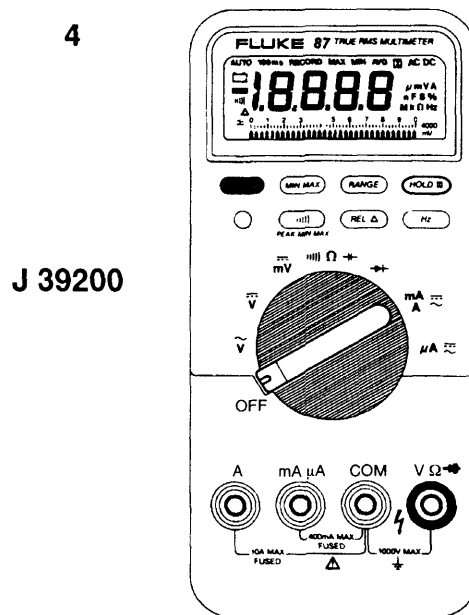
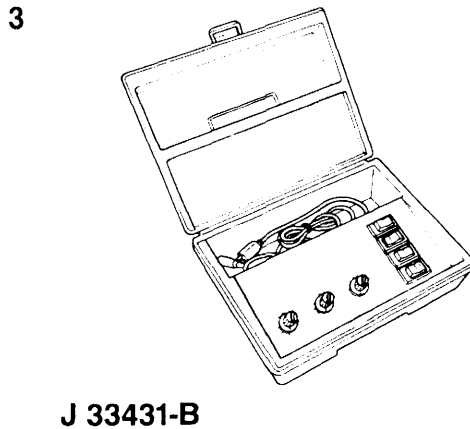
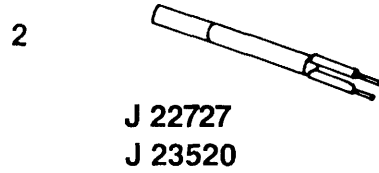
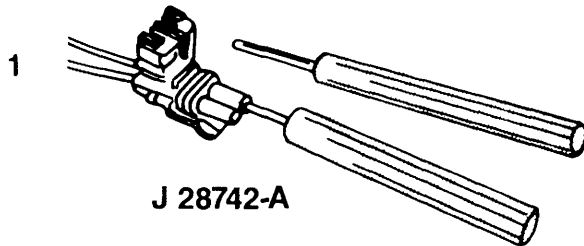


d MUCH GREATER THAN 0, POOR TERMINAL CONTACT

- 
- 1 TYPICAL METRI-PACK 150/280/480/630 SERIES FEMALE TERMINAL  
(150 SERIES PUSH-TO-SEAT SHOWN)
  - 2 CONTACT TANG
  - d AMOUNT OF DEFORMATION

Figure 38 — Deformation of a Typical Metri-Pack 150/280/480/630 Series Female Terminal

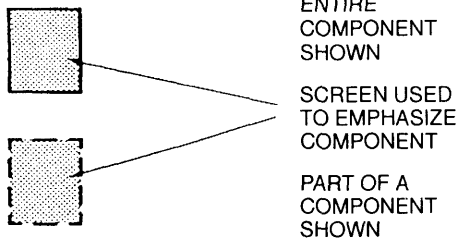
## SPECIAL TOOLS



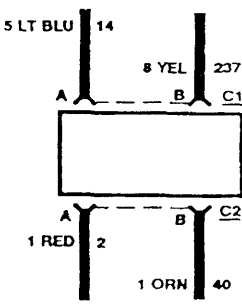
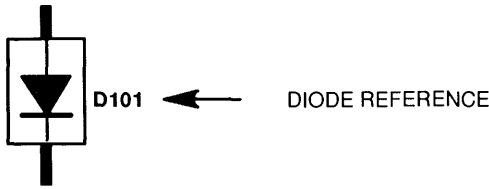
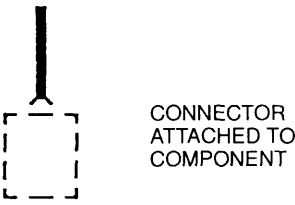
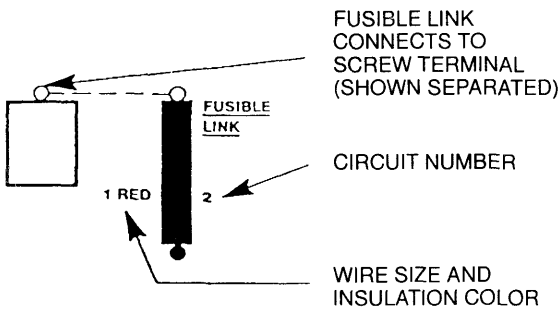
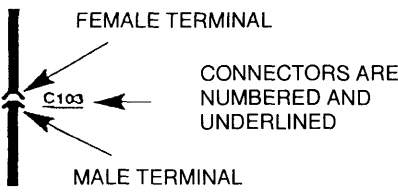
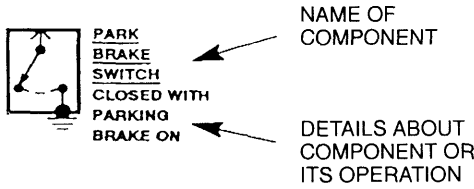
1. Weather-Pack II Terminal Remover
2. Electrical Terminal Remover
3. Signal Generator and Instrument Panel Tester
4. Digital Volt Ohmmeter
5. Terminal Repair Kit

Figure 39 — Special Tools

SYMBOLS



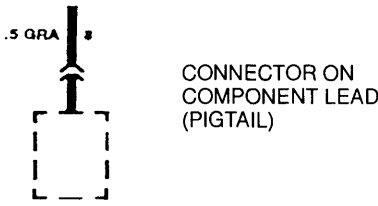
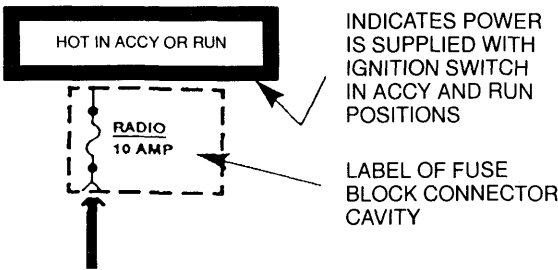
A PTC IS A CIRCUIT BREAKER THAT RESETS ONLY AFTER VOLTAGE IS REMOVED



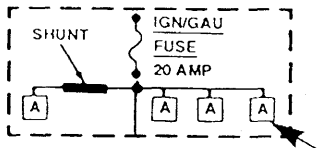
TWO TERMINALS IN THE SAME CONNECTOR

DASHED LINE SHOWS A PHYSICAL CONNECTION BETWEEN PARTS (SAME CONNECTOR)

SECOND CONNECTOR ON THE SAME COMPONENT



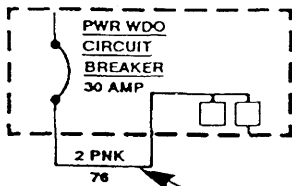
## SYMBOLS (CONT.)



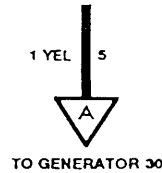
INDICATES FUSE (OR CIRCUIT BREAKER) FEEDS A BUSBAR FOR ADDED ACCESSORIES



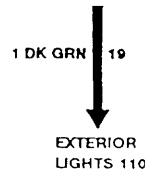
A WAVY LINE MEANS A WIRE IS TO BE CONTINUED



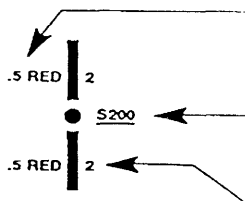
INDICATES A WIRE, LOCATED BEHIND FUSE BLOCK, USED TO CONNECT A CIRCUIT BREAKER (OR FUSE) TO A BUSBAR LOCATED IN FUSE BLOCK



A CURRENT PATH IS CONTINUED AS LABELED; ARROW SHOWS THE DIRECTION OF CURRENT FLOW AND IS REPEATED WHERE CURRENT PATH CONTINUES



A WIRE WHICH CONNECTS TO ANOTHER CIRCUIT; THE WIRE IS SHOWN AGAIN IN THAT CIRCUIT; ARROW SHOWS DIRECTION OF CURRENT FLOW



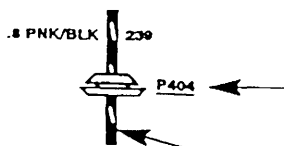
WIRE SIZE AND INSULATION COLOR ARE LABELED

SPLICES ARE NUMBERED AND UNDERLINED

CIRCUIT NUMBER IS SHOWN TO HELP IN TRACING CIRCUITS



COMPONENT CASE IS DIRECTLY ATTACHED TO METAL PART OF VEHICLE (GROUNDED)



GROMMETS ARE NUMBERED AND UNDERLINED

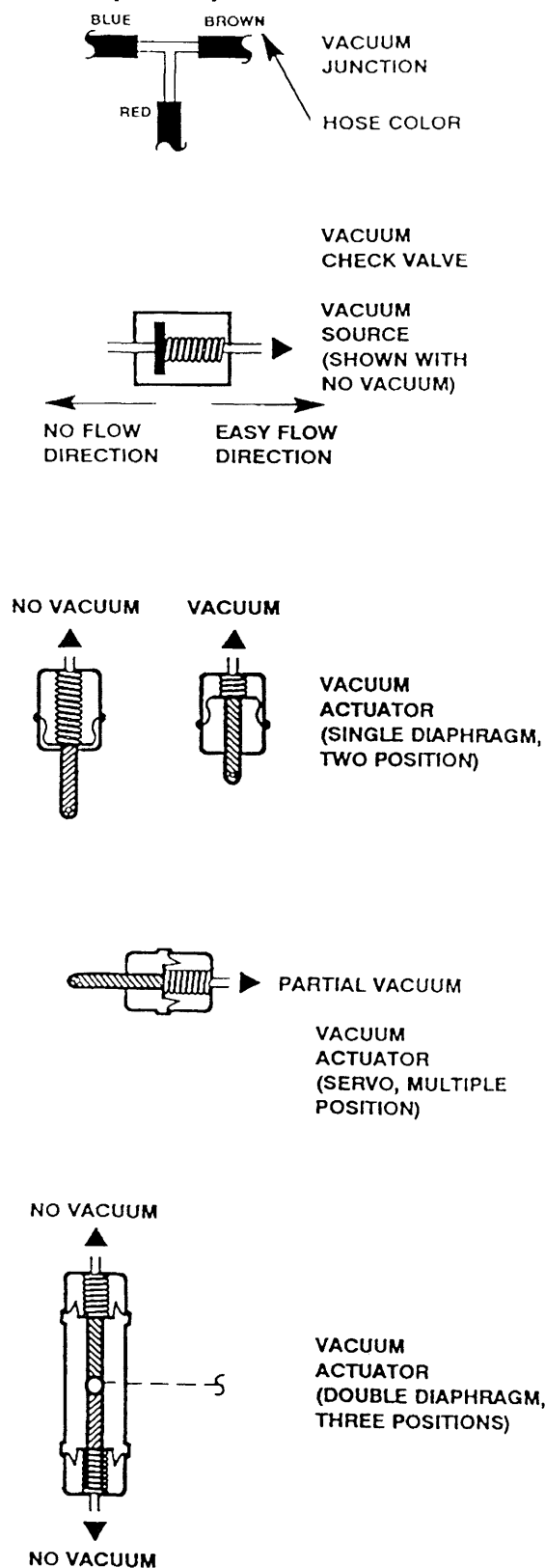
WIRE INSULATION IS ONE COLOR WITH ANOTHER COLOR STRIPE



WIRE IS ATTACHED TO METAL PART OF VEHICLE (GROUNDED)

GROUNDINGS ARE NUMBERED AND UNDERLINED

## SYMBOLS (CONT.)



## Solid-State Symbols

A group of special symbols is used to represent electronic circuits used in the Solid-State modules. These symbols are greatly simplified versions of the actual circuits. They can be very useful for troubleshooting purposes if properly used. It is important to remember that these symbols apply only to modules with all connectors in place and supply voltages on.

## Outputs

The Solid-State Switches (figures 40 and 41) are used to turn on a circuit outside the module. When the switch closes, the voltage or ground shown will be applied to the connected circuit. Additional information about what makes the switch close is often provided. The voltage controlled by the switch may be measured just as if it were a mechanical switch.

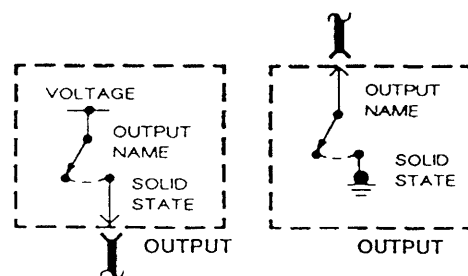


Figure 40

Figure 41

These symbols (figures 42 and 43) are similar to the Solid-State Switch. The pulses represent the rate at which the switch is turned on and off.

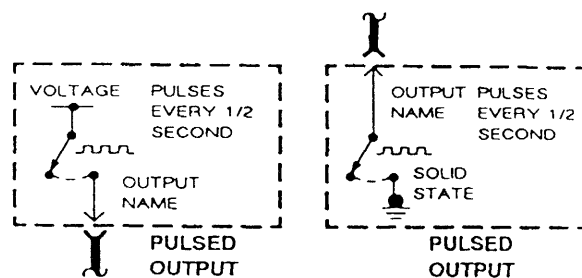


Figure 42

Figure 43

These two symbols (figures 44 and 45) are special versions of the Solid-State Switch. They represent serial data inputs and outputs. Serial data consists of coded groups of voltage pulses transmitted at high speed. These pulses cannot usually be measured with a Digital Voltmeter. There are cases, however, where procedures in System Diagnosis may describe such measurements. The Scan tool can often read and display this data.

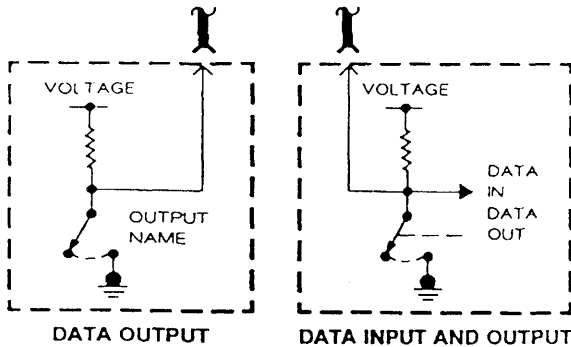


Figure 44

Figure 45

### Inputs

These symbols (figures 46 and 47) represent the equivalent circuit at the input terminals of electronic modules. You should not attempt to measure the resistance of these terminals unless instructed to do so by a service procedure. These inputs can be used to check wiring to electronic modules.

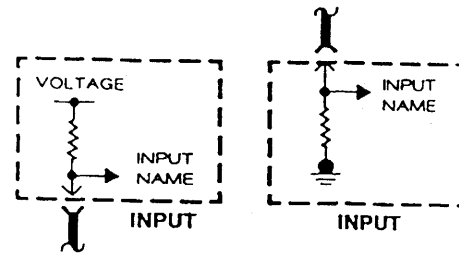
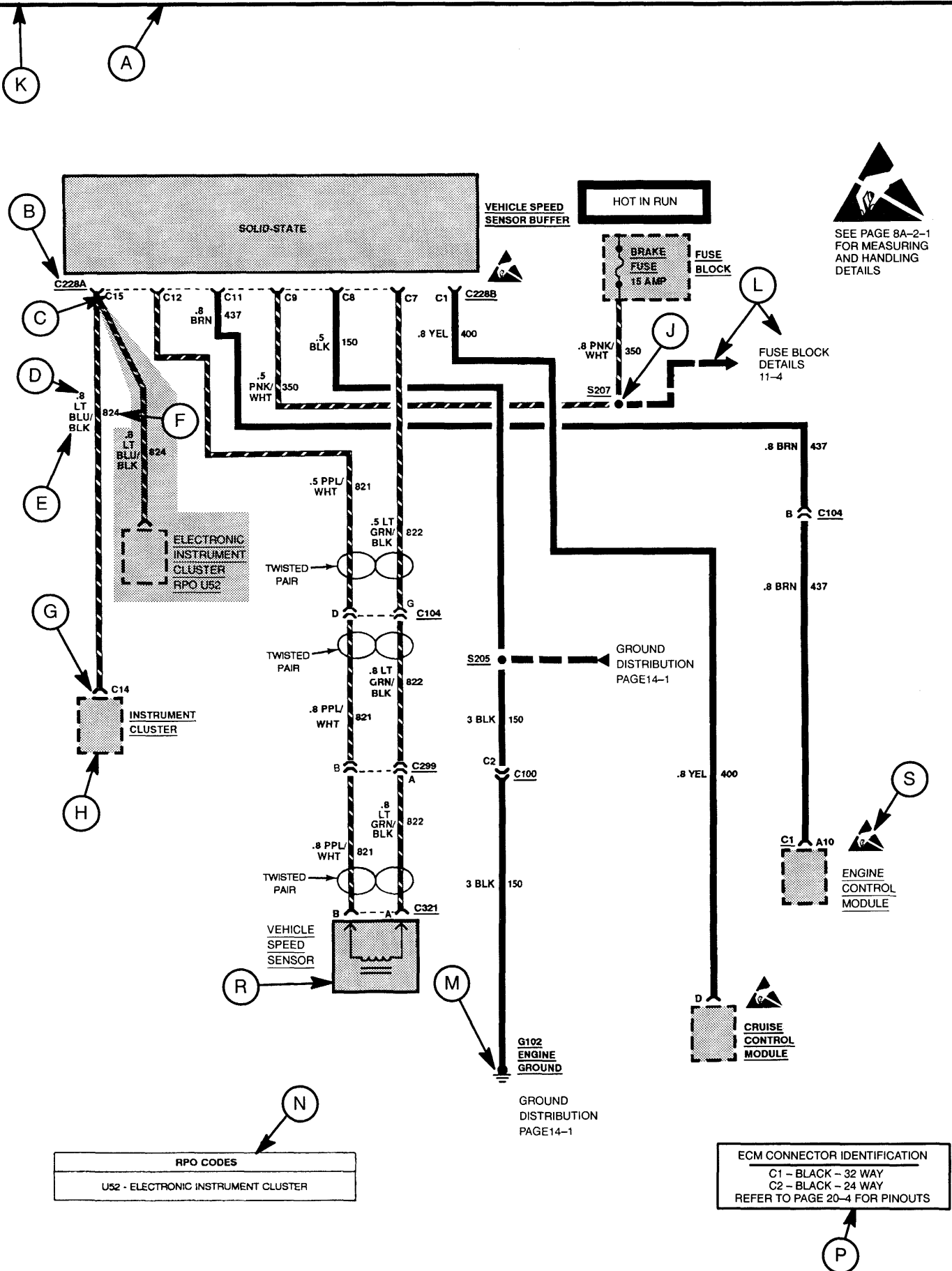


Figure 46

Figure 47

# 8A-2-28 VEHICLE SPEED SENSOR BUFFER



- A — System Title
- B — Indicates connector to be connected to a part
- C — Connector pin or cavity number
- D — Indicates wire gauge size
- E — Indicates wire color

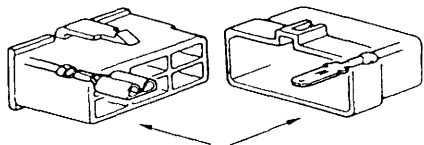
|           |        |           |        |
|-----------|--------|-----------|--------|
| BLK ..... | Black  | YEL ..... | Yellow |
| BRN ..... | Brown  | WHT ..... | White  |
| GRN ..... | Green  | BLU ..... | Blue   |
| ORN ..... | Orange | PNK ..... | Pink   |
| GRA ..... | Gray   | DK .....  | Dark   |
| PPL ..... | Purple | LT .....  | Light  |



SOLID WIRE

INDICATES WIRE  
WITH TRACER

- F — Indicates circuit number
- G — Indicates the wiring harness connector. The wiring harness with male terminal is shown with arrows



FEMALE ( ♀ )

MALE ( ♂ )

- H — Dashed line indicates only part of component is shown
- J — A “Ball” indicates splice and splice number
- K — Section number and page number
- L — Shows related system
- M — Represents ground point
- N — Indicates options shown on schematic
- P — Indicates ECM connector identification
- R — Solid exterior line indicates entire component is shown
- S — Electrostatic Discharge Symbol



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| SYMPTOM                                                                                                                                                               | PAGE      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>RADIO (AM)</b>                                                                                                                                                     |           |
| Radio Does Not Appear To Work (No Display Lights, No Sound) .....                                                                                                     | 8A-150-9  |
| Clock (If Equipped) Does Not Operate .....                                                                                                                            | 8A-150-9  |
| Radio Panel Lamp Does Not Come On .....                                                                                                                               | 8A-150-9  |
| Display Dimming Function Will Not Operate .....                                                                                                                       | 8A-150-10 |
| No Sound Or Distorted Sound From A Speaker .....                                                                                                                      | 8A-150-10 |
| <b>REAR AUXILIARY AIR CONDITIONING</b>                                                                                                                                |           |
| Rear Blower Operates In LO And MED From Both Switches But Does Not Operate In HI<br>From Either Switch .....                                                          | 8A-67A-4  |
| Rear A/C Blower Does Not Operate In Any Speed From Either Switch (Rear A/C Only) .....                                                                                | 8A-67A-5  |
| Rear Blower Motor Operates In HI Speed From Both Switches But Does Not Operate In<br>LO/MED Speeds From Either Switch .....                                           | 8A-67A-6  |
| All Rear Blower Speeds Operate But Only From Console Front Control Switch .....                                                                                       | 8A-67A-7  |
| All Blower Speeds Operate But Only From Console Rear Control Switch .....                                                                                             | 8A-67A-7  |
| <b>REAR AUXILIARY HEATER</b>                                                                                                                                          |           |
| Rear Blower Motor Does Not Operate In HI But Operates In LO Or MED .....                                                                                              | 8A-60B-4  |
| Rear Blower Does Not Operate In Any Speed .....                                                                                                                       | 8A-60B-5  |
| Rear Blower Operates In HI But Does Not Operate In LOW Or MED .....                                                                                                   | 8A-60B-6  |
| Rear Temperature Door Does Not Operate .....                                                                                                                          | 8A-60B-7  |
| <b>REAR AUXILIARY HEATER AND AIR CONDITIONING</b>                                                                                                                     |           |
| Temperature Control Mode Door Operates But Rear Airflow Mode Door Does Not Operate<br>From Either Console Control (W/Rear Heater And A/C) .....                       | 8A-67B-6  |
| Rear Temperature And Airflow Mode Door Motors Operate From Roof Console Front Control<br>Only — Blower Operates From Both Controls (W/Rear Heater And A/C) .....      | 8A-67B-6  |
| Rear Temperature And Airflow Mode Door Motors Operate From Roof Console Rear Control<br>Only — Blower Motor Operates From Both Controls (W/Rear Heater And A/C) ..... | 8A-67B-7  |
| Rear Temperature Door Motor Does Not Operate From Either Control<br>(W/Rear Heater And A/C) .....                                                                     | 8A-67B-7  |
| <b>REAR EXTERIOR LAMPS</b>                                                                                                                                            |           |
| Stoplamps Do Not Operate .....                                                                                                                                        | 8A-110-12 |
| Stoplamps Do Not Operate On One Side .....                                                                                                                            | 8A-110-12 |
| Rear Lamp Systems Do Not Operate .....                                                                                                                                | 8A-110-13 |
| Turn Signals Do Not Operate On One Side .....                                                                                                                         | 8A-110-14 |
| <b>REAR LIFTGATE WINDOW RELEASE</b>                                                                                                                                   |           |
| Rear Window Release Does Not Operate .....                                                                                                                            | 8A-135-3  |

## 8A-2-34 GENERAL INFORMATION

---

| SYMPTOM                                                                                                 | PAGE     |
|---------------------------------------------------------------------------------------------------------|----------|
| <b>REAR WINDOW DEFOGGER</b>                                                                             |          |
| On Indicator Works But Rear Window Defogger Does Not Defrost — Regular, Extended And Crew Cab .....     | 8A-61-5  |
| On Indicator Works But Rear Window Defogger Does Not Defrost — Utility And Suburban With Liftgate ..... | 8A-61-5  |
| Rear Window Defogger Does Not Work And On Indicator Does Not Light .....                                | 8A-61-6  |
| On Indicator Works But LH Or RH Cargo Door Window(s) Do Not Defrost — Suburban W/Cargo Doors .....      | 8A-61-6  |
| Rear Defogger Panel Lamp Does Not Work .....                                                            | 8A-61-7  |
| <b>REAR WIPER/WASHER</b>                                                                                |          |
| Rear Wiper Does Not Operate In Any Mode .....                                                           | 8A-92-4  |
| Rear Wiper Operates At LOW Speed Only (HIGH Speed Inoperative) .....                                    | 8A-92-5  |
| Rear Wiper Operates At HIGH Speed Only (LOW Speed Inoperative) .....                                    | 8A-92-5  |
| Rear Wiper Will Not Shut Off Or Park .....                                                              | 8A-92-5  |
| Rear Washer Will Not Operate .....                                                                      | 8A-92-6  |
| <b>START AND CHARGE</b>                                                                                 |          |
| Engine Does Not Crank And Starter Solenoid Does Not Click .....                                         | 8A-30-5  |
| Starter Solenoid Clicks, Engine Does Not Crank Or Cranks Slowly .....                                   | 8A-30-6  |
| Volts Indicator Does Not Light With Ignition Switch In Run And Engine Stopped .....                     | 8A-30-6  |
| Volts Indicator Stays On When Engine Is Running .....                                                   | 8A-30-6  |
| Battery Is Undercharged Or Overcharged .....                                                            | 8A-30-7  |
| <b>UNDERHOOD LAMP</b>                                                                                   |          |
| Underhood Reel Lamp Does Not Operate .....                                                              | 8A-118-3 |
| <b>VEHICLE SPEED SENSOR</b>                                                                             |          |
| Speedometer And Odometers Do Not Operate .....                                                          | 8A-33-4  |
| Cruise Control Does Not Operate Properly .....                                                          | 8A-33-4  |
| <b>WIPER/WASHER</b>                                                                                     |          |
| Wipers Do Not Operate In Any Mode .....                                                                 | 8A-91-4  |
| Wipers Operate At LOW Speed Only (HIGH Speed Inoperative) .....                                         | 8A-91-4  |
| Wipers Operate At HIGH Speed Only (LOW Speed Inoperative) .....                                         | 8A-91-4  |
| No Delay In The Pulse (Delay) Mode .....                                                                | 8A-91-5  |
| Wipers Will Not Shut Off .....                                                                          | 8A-91-5  |
| Washer Will Not Operate (W/O Pulse Wipers) .....                                                        | 8A-91-6  |
| Washer Will Not Operate (W/Pulse Wipers) .....                                                          | 8A-91-6  |

## RPO CODES AND ABBREVIATION LIST

REGULAR PRODUCTION OPTION (RPO)  
LIST

|     |                                                            |
|-----|------------------------------------------------------------|
| AG9 | Power Seat Adjuster, Parent Driver's Side                  |
| AU3 | Power Side Door Locks                                      |
| A31 | Power Side Windows                                         |
| A95 | High Back Reclining Bucket Seats                           |
| BYP | Sports Equipment Package                                   |
| B4U | Sports Performance Package                                 |
| CD4 | Pulse Wiper/Washer                                         |
| C36 | Auxiliary Heater                                           |
| C49 | Electric Rear Window Defogger                              |
| C5B | 15000 Lbs. GVW Rating                                      |
| C60 | Air Conditioning                                           |
| C69 | Roof Mounted Air Conditioner                               |
| D48 | Power Outside Rearview Mirror                              |
| E55 | Rear Liftgate Glass                                        |
| K30 | 1 Ton Four-Wheel Drive                                     |
| K34 | Cruise Control                                             |
| LB4 | Engine, 4.3L (262 CID) V6 Gas, Vin Z                       |
| LO3 | Engine, 5.0L (305 CID) V8 Gas Engine, Vin H                |
| LO5 | Engine, 5.7L (350 CID) V8 Gas, Vin K                       |
| L19 | Engine, 7.4L (454 CID) V8 Gas, Vin N                       |
| L49 | Engine, 6.5L (396 CID) V8 Diesel, Vin P                    |
| L56 | Engine, 6.5L (396 CID) V8 HD Diesel, Vin S                 |
| L65 | Engine, 6.5L (396 CID) V8 Turbo Diesel, Vin F              |
| MD8 | Auto Trans, 4-Spd., W/Overdrive                            |
| MG5 | Man Trans., HD 5-Spd., W/Overdrive                         |
| MT1 | Auto Trans, HD, 4-Spd., W/Overdrive                        |
| M30 | Auto Trans, 4-Spd., W/Overdrive                            |
| NRQ | Closed Coupled Exhaust                                     |
| RO5 | Dual Rear Wheels                                           |
| T61 | Daytime Running Lamps (Canadian Only)                      |
| UX1 | Radio, ETR AM/FM Stereo, Cassette<br>W/ Equalizer          |
| U01 | Roof Marker Lamps                                          |
| U88 | Premium Speaker System                                     |
| VR4 | Weight Distributing Trailer Hitch                          |
| VYU | Snowplow Preparation Package                               |
| V22 | Quad Halogen Headlamps                                     |
| YE9 | Convenience and Decor Comfort Package                      |
| ZP6 | Rear Window Defroster/Washer/Intermittent<br>Wiper Package |
| ZQ2 | Power Door Locks and Power Windows                         |
| Z49 | Canadian Package                                           |
| Z81 | Camper Special Chassis Equipment                           |
| Z82 | Trailer Special Equipment, HD                              |

## ABBREVIATION LIST

Following is a list of abbreviations used in the wiring diagrams. The abbreviations have been developed in such a way that their meaning should be clear.

Use this page as a reference to determine the meaning of an abbreviation if necessary.

|          |                               |
|----------|-------------------------------|
| A        | – Ampere                      |
| A/C      | – Air Conditioner             |
| AC       | – Alternating Current         |
| ACC      | – Accessory                   |
| AIR      | – Air Injection Reaction      |
| AIR/COND | – Air Conditioner             |
| AMP      | – Ampere                      |
| ANT      | – Anticipate                  |
| ASM      | – Assembly                    |
| ASSY     | – Assembly                    |
| AUD      | – Audio                       |
| AUTO     | – Automatic                   |
| AUX      | – Auxiliary                   |
| BAT      | – Battery                     |
| BATT     | – Battery                     |
| BI-LEV   | – Bi-Level                    |
| BLK      | – Black                       |
| BLT      | – Belt                        |
| BLU      | – Blue                        |
| BOT      | – Bottom                      |
| BRK      | – Brake                       |
| BRN      | – Brown                       |
| BTSL     | – Brake/Trans Shift Interlock |
| BU       | – Backup                      |
| BUZZ     | – Buzzer                      |
| CD       | – Compact Disc                |
| CID      | – Cubic Inch Displacement     |
| CIR/BRK  | – Circuit Breaker             |
| CIRC     | – Circuit                     |
| CLSTR    | – Cluster                     |
| CNTRL    | – Control                     |
| COMP     | – Compartment                 |
| COMP     | – Compressor                  |
| CONN     | – Connector                   |
| CONV     | – Convenience                 |

## 8A-2-36 GENERAL INFORMATION

---

CRNK – Crank  
CTSY – Courtesy  
CYL – Cylinder

DC – Direct Current  
DEF – Defrost  
DK – Dark  
DIAG – Diagnostic  
DIM – Dimmer  
DIR – Directional  
DISC – Discrete  
DIV – Diverter  
DLC – Data Link Connector  
DM – Dome  
DR – Door  
DRL – Daytime Running Lamps (Canadian Only)

ECM – Engine Control Module  
EGR – Exhaust Gas Recirculation  
ELEC – Electric  
ENG – Engine  
EPR – Exhaust Pressure Regulator  
ETR – Electronically Tuned Radio  
EXC – Except

F-PUMP – Fuel Pump  
FLASH – Flasher  
FRT – Front  
4WD – Four-Wheel Drive

GAU – Gauges  
GEN – Generator  
GRA – Gray  
GRD – Ground  
GRN – Green

HAND – Handling  
HAZ – Hazard  
HD – Heavy Duty  
HDLP – Headlamp  
HI – High  
HTR – Heater

IAC – Idle Air Control  
IGN – Ignition  
ILLUM – Illumination  
I/P – Instrument Panel  
INC – Increased  
IND – Indicator  
INJ – Injector  
INST – Instrument  
INSTR – Instrument  
INTER – Interior

LD – Light Duty  
LH – Left Hand  
LO – Low  
LP – Lamp  
LPS – Lamps  
LT – Light  
LTR – Lighter

M – Motor  
MAN – Manual  
MAP – Manifold Absolute Pressure  
MAX – Maximum  
MED – Medium  
MRKR – Marker  
MTR – Manually Tuned Radio  
MULT – Multiple

NAT – Natural  
NEU – Neutral  
NO – Normally Open  
NC – Normally Closed

ORN – Orange

PCM – Powertrain Control Module  
PK – Park  
PLR – Puller  
PNK – Pink  
PNL – Panel  
PPL – Purple  
PRESS – Pressure  
PVAC – Partial Vacuum  
PWR – Power

RCVR – Receiver  
REF – Reference  
RESIST – Resistance  
RH – Right Hand  
RKE – Remote Keyless Entry  
RPO – Regular Production Option  
RST – Rust  
RWAL – Rear Wheel Antilock

SEN – Sensor  
SEND – Sender  
SIG – Signal  
SIL – Silver  
SIR – Supplemental Inflatable Restraint  
SKT – Socket  
SOL – Solenoid  
SPEEDO – Speedometer  
STR – Stripe

STRG – Steering  
SW – Switch

TACH – Tachometer  
TBI – Throttle Body Fuel Injection  
TCC – Torque Converter Clutch  
TCM – Transmission Control Module  
TEMP – Temperature  
T/L– Taillamp  
TP – Throttle Position  
TRANS – Transmission  
TYP – Typical

V – Volt  
VAC – Vacuum  
VCM – Vehicle Control Module  
VEN – Vent  
VLV – Valve  
VSS – Vehicle Speed Sensor

W/ – With  
W/O – Without  
W/S – Windshield  
W/WASHER – Window Washer  
WDO – Window  
WHT – White  
WGR – Wiring

YEL – Yellow



**BLANK**

**COMPONENT LOCATION****Page — Figure**

|                                    |                                              |       |   |
|------------------------------------|----------------------------------------------|-------|---|
| Battery Junction Block .....       | RH rear of engine compartment, at cowl ..... | 10-7  | 1 |
| Battery, LH (Diesel) .....         | LH front of engine compartment .....         | 10-12 | 7 |
| Battery, RH .....                  | RH front of engine compartment .....         | 10-7  | 1 |
| Clutch Pedal Position Switch ..... | At top of clutch pedal .....                 | 10-10 | 5 |
| Fuse Block .....                   | Lower LH side of I/P .....                   | 10-8  | 2 |
| Ignition Switch .....              | Under I/P, on steering column .....          | 10-11 | 6 |
| Light Switch .....                 | Upper LH side of I/P .....                   | 10-8  | 2 |

**CONNECTORS:**

|            |                             |           |   |
|------------|-----------------------------|-----------|---|
| C100 ..... | At bulkhead connector ..... | Not Shown |   |
| C202 ..... | Behind RH side of I/P ..... | 10-12     | 8 |

**GROMMETS:**

|            |                                          |      |   |
|------------|------------------------------------------|------|---|
| P101 ..... | RH lower cowl (engine compartment) ..... | 10-9 | 4 |
|------------|------------------------------------------|------|---|

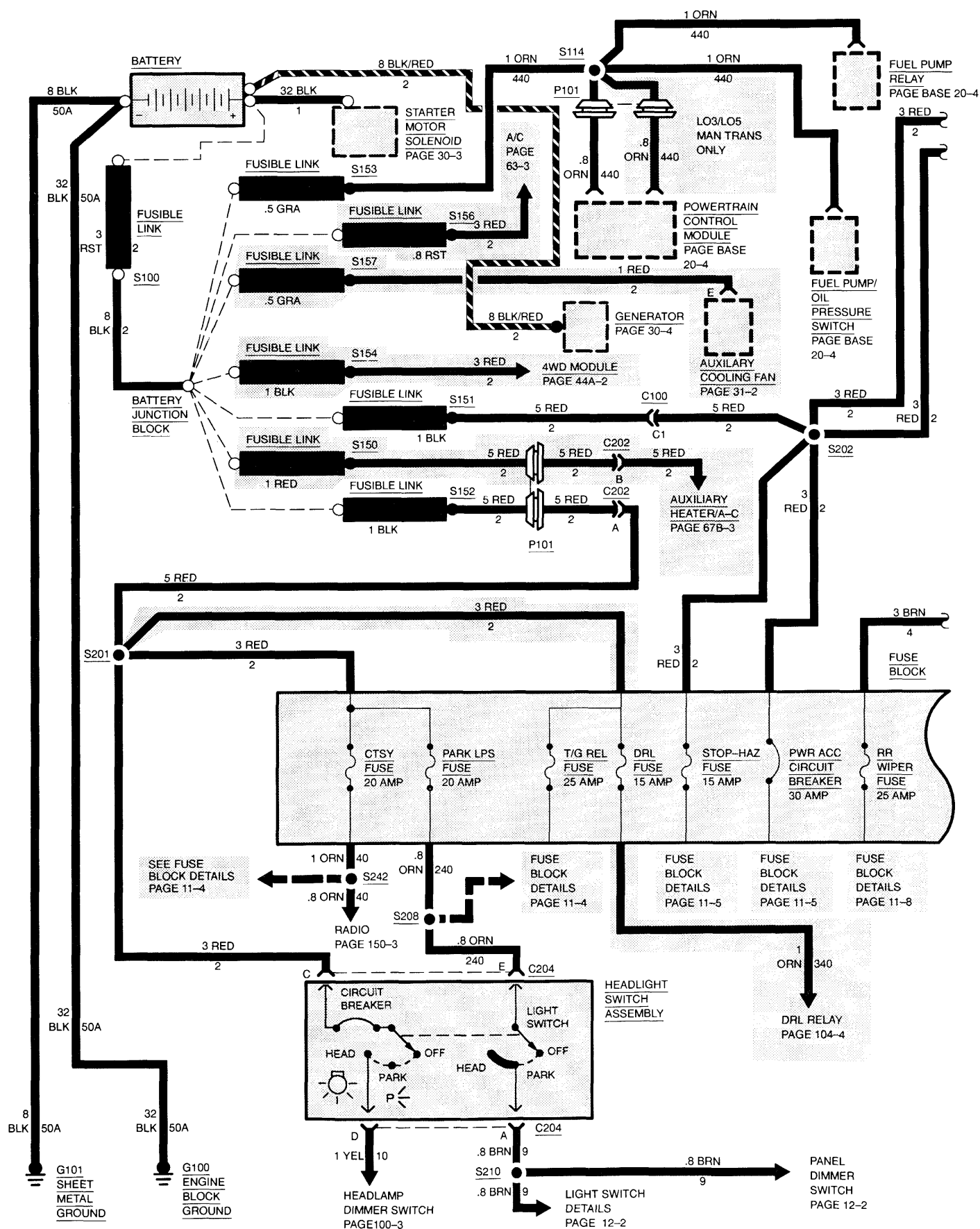
**GROUND:**

|                       |                                     |           |   |
|-----------------------|-------------------------------------|-----------|---|
| G100 (Gasoline) ..... | RH front of engine .....            | 10-7      | 1 |
| G100 (Diesel) .....   | RH front top of engine .....        | 10-12     | 7 |
| G101 .....            | RH inner fender, near battery ..... | Not Shown |   |
| G102 (Diesel) .....   | LH front top of engine .....        | 10-12     | 7 |

**SPLICES:**

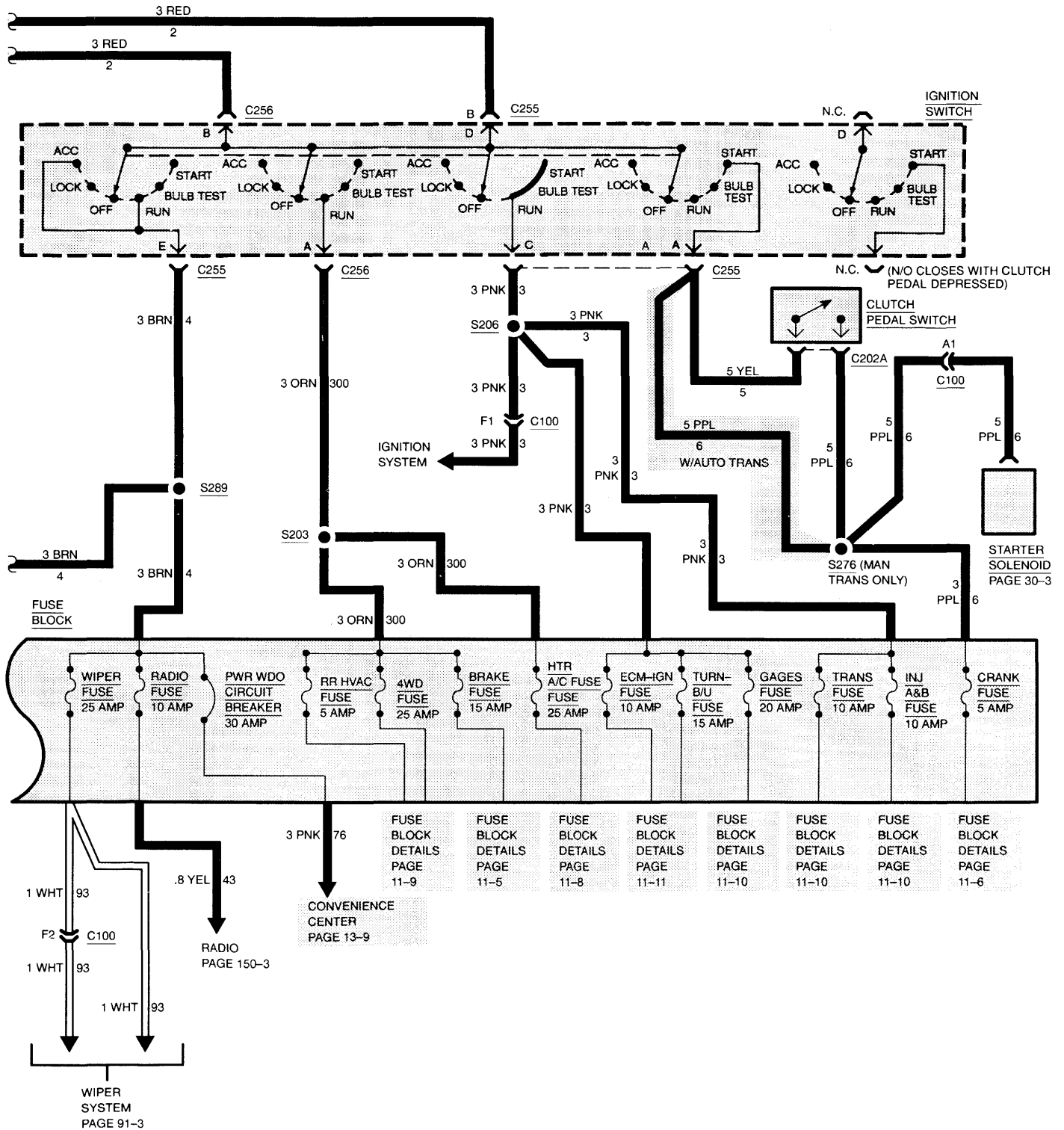
|            |                                                        |           |   |
|------------|--------------------------------------------------------|-----------|---|
| S100 ..... | Positive battery cable, near battery .....             | 10-7      | 1 |
| S114 ..... | RH rear engine compartment, near A/C accumulator ..... | Not Shown |   |
| S150 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S151 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S152 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S153 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S154 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S156 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S157 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S158 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S159 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S161 ..... | Center of cowl, below battery junction block .....     | 10-9      | 3 |
| S203 ..... | Under LH side of I/P .....                             | 10-11     | 6 |
| S206 ..... | Under LH side of I/P .....                             | 10-11     | 6 |
| S208 ..... | Behind LH side of I/P .....                            | 10-8      | 2 |
| S210 ..... | Behind LH side of I/P .....                            | 10-8      | 2 |
| S231 ..... | Behind LH side of I/P .....                            | 10-12     | 8 |
| S242 ..... | Under LH side of I/P .....                             | 10-8      | 2 |
| S276 ..... | Under LH side of I/P .....                             | 10-8      | 2 |

## GASOLINE ENGINES

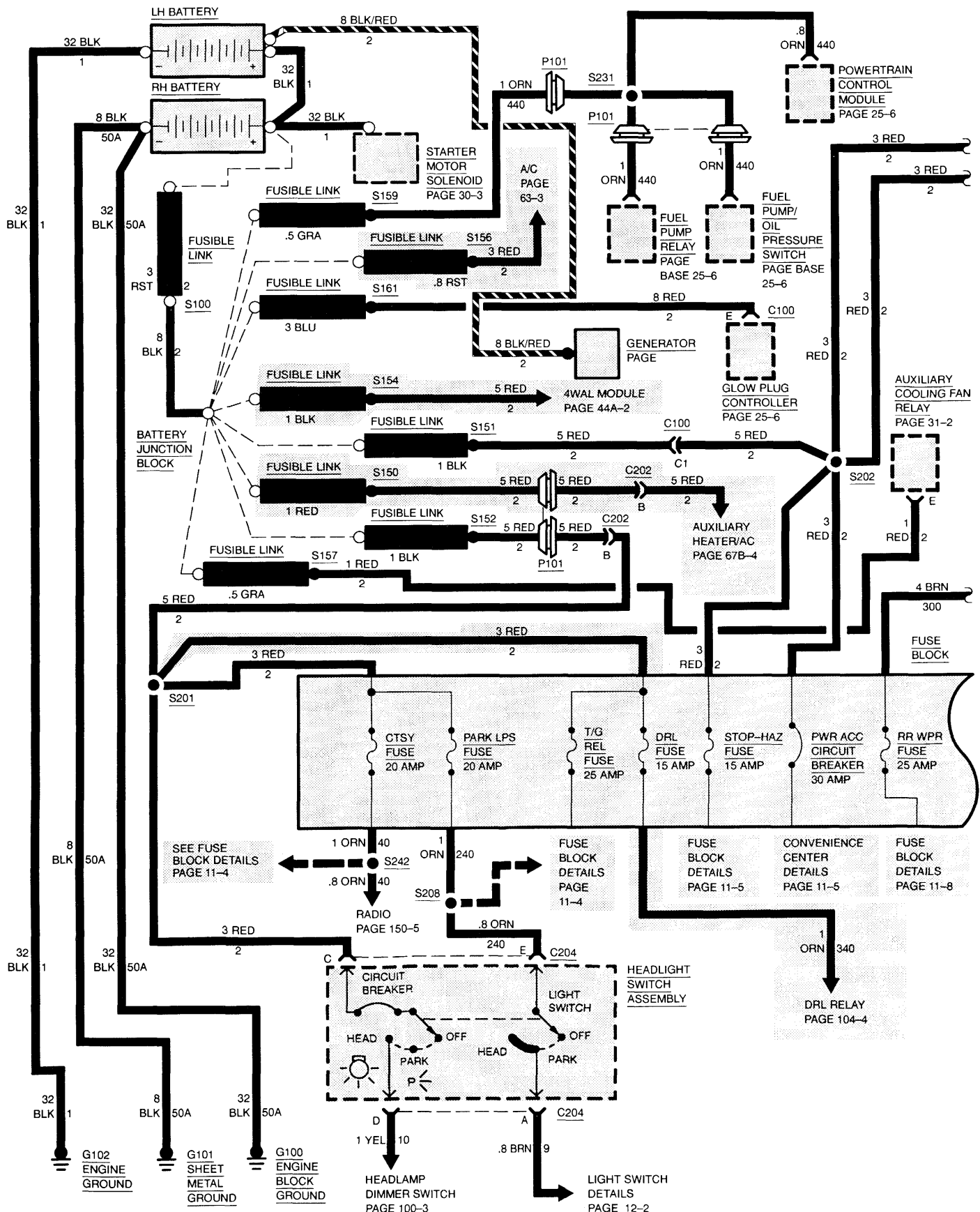


# POWER DISTRIBUTION 8A-10-3

## GASOLINE ENGINES



## DIESEL ENGINES

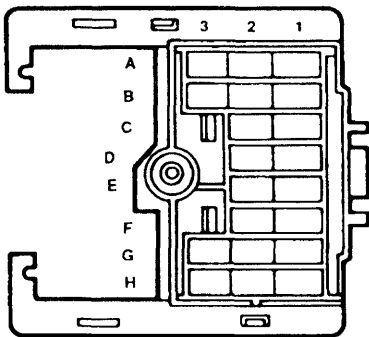


## DIESEL ENGINES



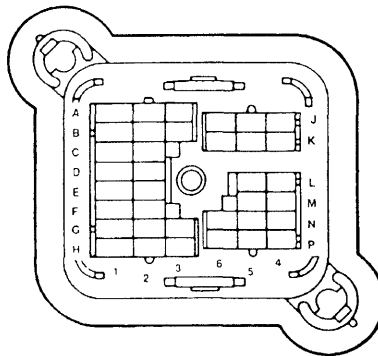
## 8A-10-6 POWER DISTRIBUTION

12020183



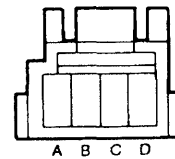
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



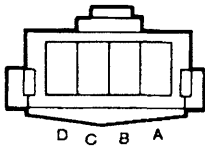
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12015664



**BLACK**  
Metri-Pack 630  
**C202**  
In-Line Battery Junction Block  
to I/P

12052623



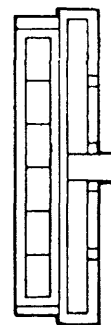
**BLACK**  
Metri-Pack 630  
**C202**  
In-Line I/P to Battery Junction  
Block

12034417



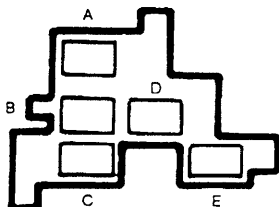
**202A**  
Clutch Pedal Position Switch

12034061



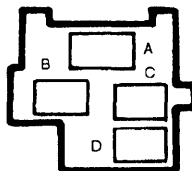
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

12010966



**BLUE**  
56 Series  
**C255**  
Ignition Switch

06294641



**BLACK**  
56 Series  
**C256**  
Ignition Switch

### Figure 1 — Battery Wiring, Gasoline Engines



## 8A-10-8 POWER DISTRIBUTION

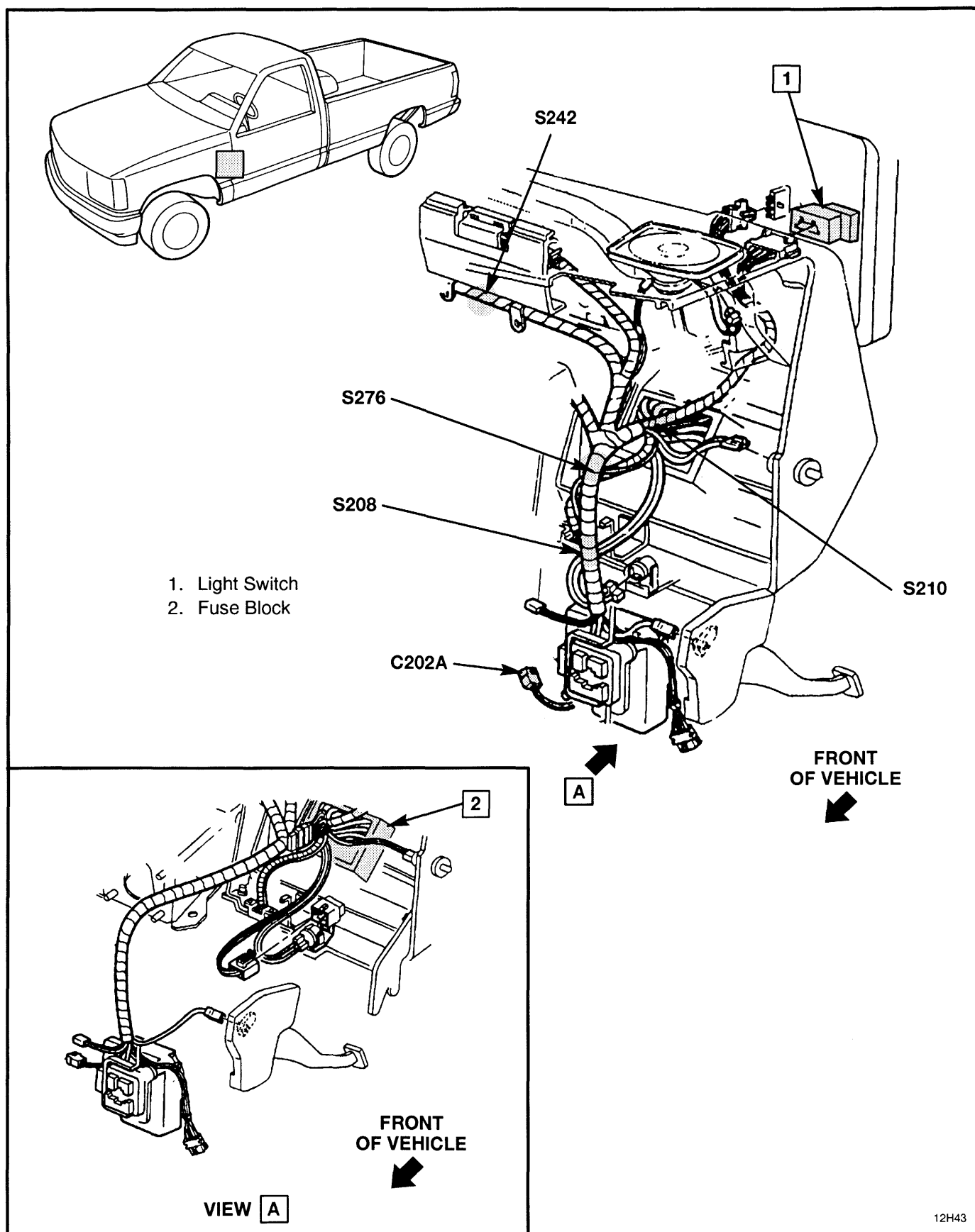


Figure 2 — LH Side of Instrument Panel

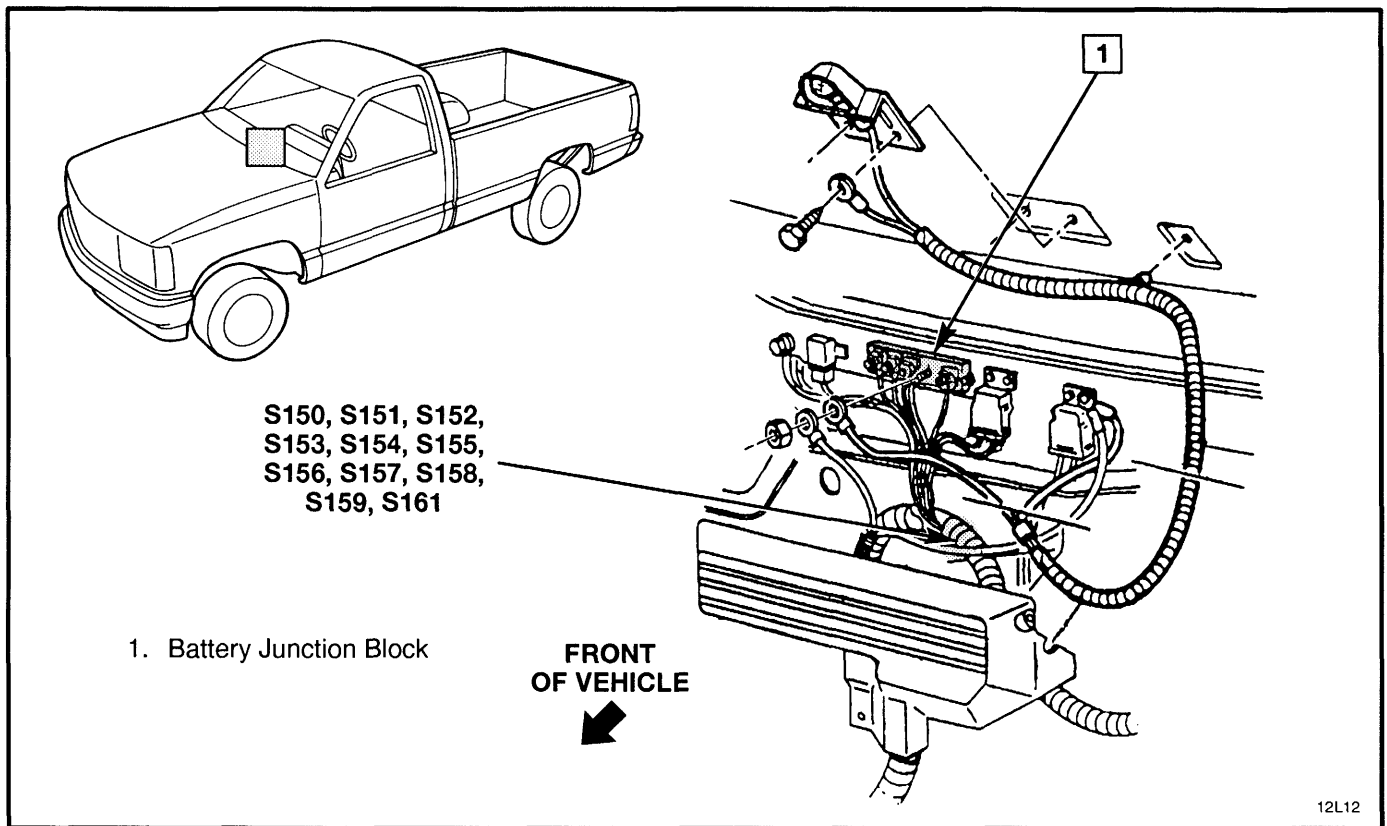


Figure 3 — Junction Block Wiring

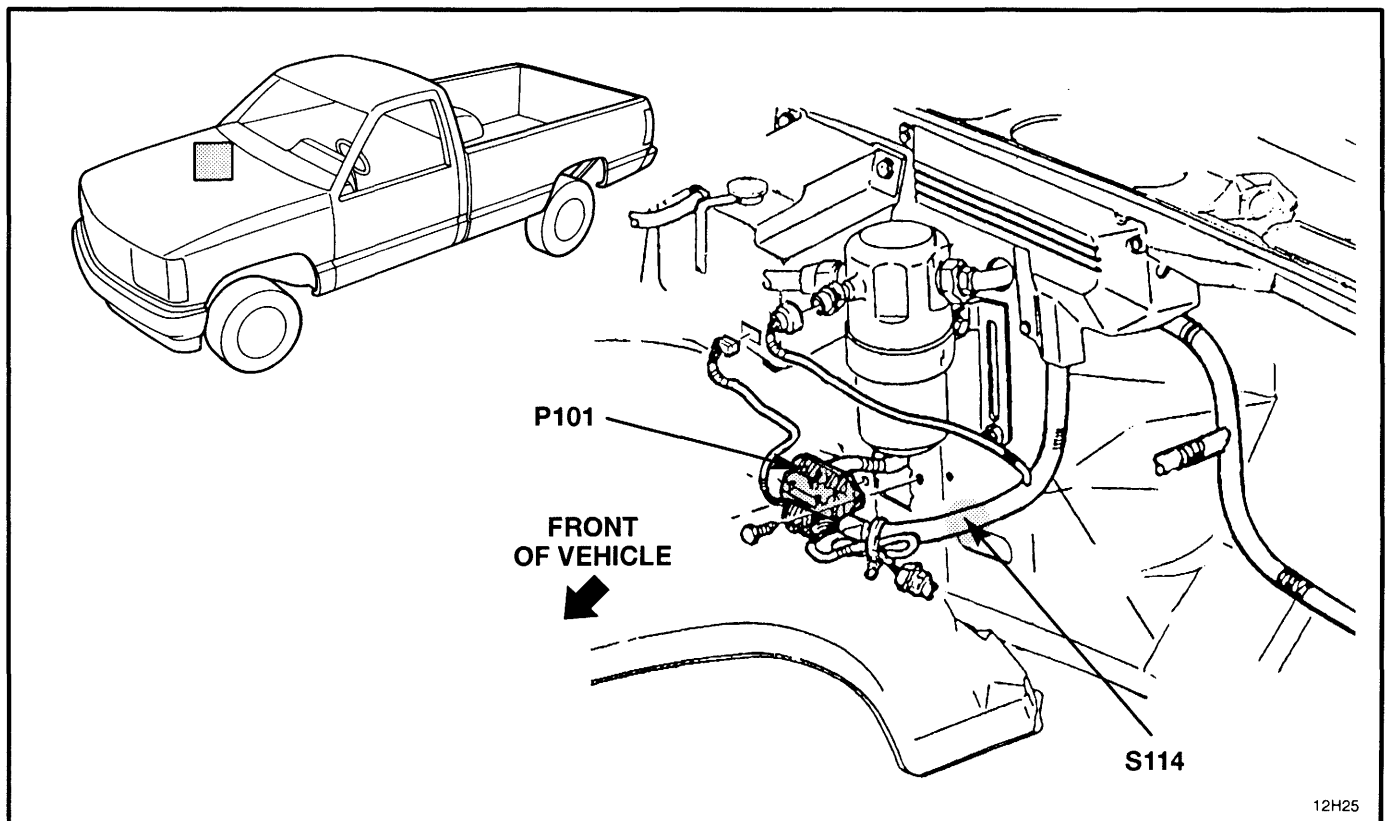


Figure 4 — Engine Wiring to Dash

## 8A-10-10 POWER DISTRIBUTION

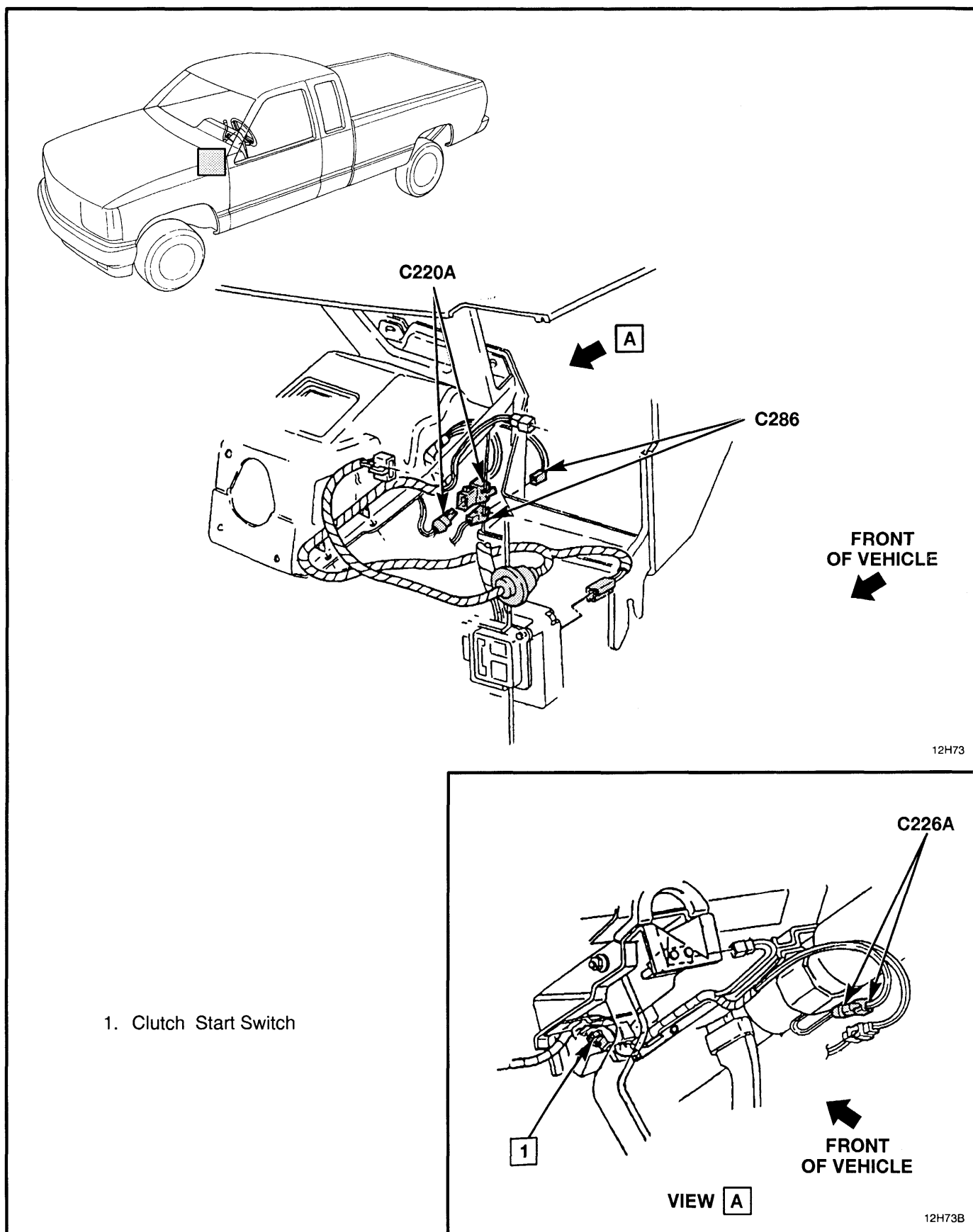
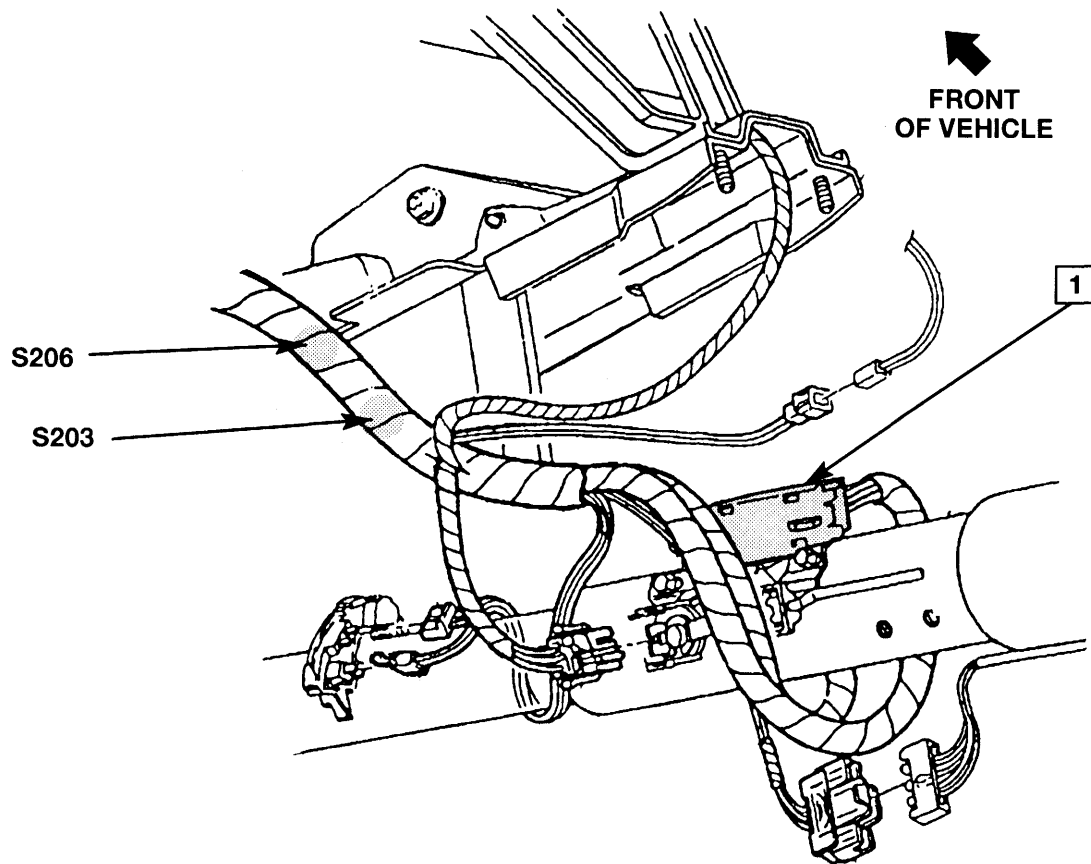
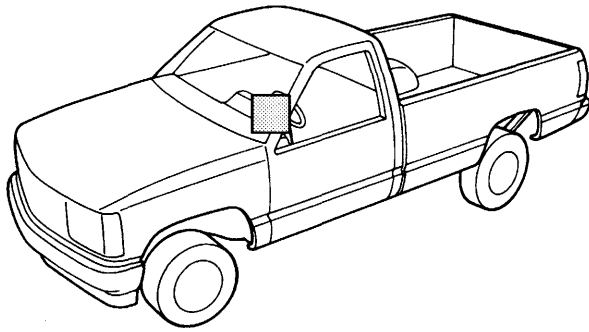


Figure 5 — Cruise Control Wiring



1. Ignition Switch

Figure 6 — LH Side of Steering Column Wiring

## 8A-10-12 POWER DISTRIBUTION

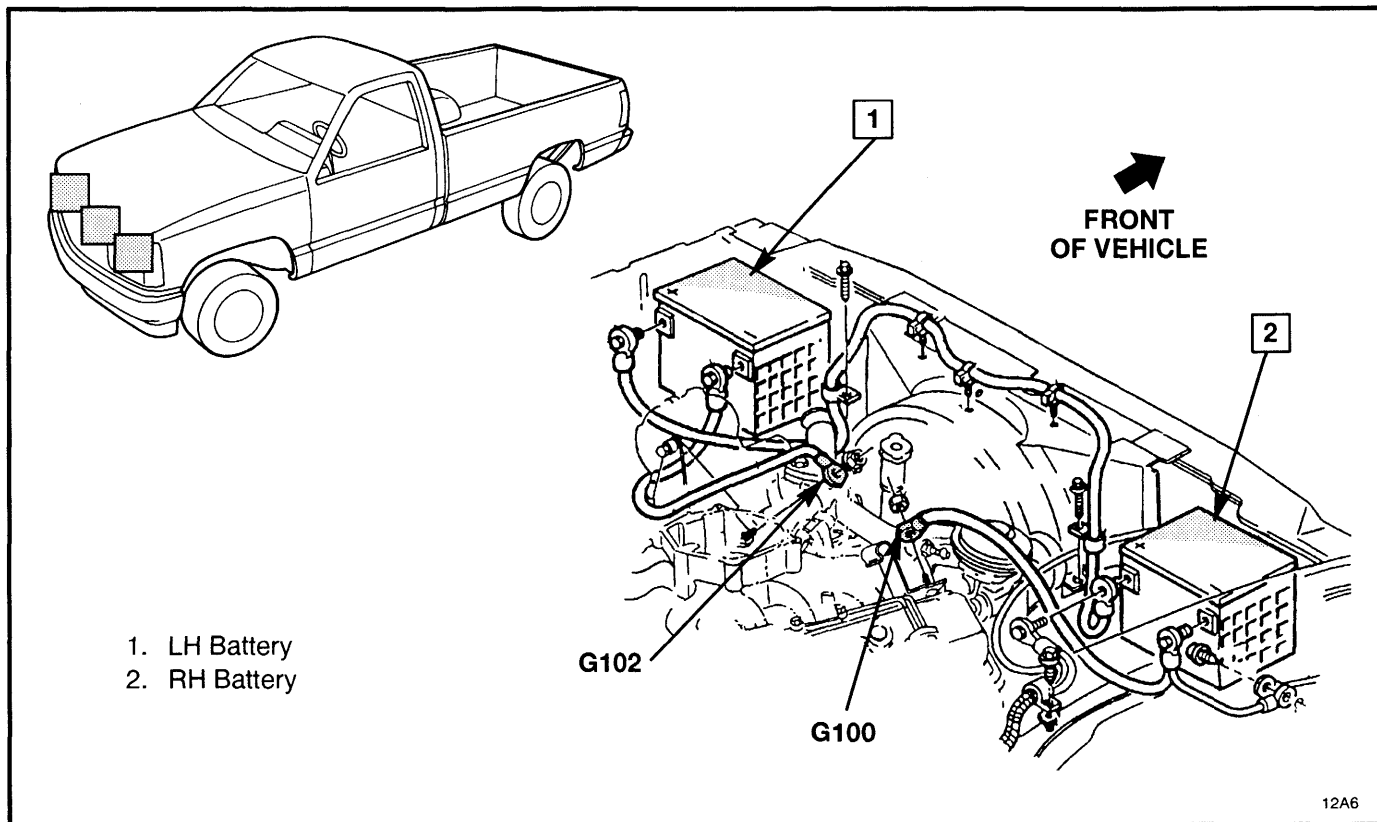


Figure 7 — Battery Cables, Diesel

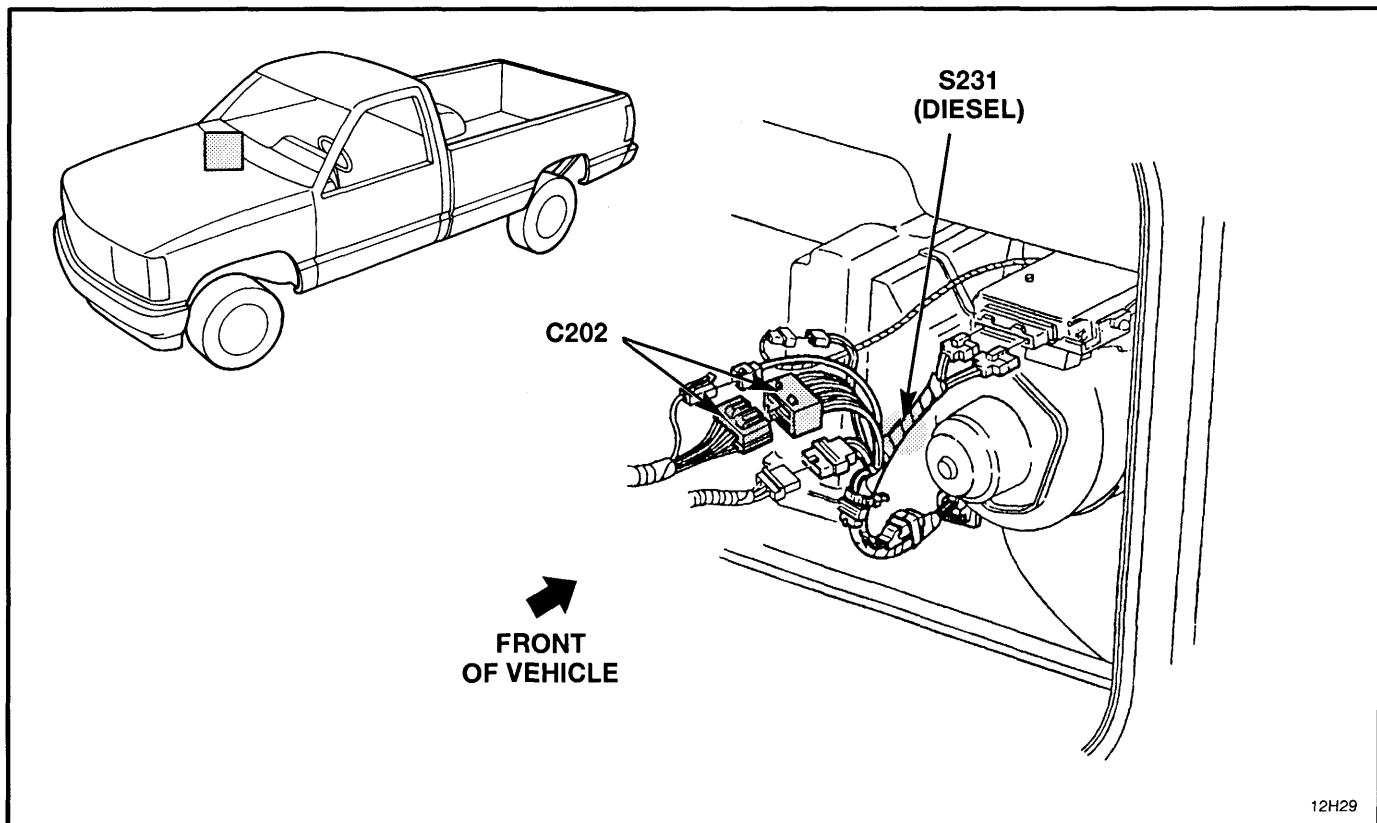


Figure 8 — Behind RH Side of I/P

## COMPONENT LOCATION

Page — Figure

|                          |                            |       |   |
|--------------------------|----------------------------|-------|---|
| Convenience Center ..... | Under LH side of I/P ..... | 11-32 | 3 |
| Fuse Block .....         | Lower LH side of I/P ..... | 11-32 | 3 |

## CONNECTORS:

|            |                                                      |           |    |
|------------|------------------------------------------------------|-----------|----|
| C100 ..... | At bulkhead connector .....                          | Not Shown |    |
| C200 ..... | Under RH side of I/P, near blower motor .....        | 11-35     | 6  |
| C202 ..... | Behind RH side of I/P .....                          | Not Shown |    |
| C230 ..... | At heater-A/C control .....                          | 11-34     | 5  |
| C266 ..... | At steering column under cowl .....                  | Not Shown |    |
| C273 ..... | Behind LH side of I/P, near convenience center ..... | Not Shown |    |
| C296 ..... | Under LH side of I/P .....                           | Not Shown |    |
| C326 ..... | LH body hinge pillar .....                           | Not Shown |    |
| C327 ..... | LH body hinge pillar .....                           | 11-33     | 4  |
| C328 ..... | RH body hinge pillar .....                           | 11-33     | 4  |
| C382 ..... | Above overhead console .....                         | 11-37     | 10 |
| C476 ..... | At RH D-pillar .....                                 | 11-36     | 9  |

## GROMMETS:

|            |                                                                        |           |   |
|------------|------------------------------------------------------------------------|-----------|---|
| P100 ..... | LH side of cowl .....                                                  | Not Shown |   |
| P102 ..... | Lower LH cowl, above convenience center .....                          | 11-36     | 8 |
| P105 ..... | LH rear engine compartment at cowl left of<br>bulkhead connector ..... | 11-31     | 2 |

## SPLICES:

|            |                                                                                    |           |    |
|------------|------------------------------------------------------------------------------------|-----------|----|
| S113 ..... | LH rear, behind engine harness .....                                               | 11-31     | 1  |
| S115 ..... | LH side of engine, near bulkhead connector .....                                   | Not Shown |    |
| S170 ..... | RH side near headlamp .....                                                        | Not Shown |    |
| S208 ..... | Behind LH side of I/P .....                                                        | 11-32     | 3  |
| S213 ..... | Under LH side of I/P .....                                                         | 11-32     | 3  |
| S217 ..... | Under LH side of I/P .....                                                         | Not Shown |    |
| S234 ..... | Cruise control harness, near convenience center .....                              | 11-36     | 8  |
| S238 ..... | Engine harness, near PCM .....                                                     | 11-35     | 6  |
| S242 ..... | Under LH side of I/P .....                                                         | 11-32     | 3  |
| S244 ..... | Engine harness, near P101 .....                                                    | 11-35     | 6  |
| S251 ..... | Under LH side of I/P .....                                                         | 11-32     | 3  |
| S259 ..... | RH upper side of engine .....                                                      | Not Shown |    |
| S278 ..... | Power window and door locks harness,<br>near convenience center .....              | 11-33     | 4  |
| S279 ..... | Power window and door locks harness,<br>near convenience center .....              | 11-33     | 4  |
| S290 ..... | Under LH side of I/P .....                                                         | 11-35     | 7  |
| S300 ..... | LH door sill area .....                                                            | Not Shown |    |
| S325 ..... | Auxiliary heater-A/C control harness, behind roof console ...                      | 11-37     | 10 |
| S330 ..... | Auxiliary heater-A/C control harness, at rear control lead ...                     | 11-37     | 10 |
| S500 ..... | Power window and lock harness LH front door, near power<br>window motor lead ..... | Not Shown |    |

## 8A-11-2 FUSE BLOCK DETAILS

### FUSE INFORMATION

| FUSE LOCATION                 | FUSE PART NO. | COLOR AND AMPERES | HOT CONDITION            | DESCRIPTION                                                                                                                                                                                                                    |
|-------------------------------|---------------|-------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACC-BATT<br>(Circuit Breaker) |               | 30 AMP            | HOT AT ALL TIMES         | DOOR LOCKS<br>REAR DEFOGGER<br>FOG LAMPS<br>FOG LAMP SWITCH PILOT LAMP                                                                                                                                                         |
| ACC-IGN<br>(Circuit Breaker)  |               | 30 AMP            | HOT IN ACC OR RUN        | POWER WINDOWS                                                                                                                                                                                                                  |
| A/C HTR                       | 12004010      | WHITE<br>25 AMP   | HOT IN RUN               | HEATER OR AIR CONDITIONING<br>AUXILIARY BATTERY RELAY<br>FOUR-WHEEL DRIVE INDICATOR                                                                                                                                            |
| BRAKE                         | 12004008      | LT BLU<br>15 AMP  | HOT IN RUN               | INSTRUMENT CLUSTER — SPEEDOMETER<br>REAR WHEEL ANTILOCK BRAKES                                                                                                                                                                 |
| CRANK                         | 12004005      | TAN<br>5 AMP      | HOT IN START             | CRANK                                                                                                                                                                                                                          |
| CTSY                          | 12004009      | YELLOW<br>20 AMP  | HOT AT ALL TIMES         | DOME LAMP<br>CARGO LAMP<br>COURTESY AND I/P COMPARTMENT BOX LAMP<br>RADIO MEMORY AND CLOCK<br>LOW BEAM HEADLAMPS                                                                                                               |
| DRL                           | 12004008      | LT BLU<br>15 AMP  | HOT AT ALL TIMES         | DAYTIME RUNNING LAMPS (CANADIAN ONLY)                                                                                                                                                                                          |
| ECM-IGN                       | 12004007      | RED<br>10 AMP     | HOT IN START OR RUN      | AIR DIVERTER<br>IGNITION SPARK CONTROL<br>EXHAUST GAS RECIRCULATION<br>ECM — IGNITION<br>REAR WHEEL ANTILOCK BRAKE SWITCH                                                                                                      |
| GAGES                         | 12004009      | YELLOW<br>20 AMP  | HOT IN ACC OR RUN        | CRUISE CONTROL<br>REAR DEFOGGER TIMER<br>AUXILIARY BATTERY RELAY FEED<br>SAFETY BELT WARNING<br>INSTRUMENT CLUSTER IGNITION FEED<br>DAYTIME RUNNING LAMPS RELAY                                                                |
| INJ A & B                     | 12004007      | RED<br>10 AMP     | HOT IN START OR RUN      | THROTTLE BODY FUEL INJECTORS                                                                                                                                                                                                   |
| PANEL LPS                     | 12004005      | TAN<br>5 AMP      | HOT WITH LIGHT SWITCH ON | CLUSTER ILLUMINATION<br>REAR WINDOW DEFOGGER SWITCH<br>ILLUMINATION<br>HEADLAMP "ON" WARNING<br>RADIO ILLUMINATION<br>HEATER OR AIR CONDITIONING ILLUMINATION<br>FOUR-WHEEL DRIVE ILLUMINATION<br>FOG LAMP SWITCH ILLUMINATION |
| PARK LP                       | 12004009      | YELLOW<br>20 AMP  | HOT AT ALL TIMES         | HORN RELAY<br>HORN FEED<br>LICENSE LAMPS<br>CLEARANCE LAMPS<br>ASHTRAY LAMP<br>PARK LAMPS<br>ENDGATE LAMPS W/DUAL REAR WHEELS<br>ROOF MARKER LAMPS<br>CAB CHASSIS REAR LAMPS<br>TRAILER/CAMPER LAMPS<br>CIGARETTE LIGHTER      |

**FUSE INFORMATION (CONTINUED)**

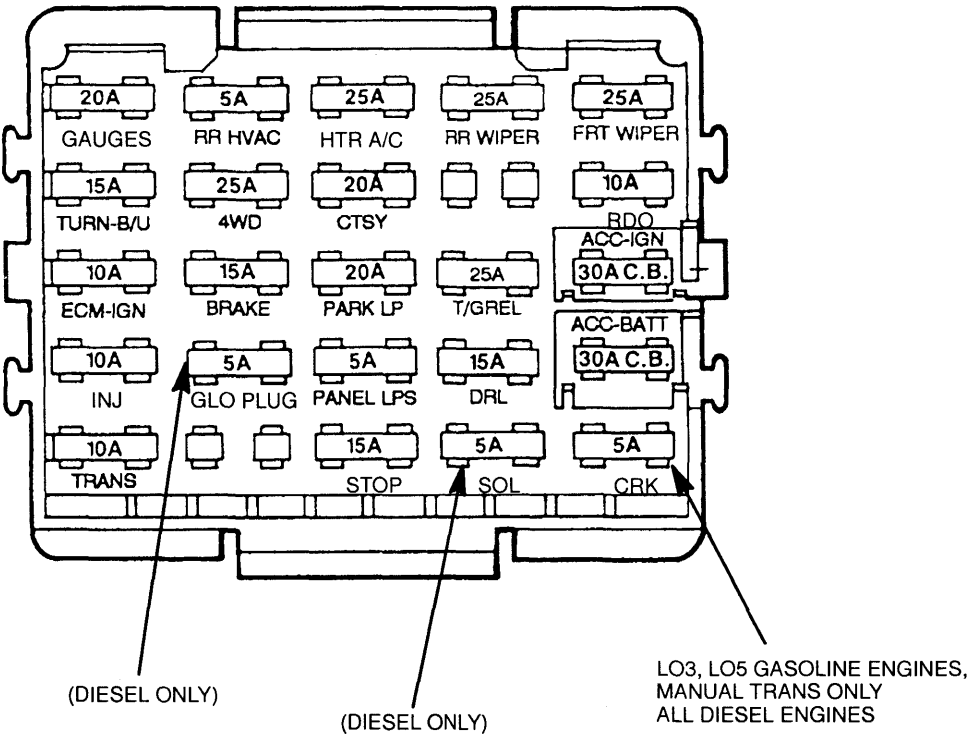
| <b>FUSE LOCATION</b> | <b>FUSE PART NO.</b> | <b>COLOR AND AMPERE</b> | <b>HOT CONDITION</b>   | <b>DESCRIPTION</b>                                                                        |
|----------------------|----------------------|-------------------------|------------------------|-------------------------------------------------------------------------------------------|
| RADIO                | 12004007             | RED<br>10 AMP           | HOT IN ACC<br>OR RUN   | RADIO FEED                                                                                |
| RR HVAC              | 12004005             | TAN<br>5 AMP            | HOT IN RUN             | REAR AIR CONDITIONING<br>REAR HEATER                                                      |
| STOP-HAZ             | 12004005             | TAN<br>15 AMP           | HOT AT<br>ALL TIMES    | HAZARD FLASHER<br>SAFETY BELT BUZZER<br>STOPLAMPS<br>REAR WHEEL ANTILOCK BRAKES<br>MEMORY |
| TRANS                | 12004007             | RED<br>10 AMP           | HOT IN<br>START OR RUN | TRANSMISSION                                                                              |
| TURN-B/U             | 12004008             | LT BLU<br>15 AMP        | HOT IN<br>START OR RUN | BACKUP LAMPS<br>TURN SIGNALS<br>CAB CHASSIS REAR LAMPS<br>TRAILER/CABLE HARNESS           |
| FRT WIPER            | 12004010             | WHITE<br>25 AMP         | HOT IN ACC<br>OR RUN   | WINDSHIELD WIPER<br>WINDSHIELD WASHER                                                     |
| 4WD                  | 12004010             | WHITE<br>25 AMP         | HOT IN RUN             | FOUR-WHEEL DRIVE                                                                          |
| RR WIPER             | 12004010             | WHITE<br>25 AMP         | HOT IN START<br>OR RUN | REAR WINDORW WIPER MOTOR                                                                  |
| T/GREL               | 12004010             | WHITE<br>25 AMP         | HOT AT<br>ALL TIMES    | REAR TAILGATE RELEASE                                                                     |

**RELAY DATA**

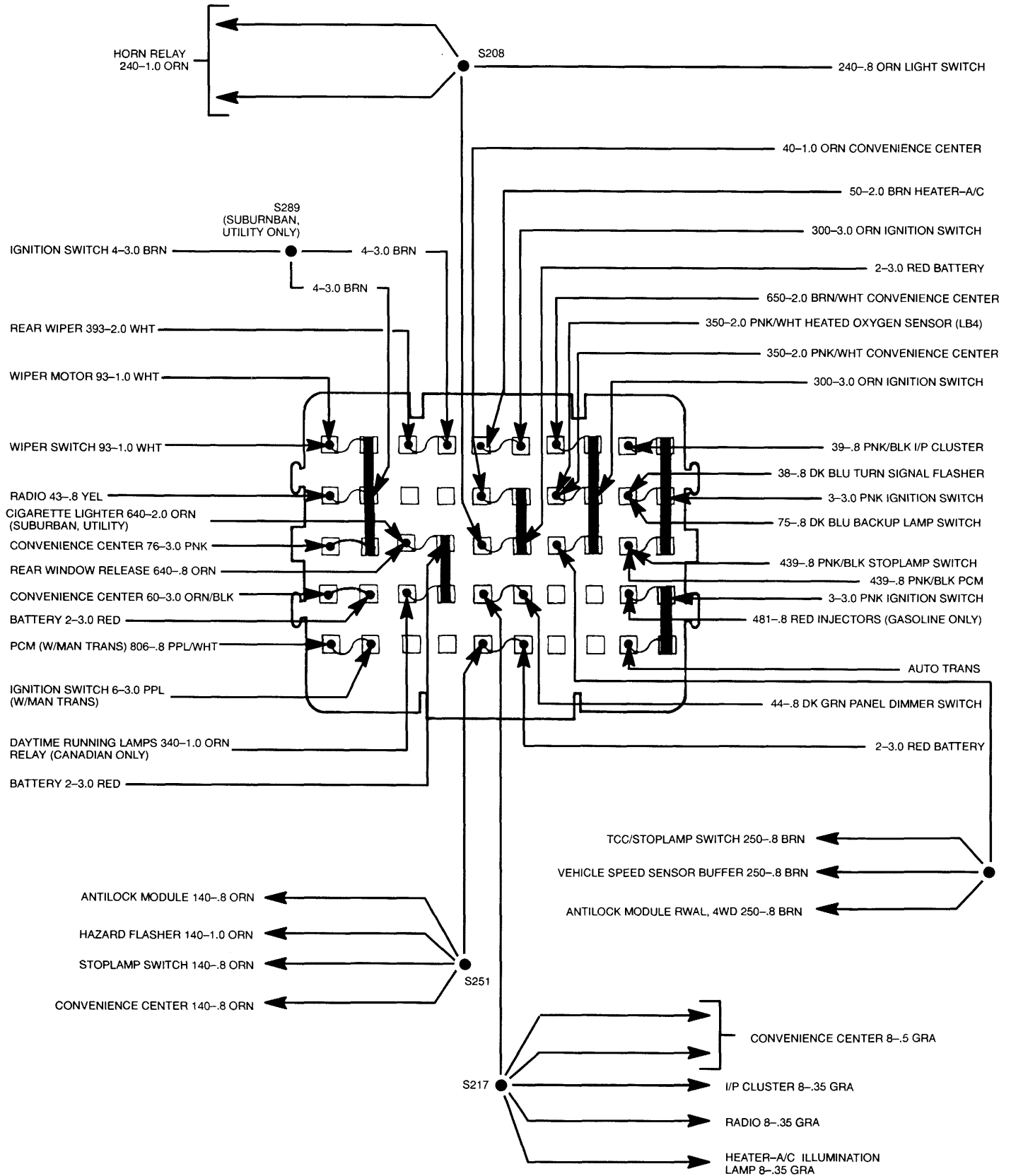
| <b>PART NUMBER</b> | <b>APPLICATION</b>                                                                                                                                                                                                                                             |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12065118           | POWER AMPLIFIER RELAY                                                                                                                                                                                                                                          |
| 12065122           | POWER DOOR LOCKS RELAY                                                                                                                                                                                                                                         |
| 14089936           | AUXILIARY COOLING FAN RELAY<br>COLD ADVANCE RELAY<br>FUEL PUMP RELAY<br>TRANSFER CASE RELAY<br>SNOWPLOW TURN SIGNAL RELAY                                                                                                                                      |
| 15555675           | AUXILIARY BATTERY RELAY                                                                                                                                                                                                                                        |
| 15591178           | A/C COMPRESSOR CLUTCH RELAY<br>DAYTIME RUNNING LAMPS RELAY (CANADIAN ONLY)<br>FOG LAMP RELAY<br>HI BLOWER RELAY, FRONT<br>HI BLOWER RELAY, REAR<br>LOW BLOWER RELAY, FRONT<br>LOW BLOWER RELAY, REAR<br>MEDIUM BLOWER RELAY, REAR<br>REAR WINDOW RELEASE RELAY |
| 25520198           | HORN RELAY                                                                                                                                                                                                                                                     |



8A-11-4 FUSE BLOCK DETAILS



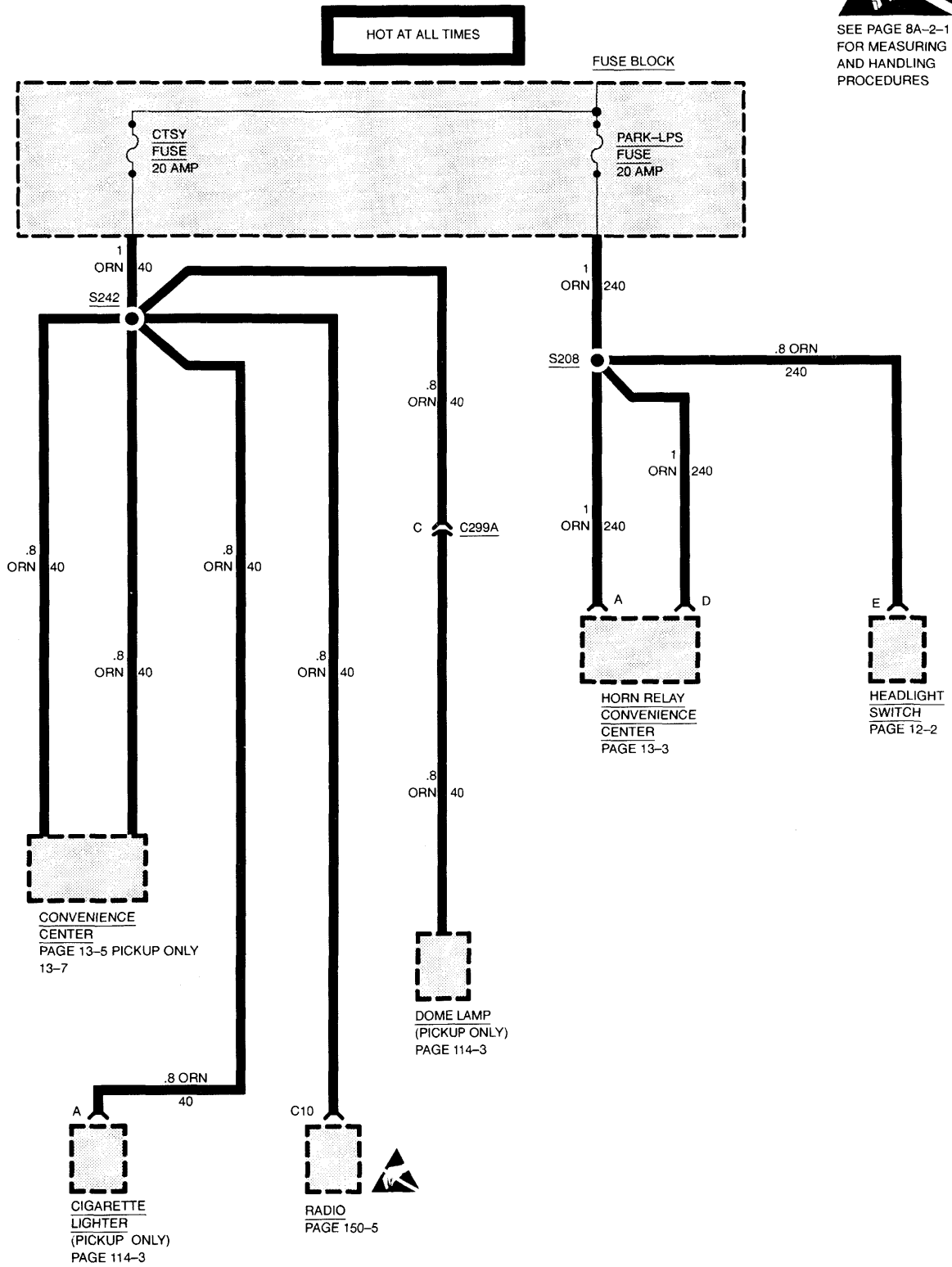
# FUSE BLOCK DETAILS 8A-11-5

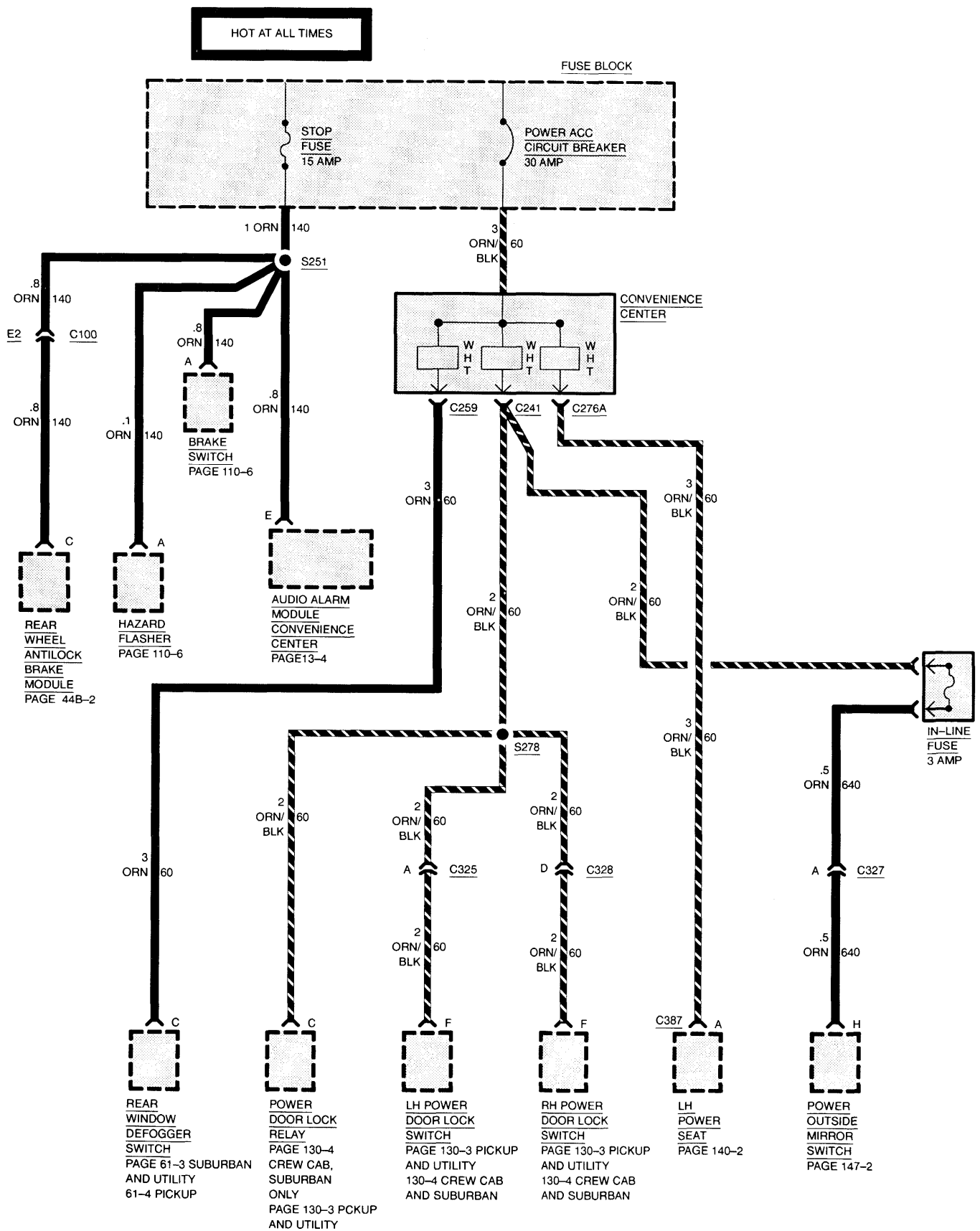


# 8A-11-6 FUSE BLOCK DETAILS



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

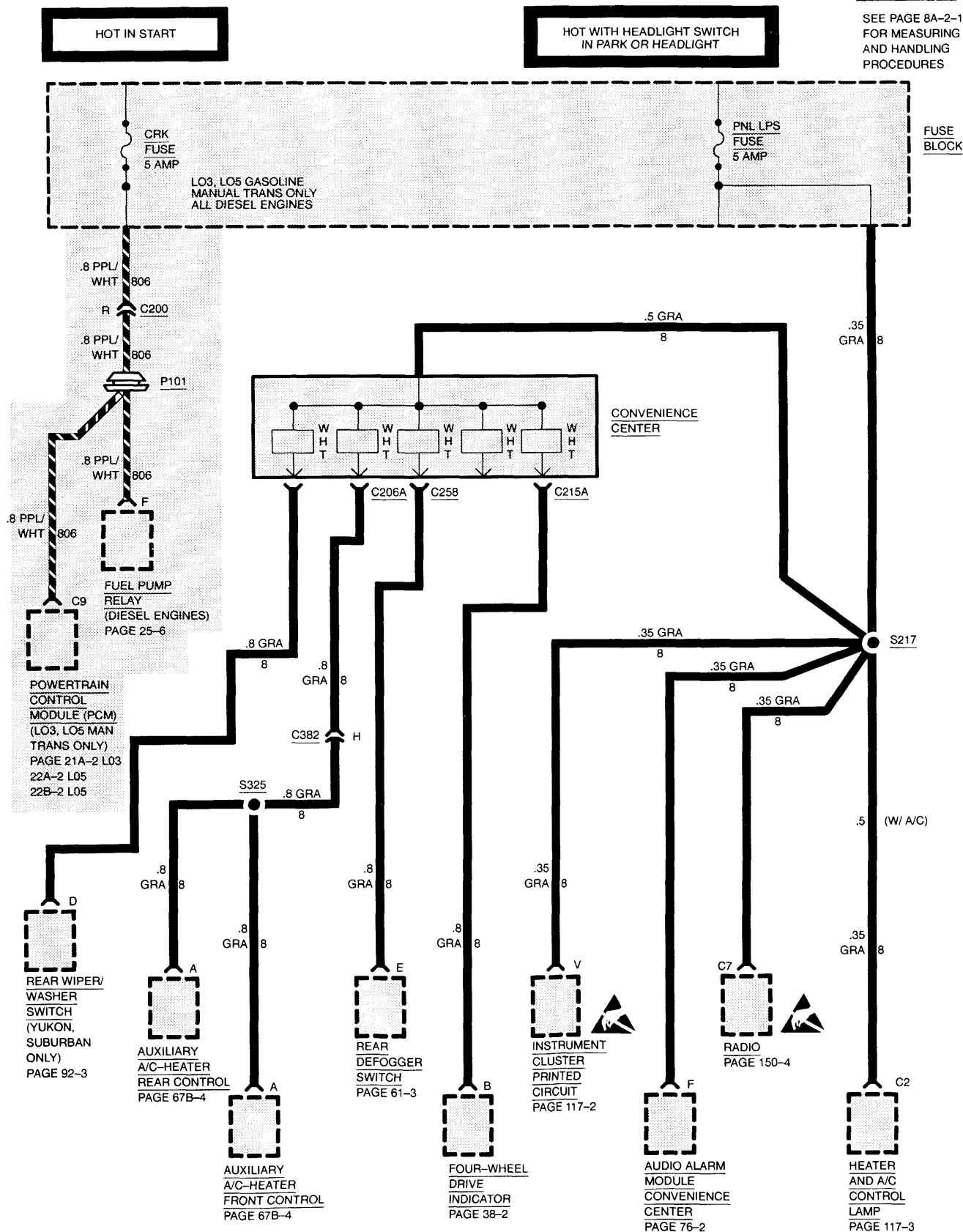




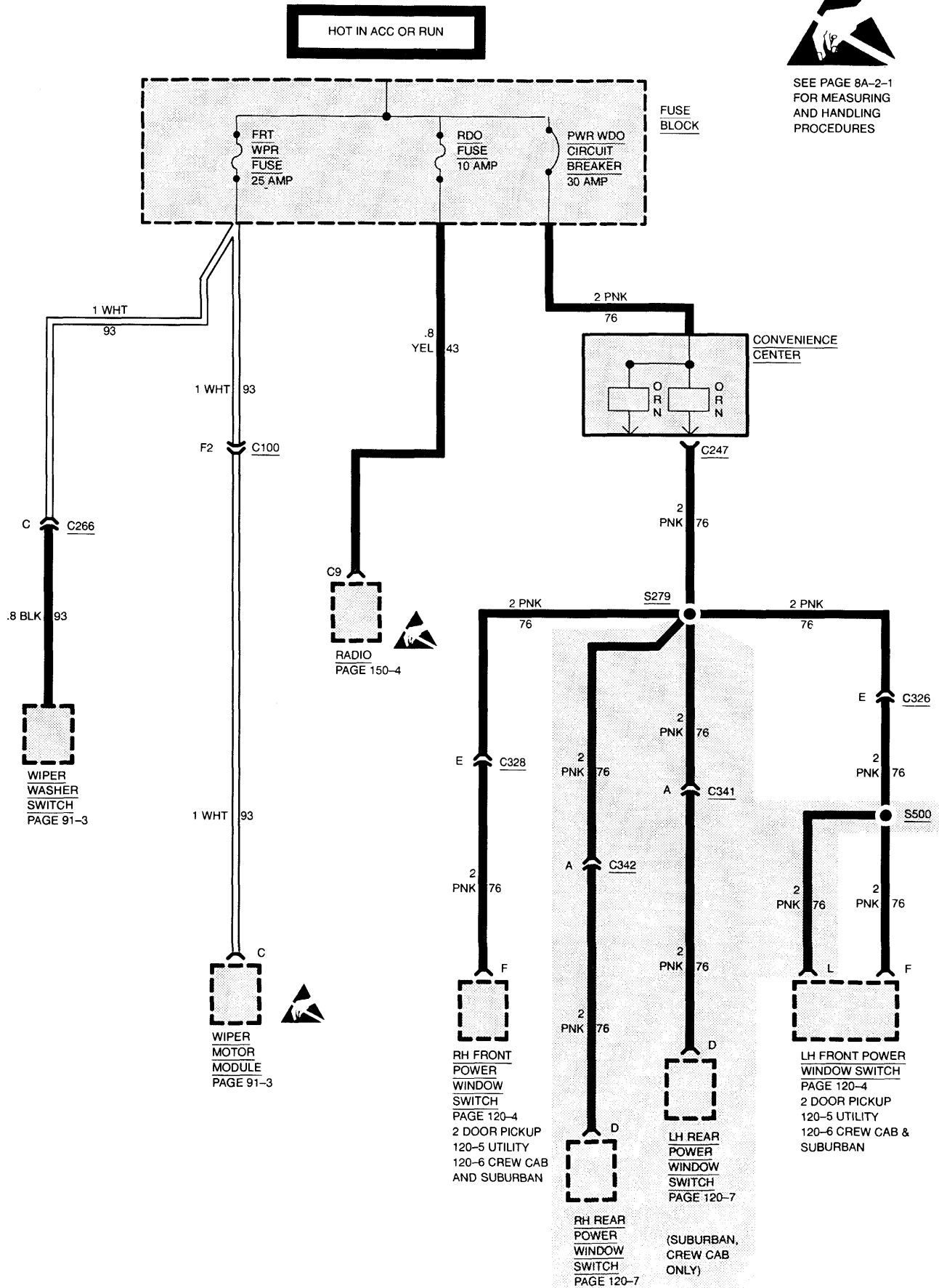
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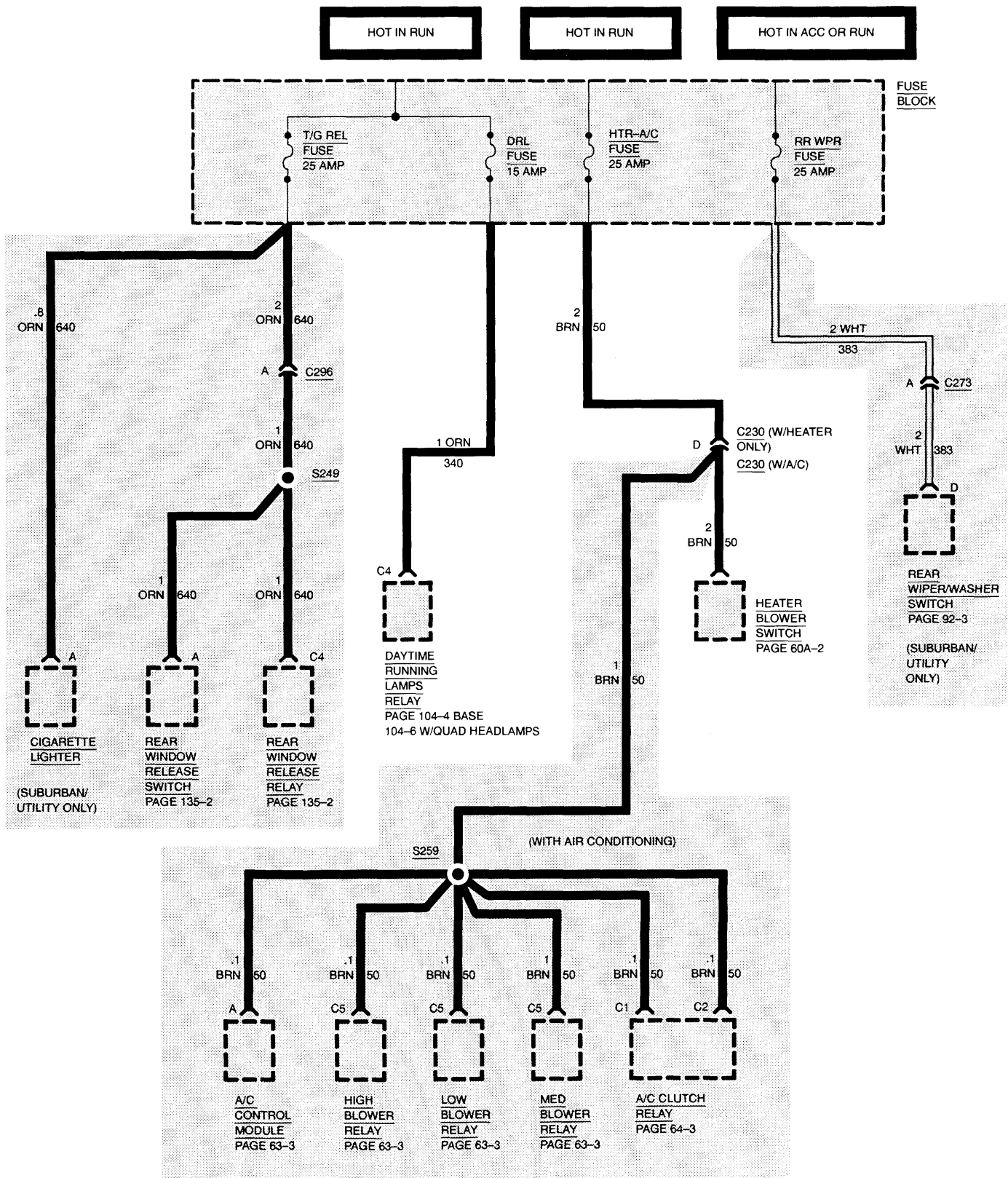
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



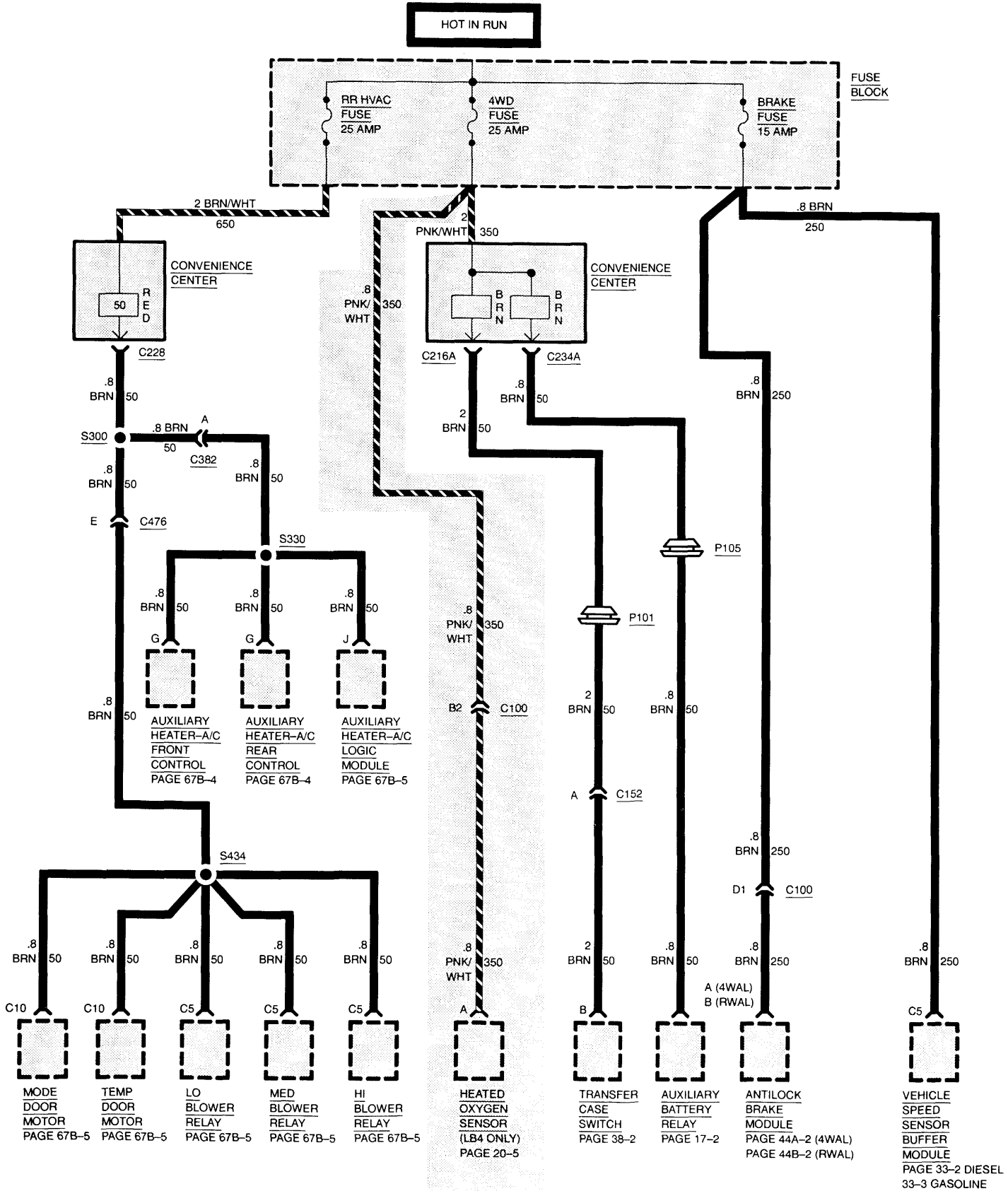
# FUSE BLOCK DETAILS 8A-11-9



# 8A-11-10 FUSE BLOCK DETAILS

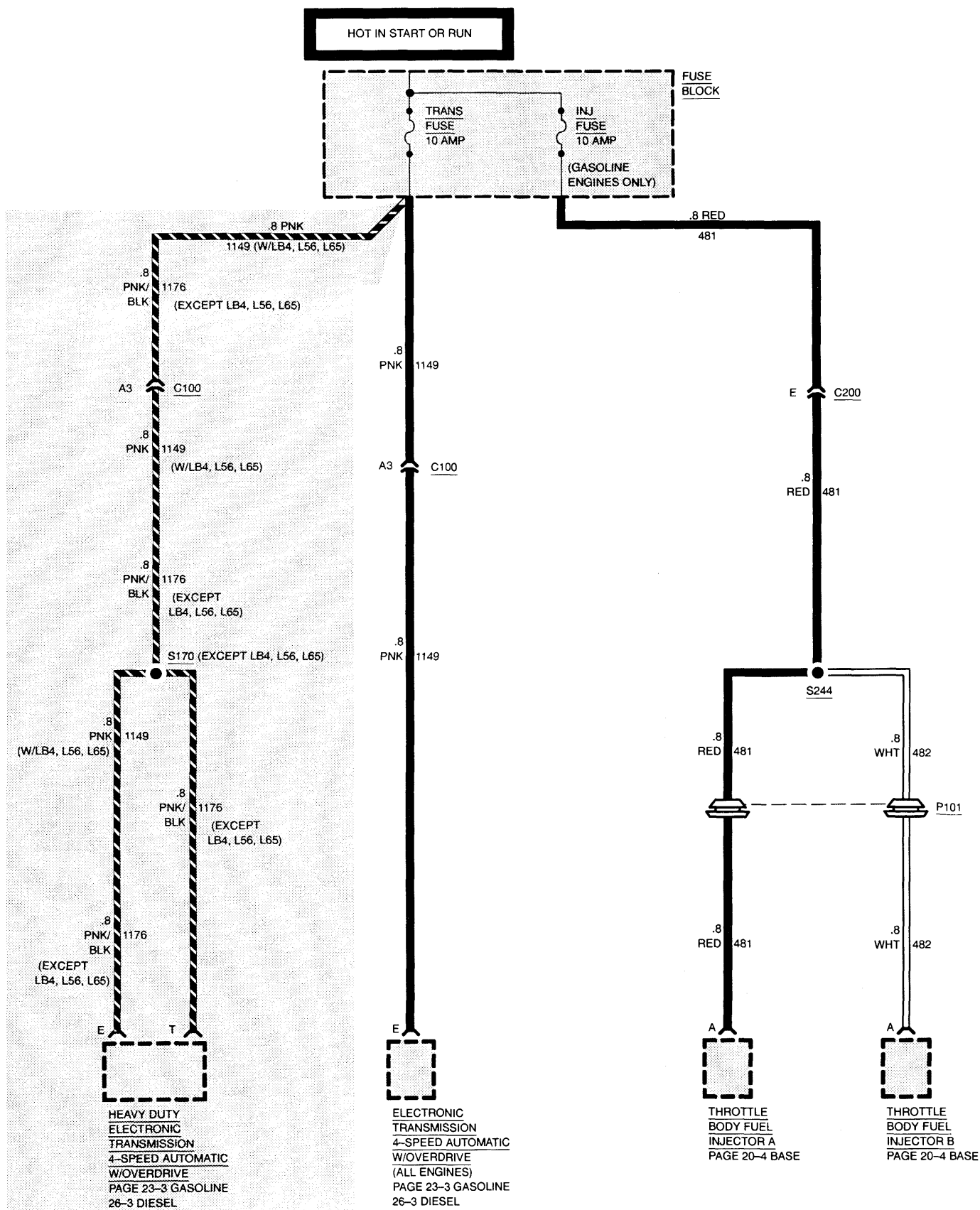


FUSE BLOCK DETAILS 8A-11-11



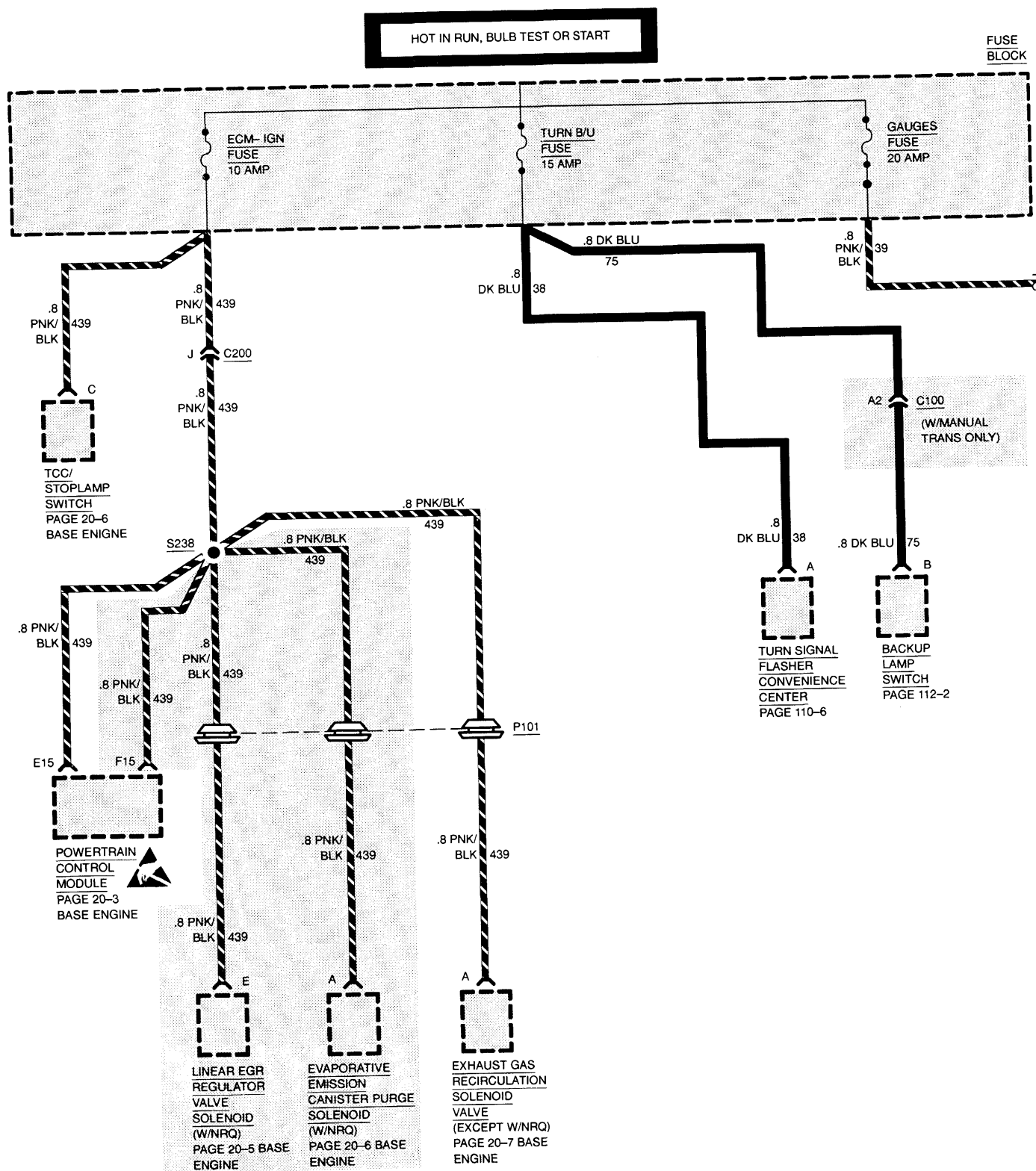


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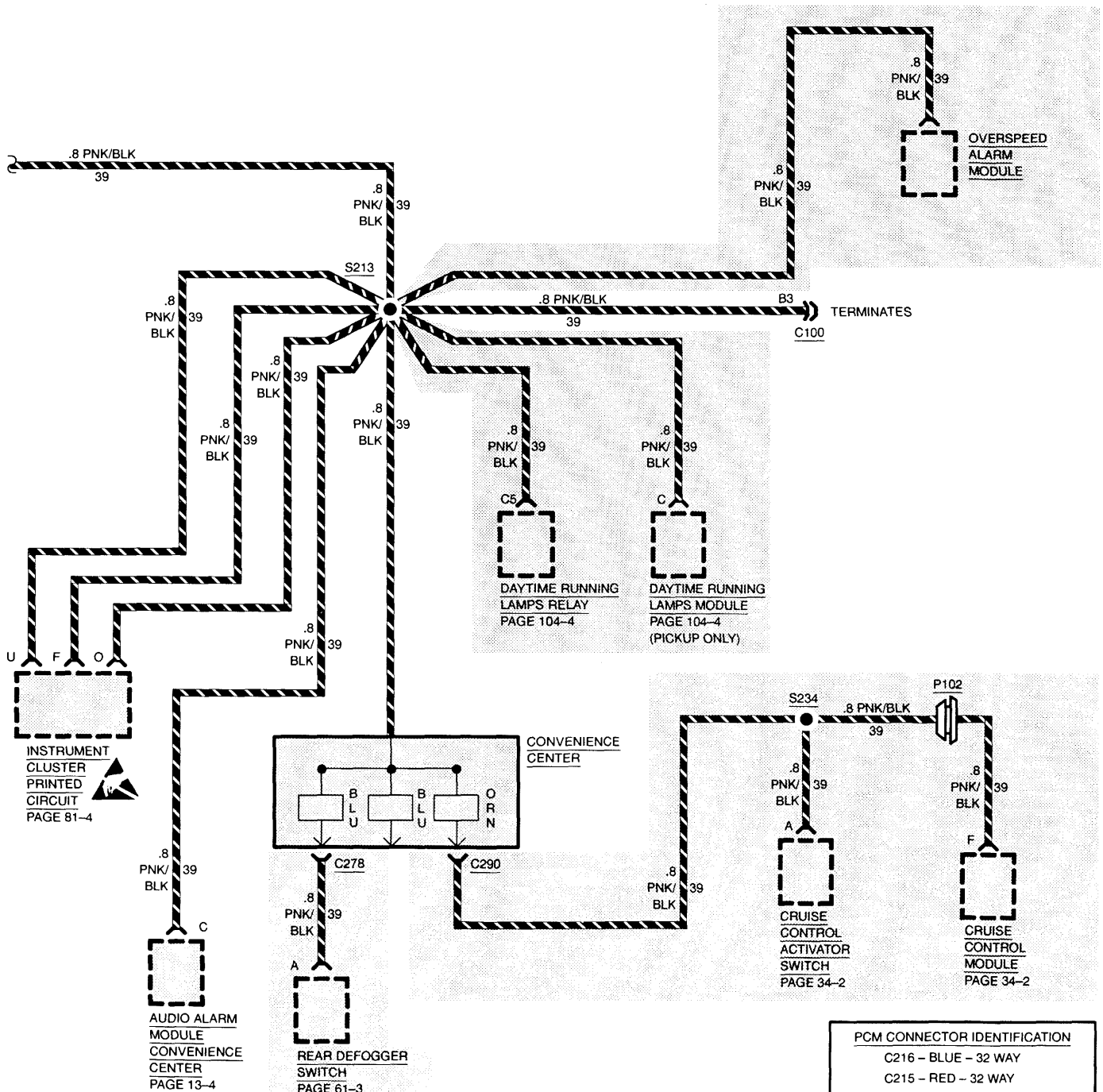
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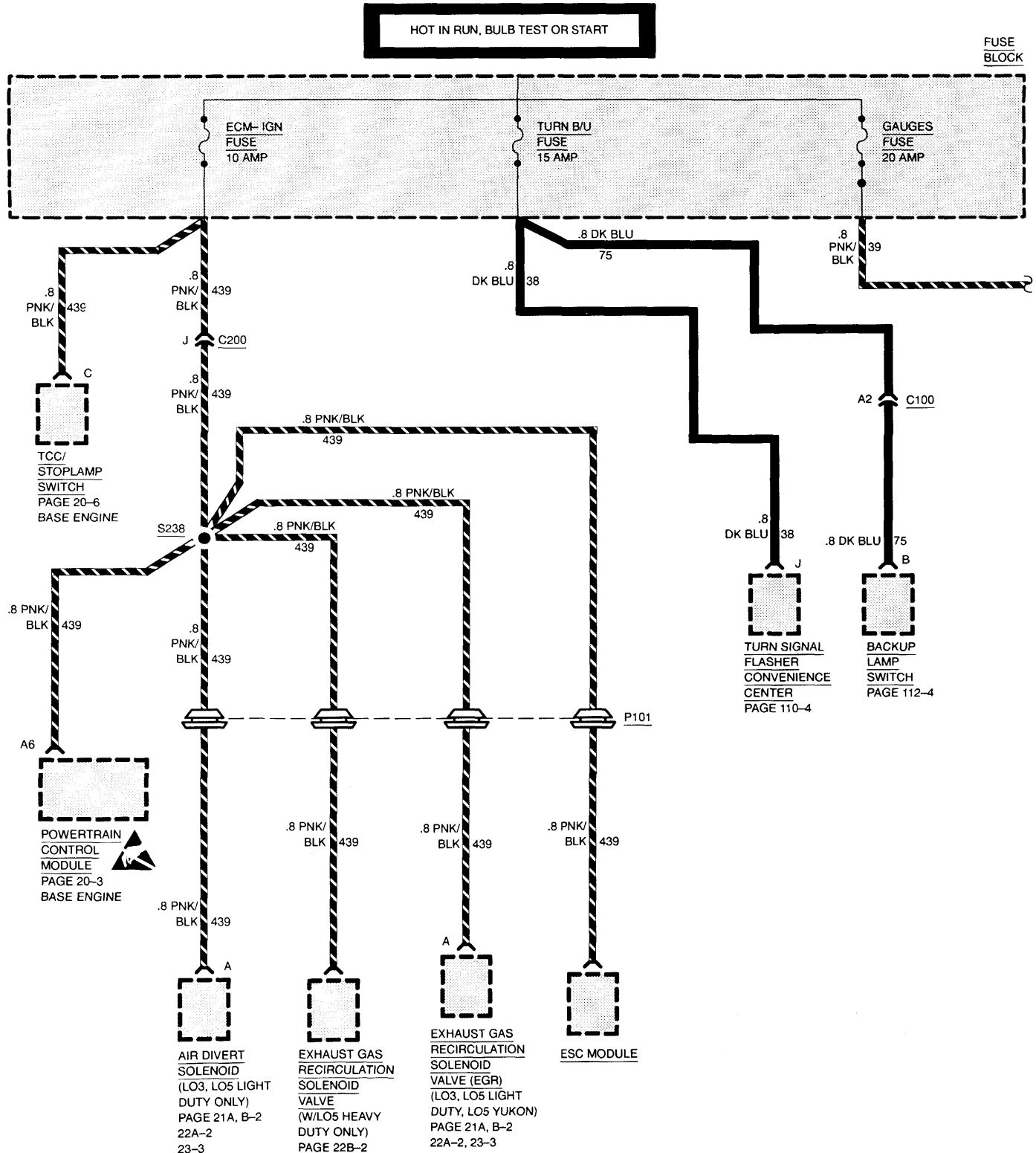




SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

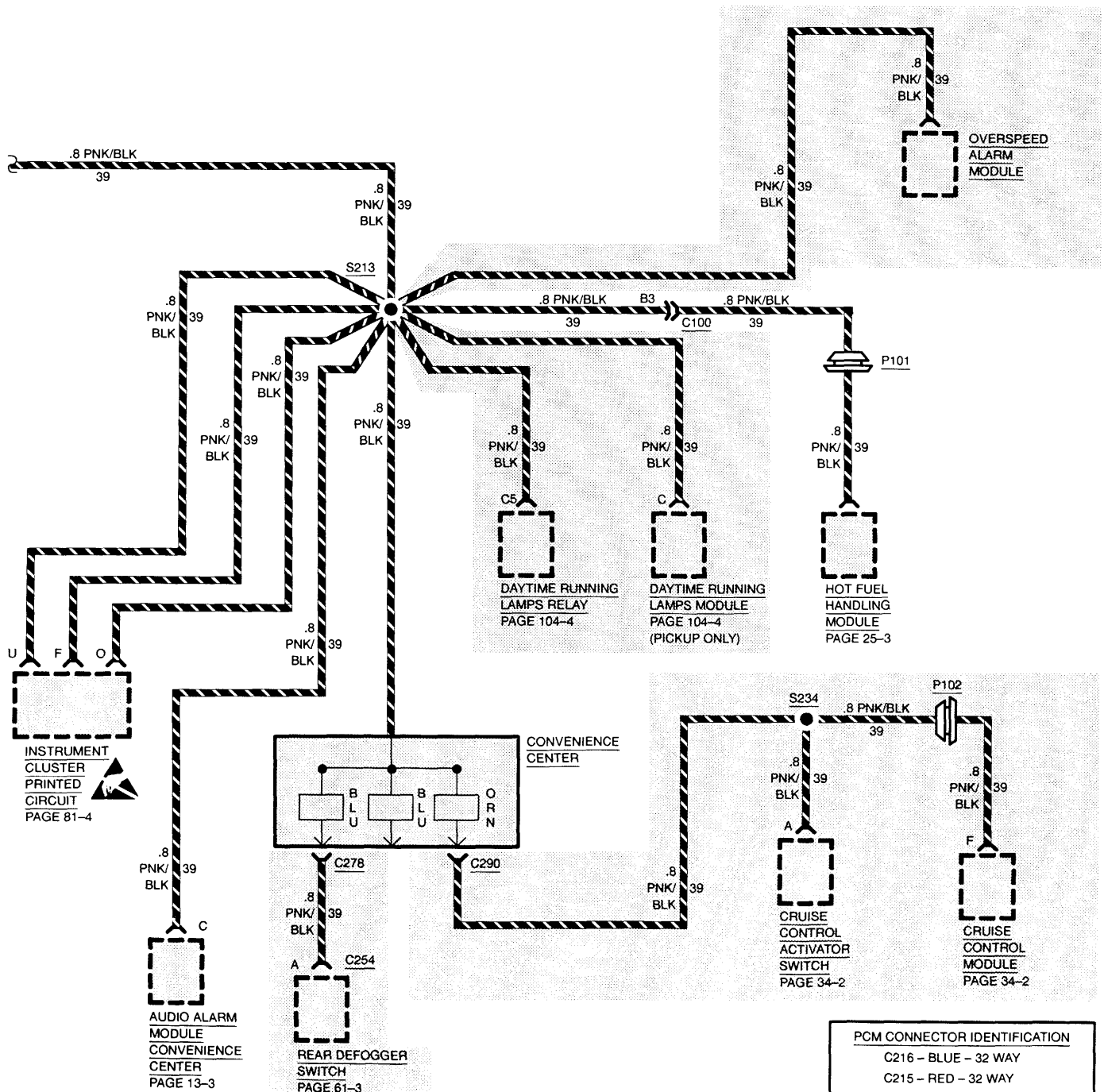


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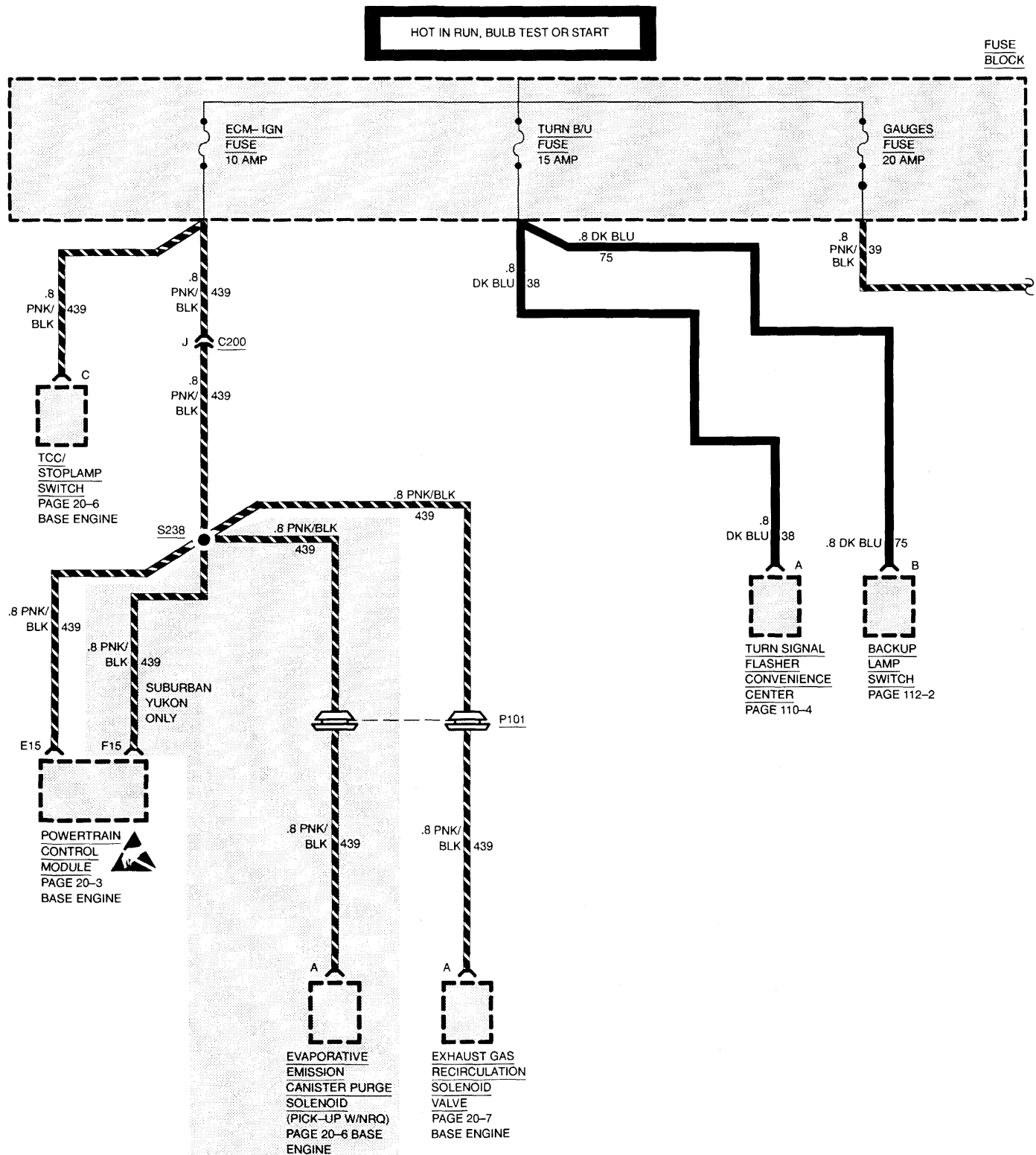




SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

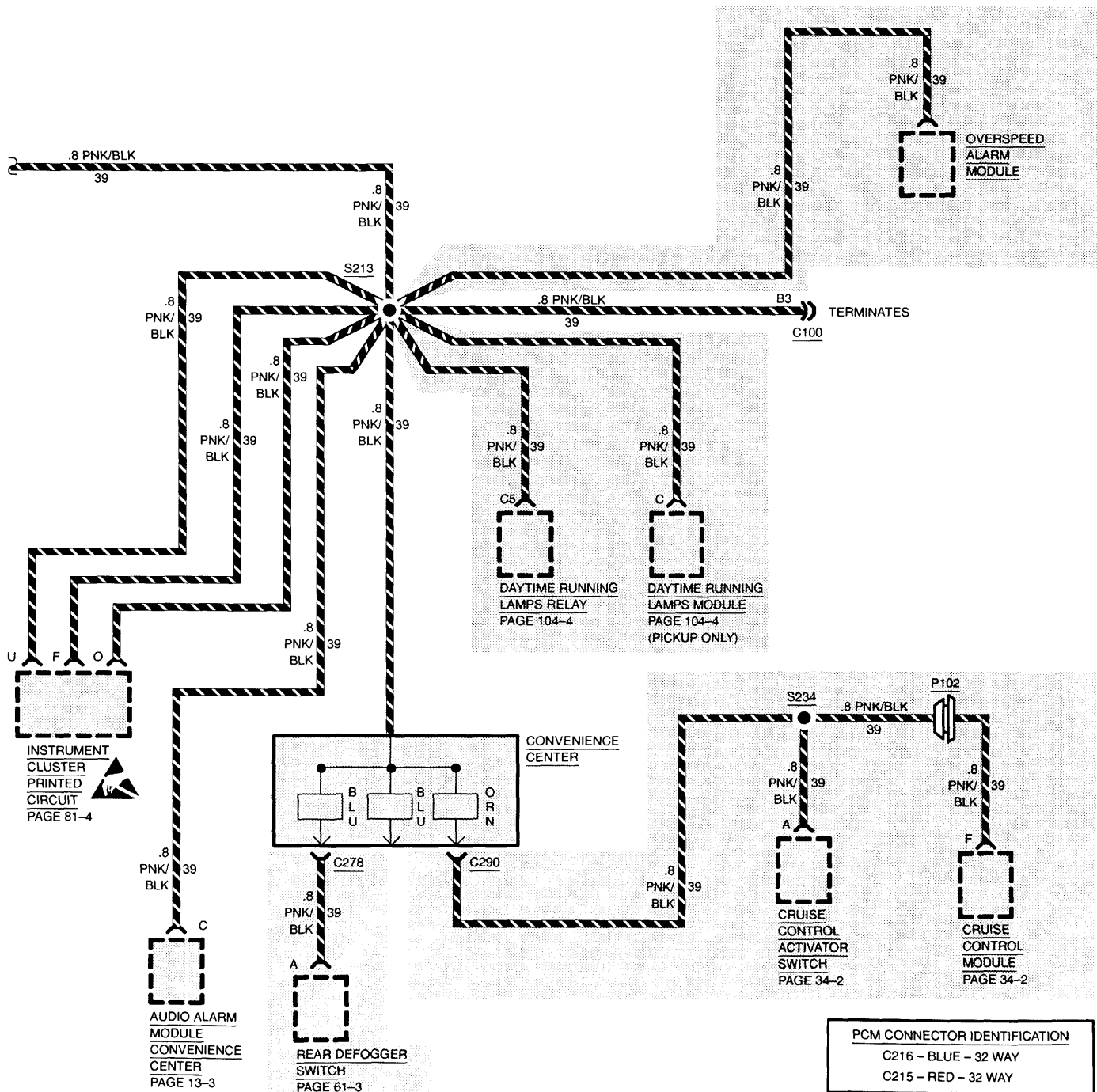


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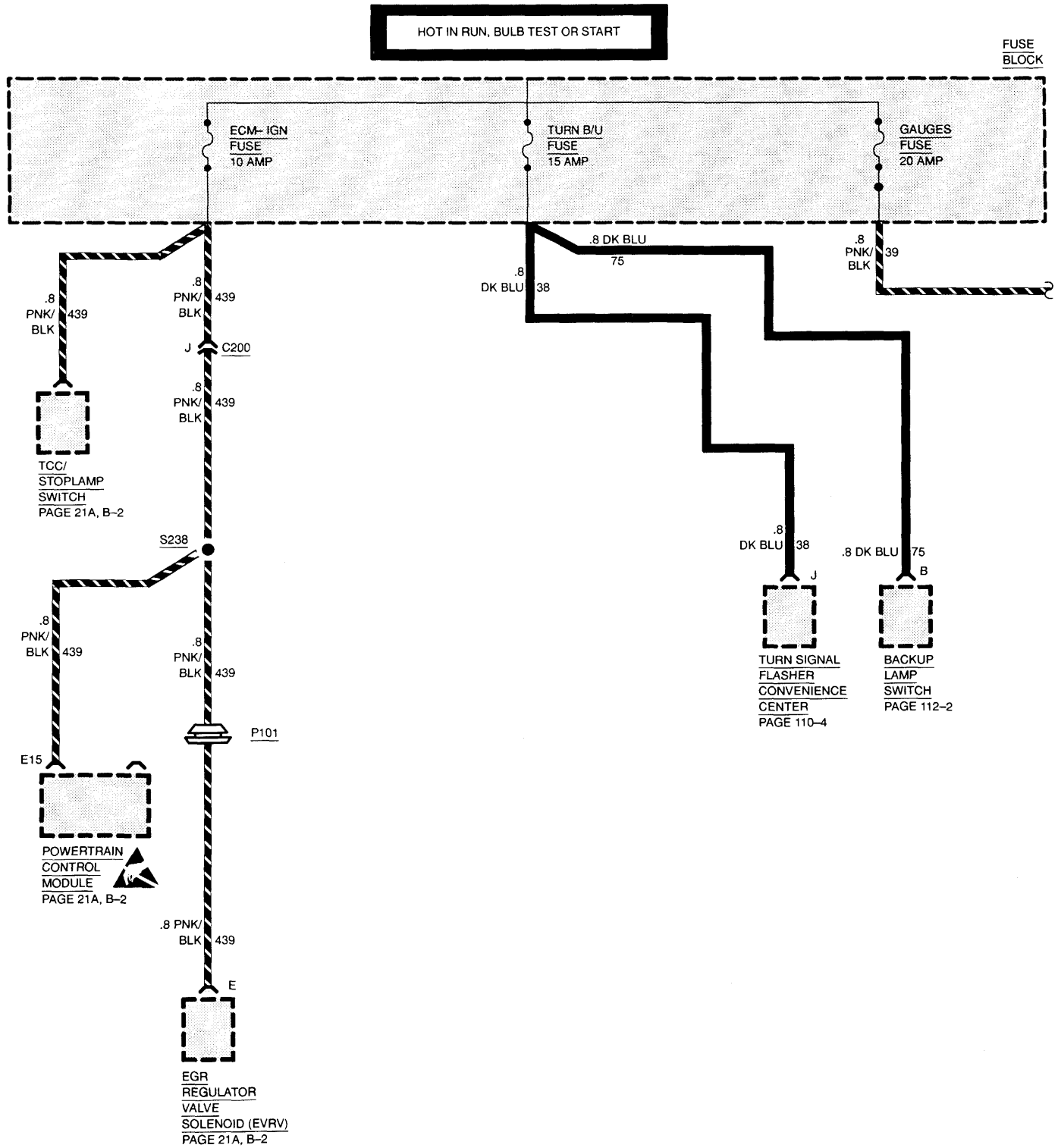


SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



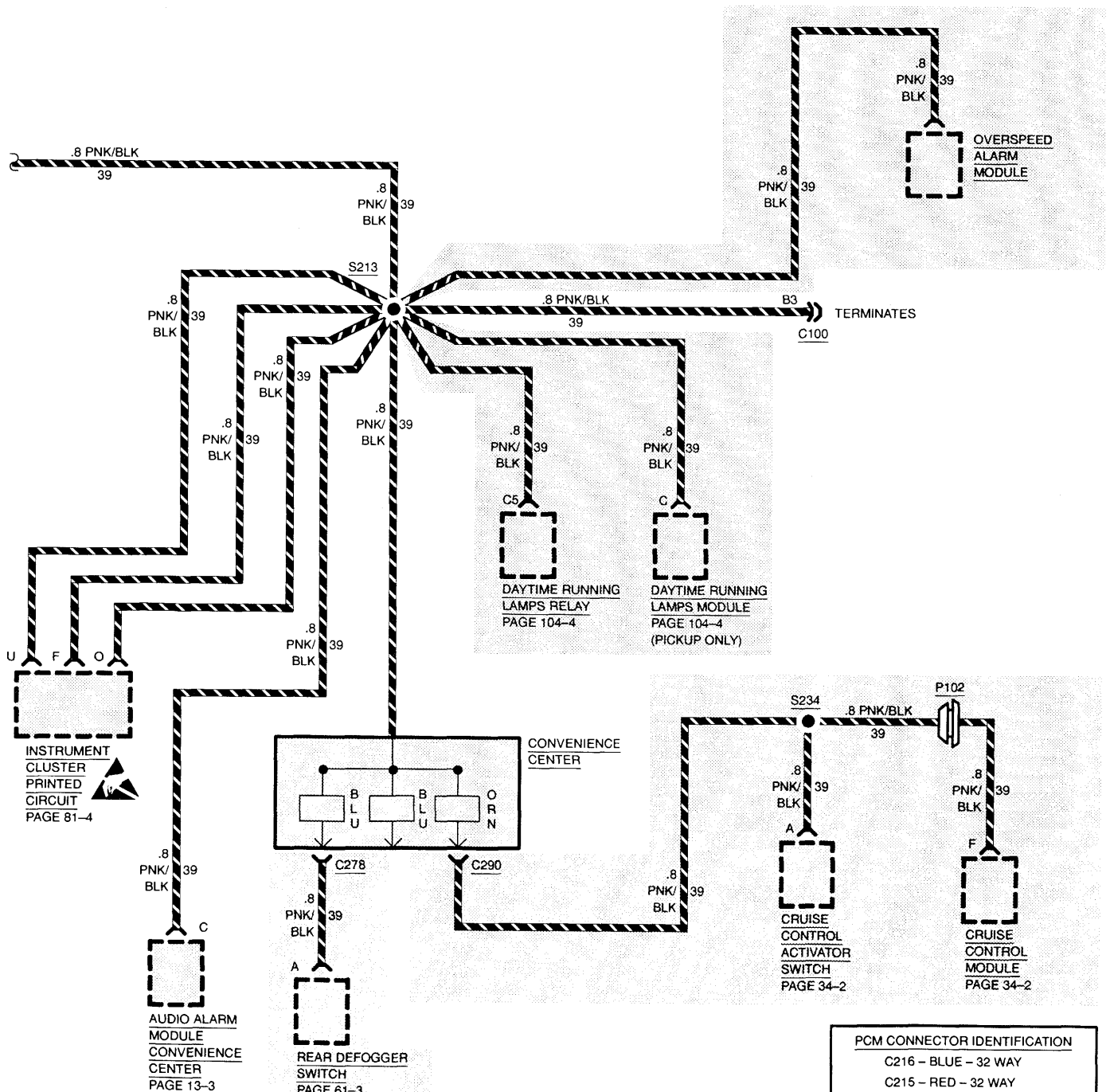


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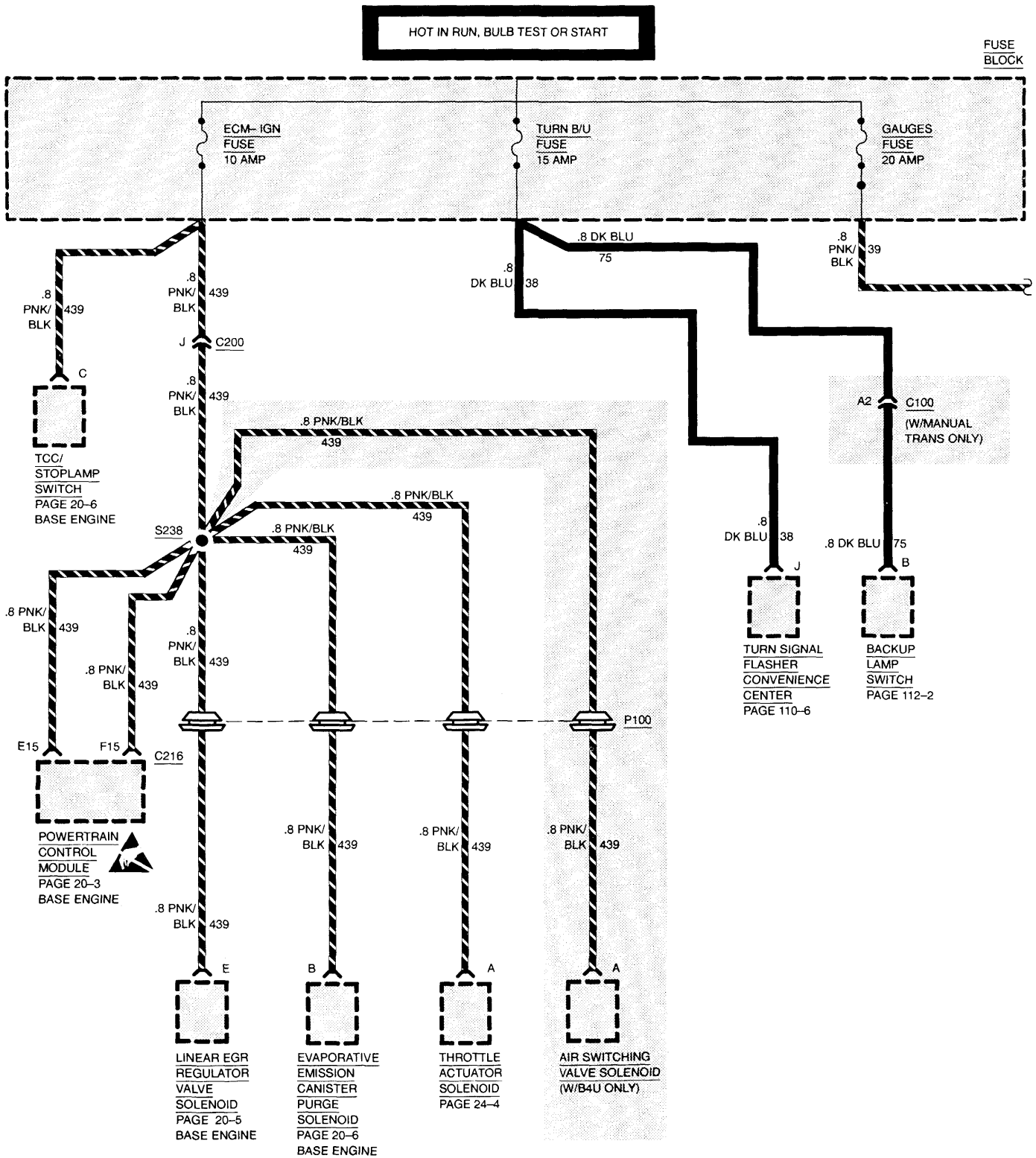




SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

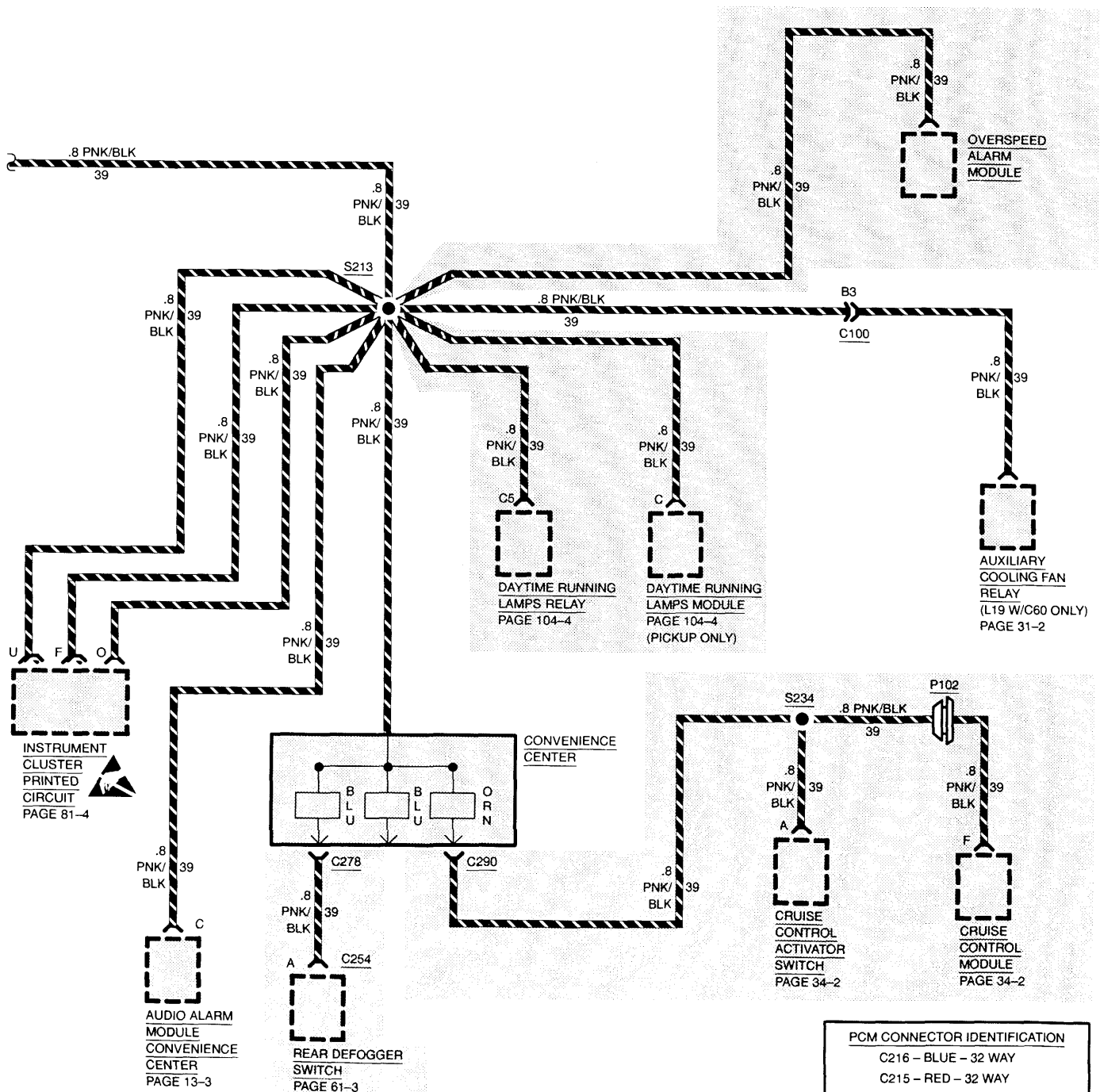


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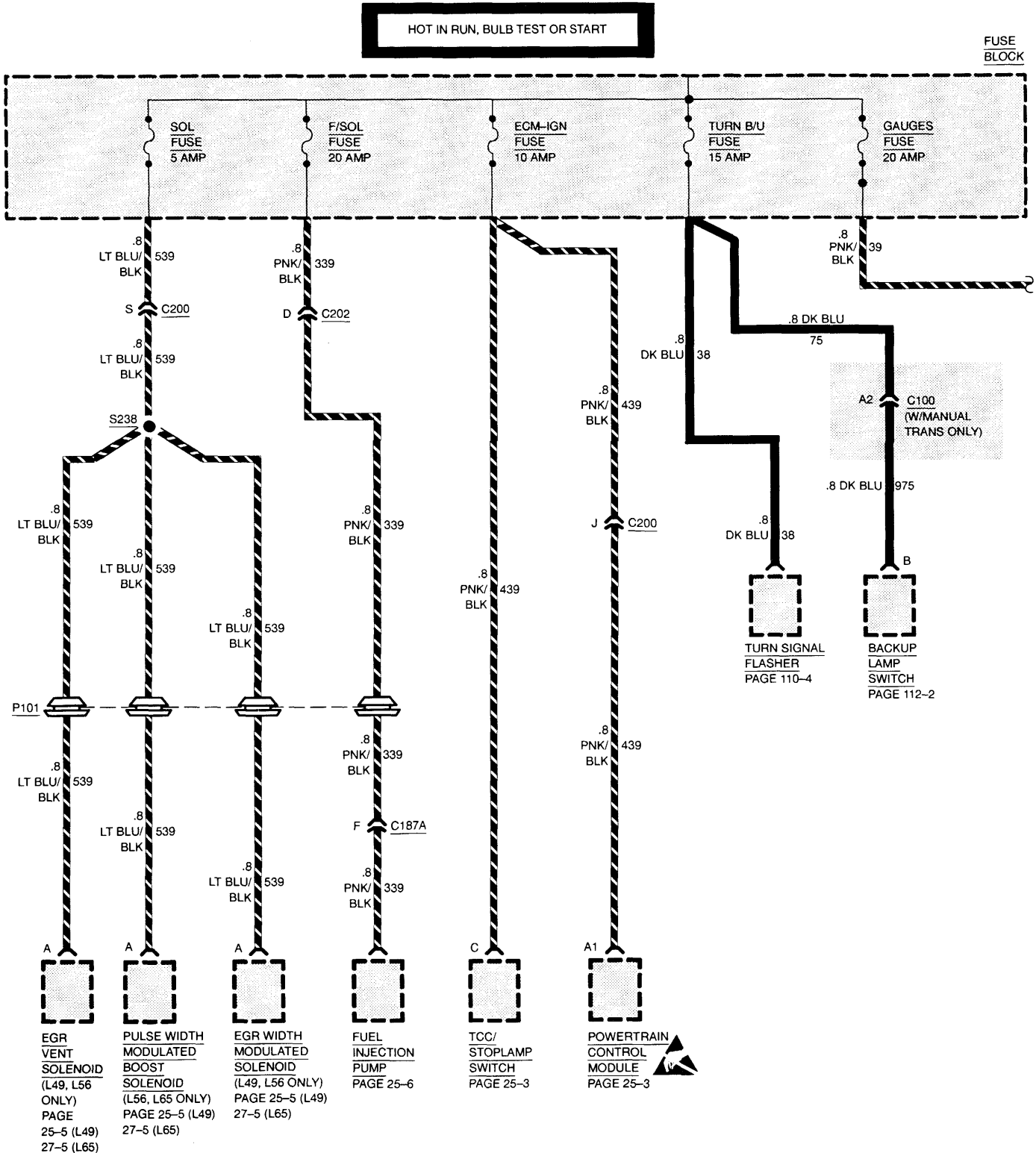




SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

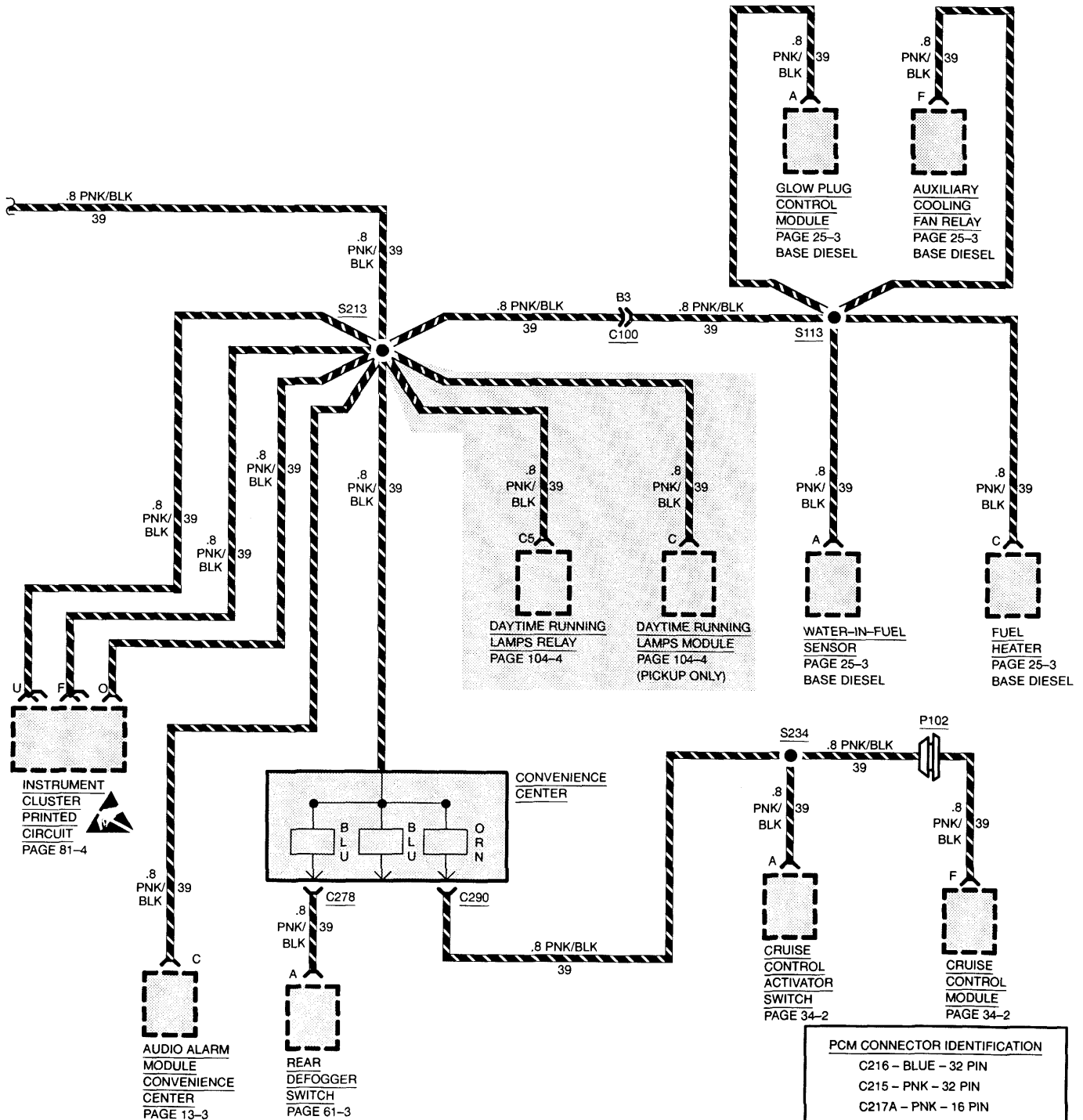


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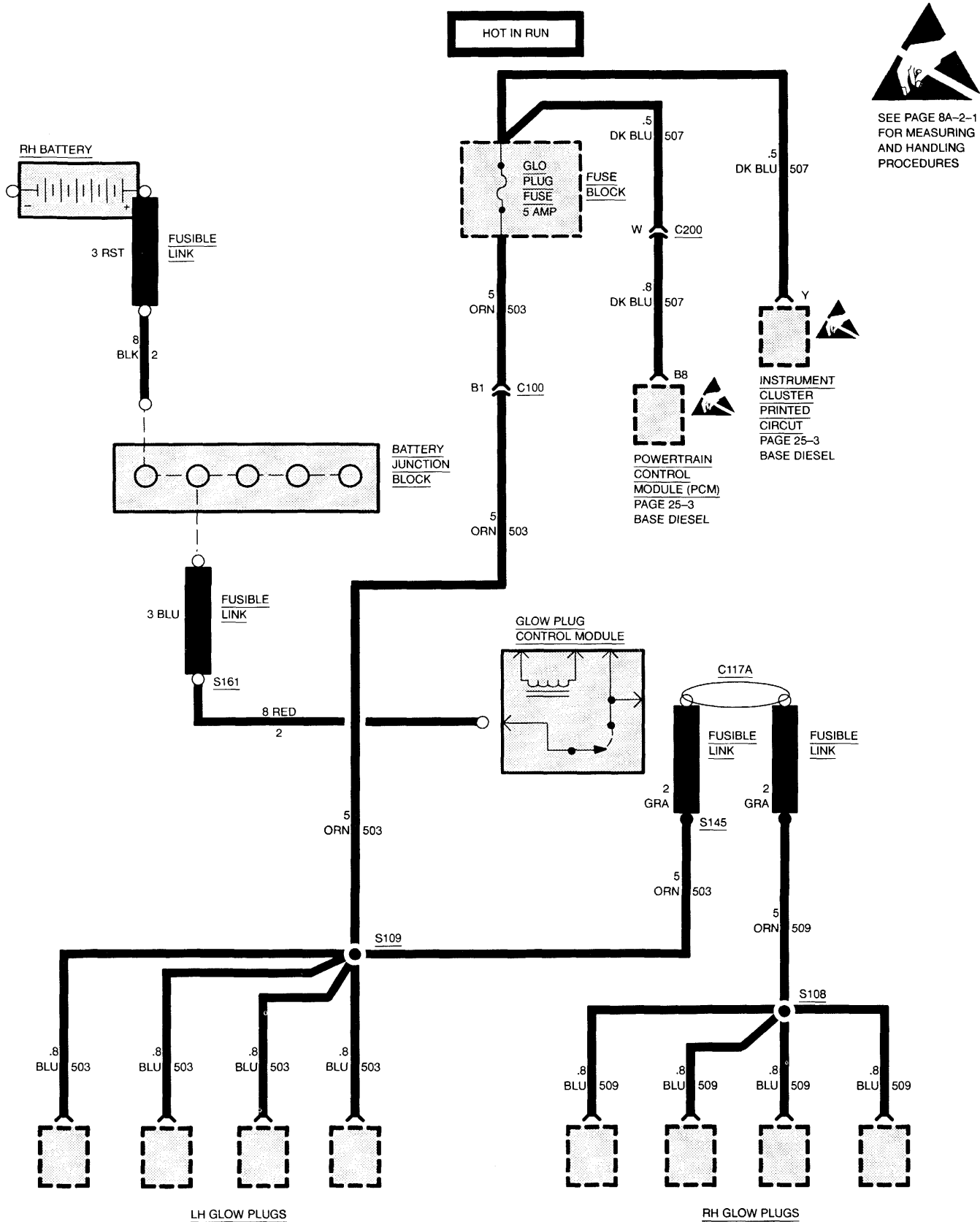




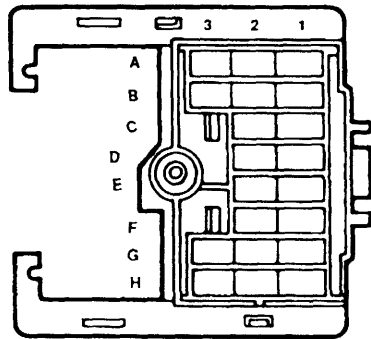
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## 8A-11-26 FUSE BLOCK DETAILS

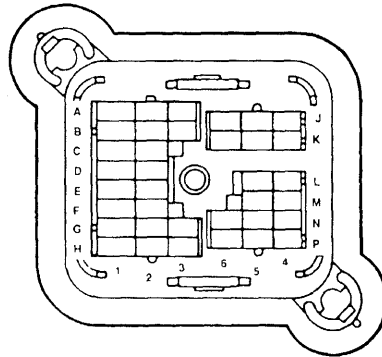


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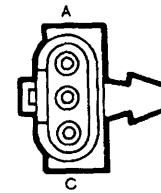
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



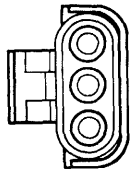
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**C100**  
Bulkhead Connector – I/P

12033852



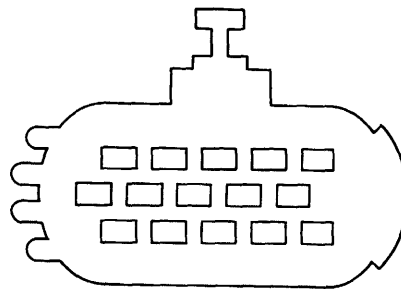
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Weather-Pack  
**C152**  
I/P to Transfer Case Switch

12020829



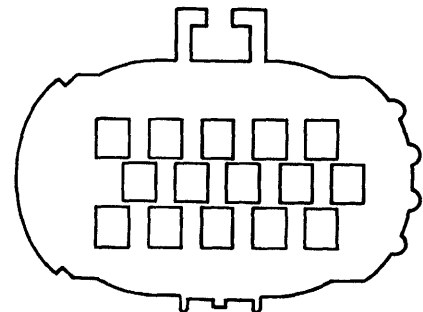
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**C152**  
Transfer Case Switch to I/P

12110779



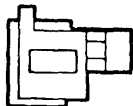
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**C187A**  
Engine to Injector Pump

12110781



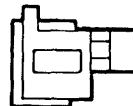
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12059233



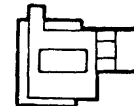
**C241**  
Power Door Lock Convenience  
Center Tap

12059233



**C259**  
Rear Window Defogger  
Convenience Center Tap

12059233

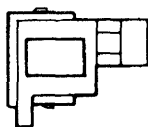


**C276A**  
Power Seat Convenience Center  
Tap



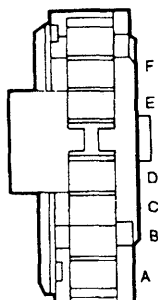
# 8A-11-28 FUSE BLOCK DETAILS

12059235



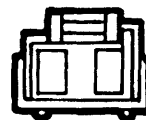
**C247**  
Power Window Convenience  
Center Tap

12020491



**BLACK**  
Pac/on  
**C266**  
Wiper/Washer Switch

12034344



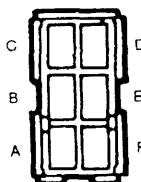
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Metri-Pack 280  
**C296**  
I/P to Liftgate Release Switch

12034343



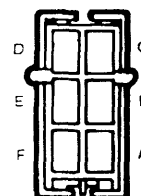
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**C296**  
Liftgate Release Switch to I/P

12034481



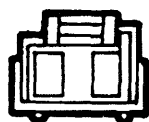
**GRAY**  
Metri-Pack 280  
**C230**  
I/P to Heater-A/C Controller

12034482



**GRAY**  
Metri-Pack 280  
**C230**  
Heater-A/C Controller to I/P

12034344



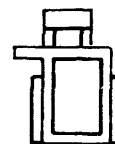
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**C273**  
I/P to Rear Wiper Switch

12034343



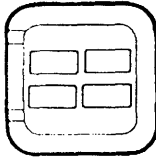
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Metri-Pack  
**C273**  
Rear Wiper Switch to I/P

12059232



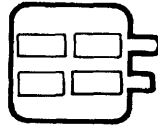
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Heater-A/C Convenience Center  
Tap

12047786



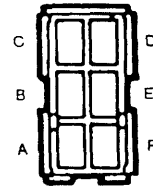
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Metri-Pack 150  
**C299A**  
I/P to Dome Lamp

12047785



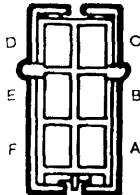
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**C299A**  
Dome Lamp to I/P

12015345



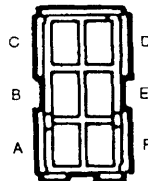
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**C325**  
Convenience Center to LH Front Door

12015344



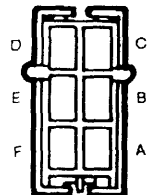
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**C325**  
LH Front Door to Convenience Center

12015345



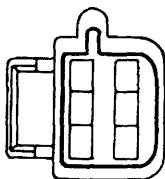
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Metri-Pack 280  
**C328**  
Convenience Center to RH Front Door

12015344



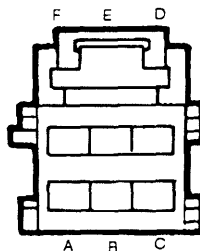
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**C328**  
RH Front Door to Convenience Center

12064763



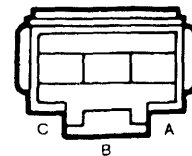
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**C327**  
Fuse to Power Mirror Switch

12064762



**GRAY**  
Metri-Pack 150  
**C327**  
Power Mirror Switch to Fuse

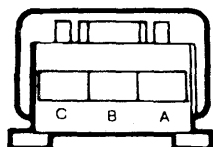
12020398



**BLACK**  
Metri-Pack 180  
**C326**  
Convenience Center to LH Front Door

## 8A-11-30 FUSE BLOCK DETAILS

12020397



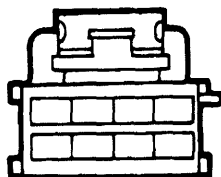
**BLACK**

Metri-Pack 280

**C326**

**LH Front Door to Convenience  
Center**

12064766



**BLUE**

Metri-Pack 150

**C382**

**Auxiliary Heater-A/C Control to  
Convenience Center**

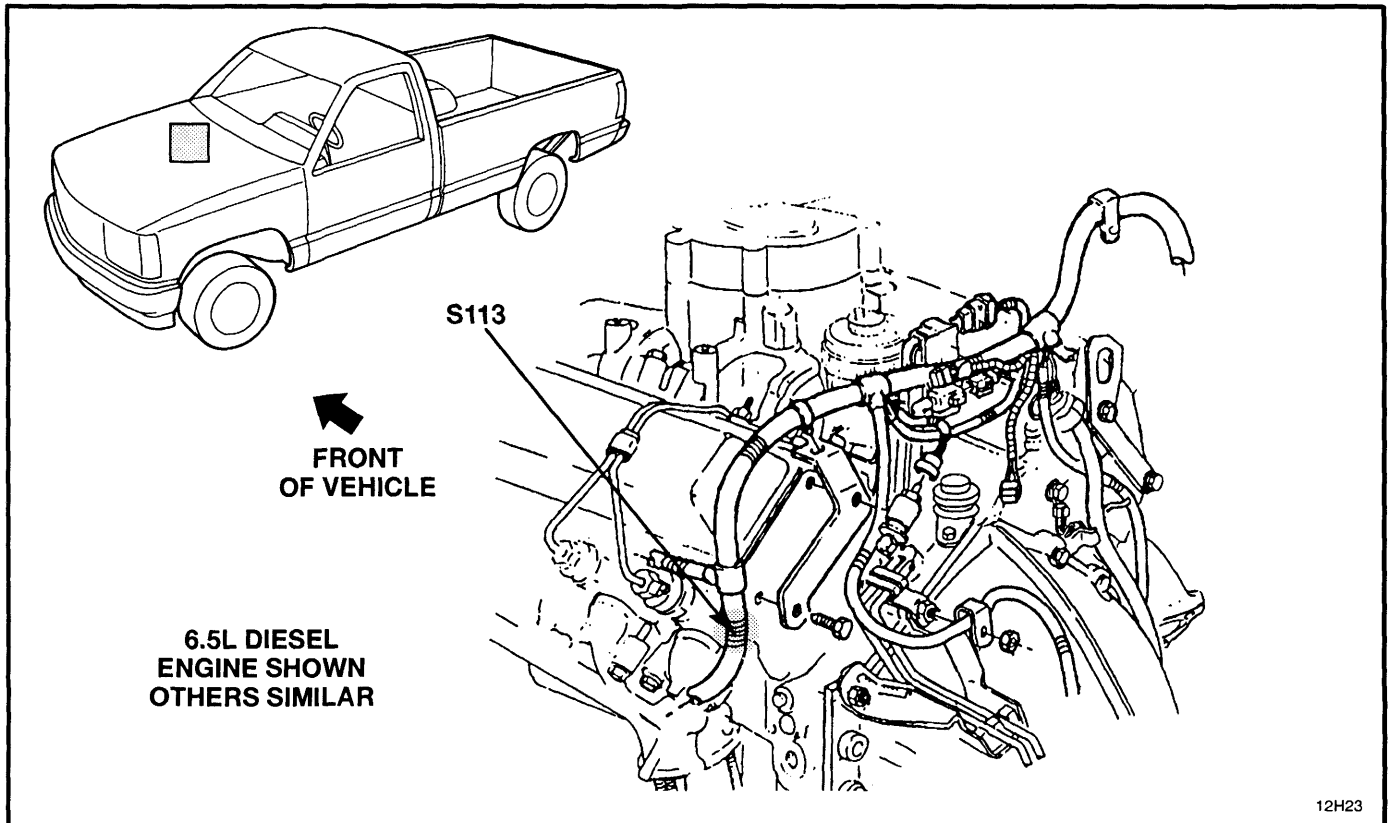


Figure 1 — Engine Wiring, Rear — Diesel

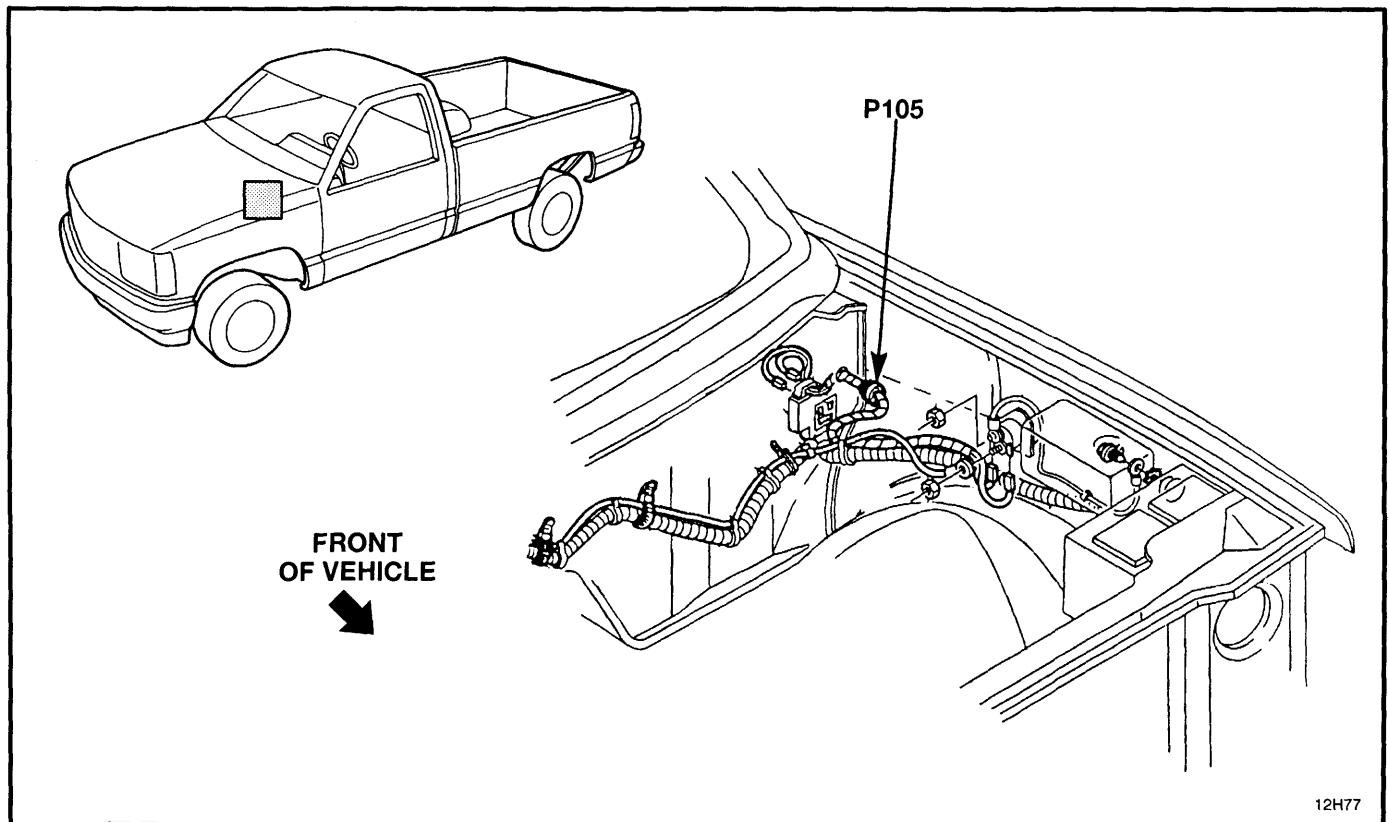
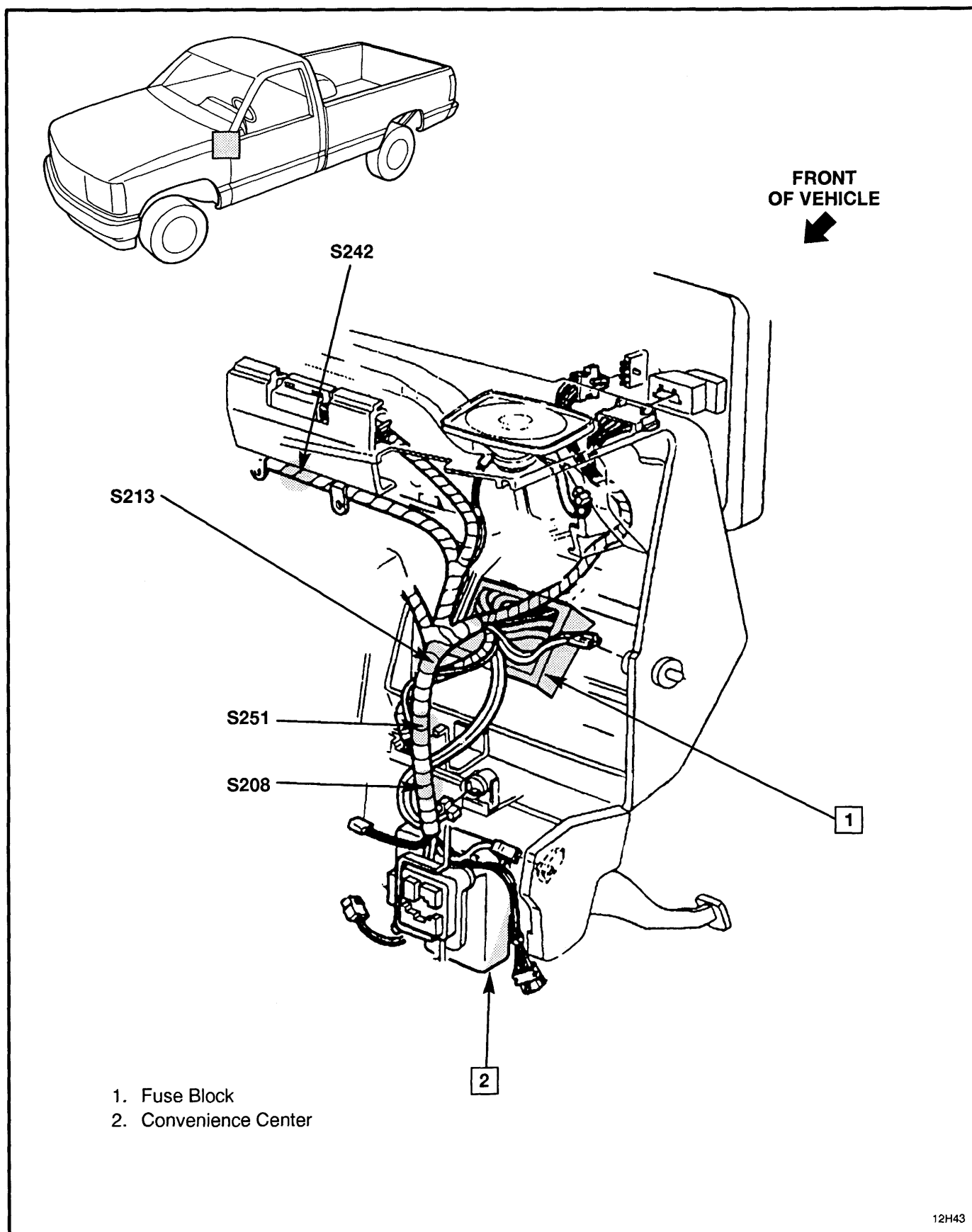


Figure 2 — Left Front Fender Wiring

## 8A-11-32 FUSE BLOCK DETAILS



12H43

Figure 3 — LH Side of Instrument Panel

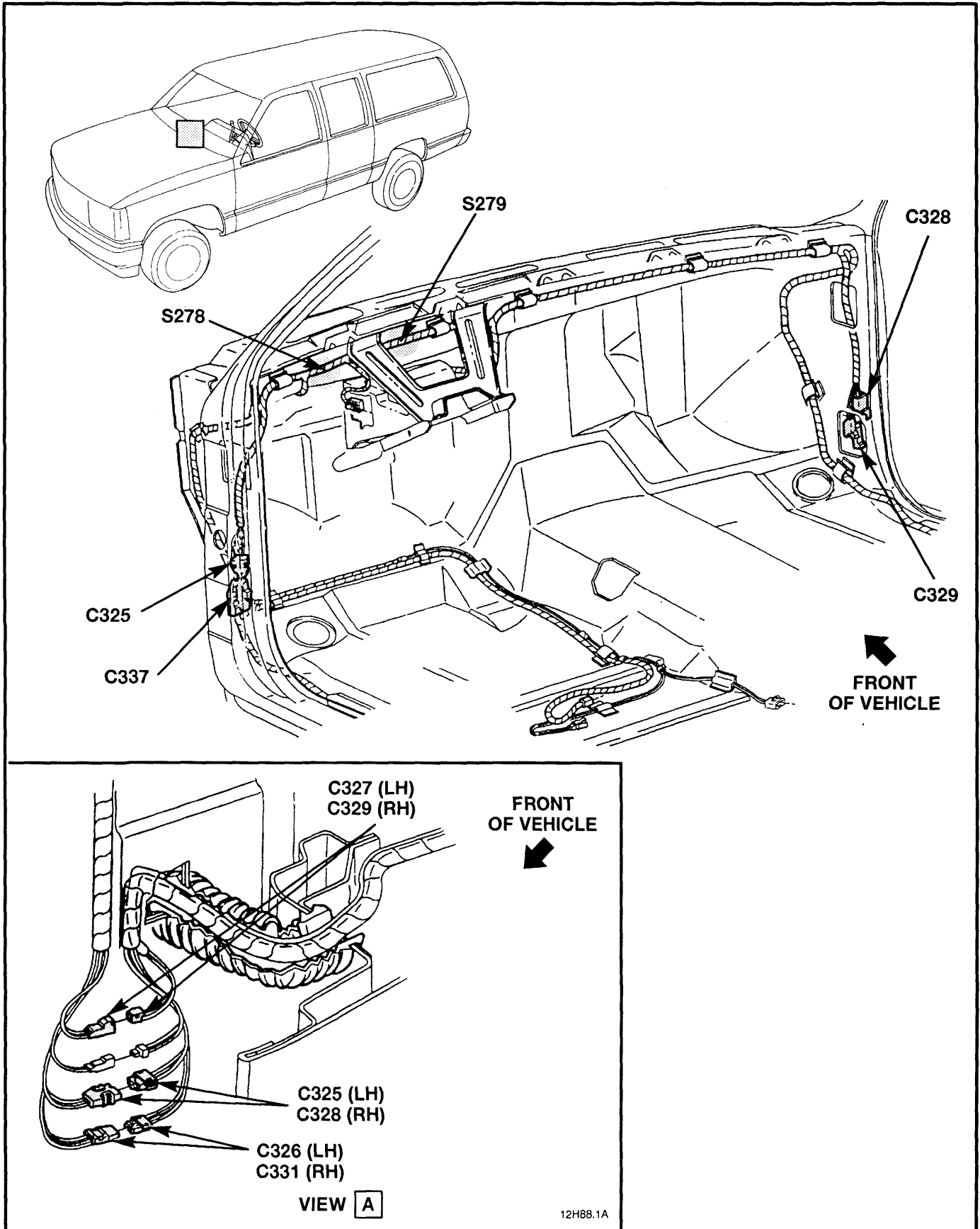
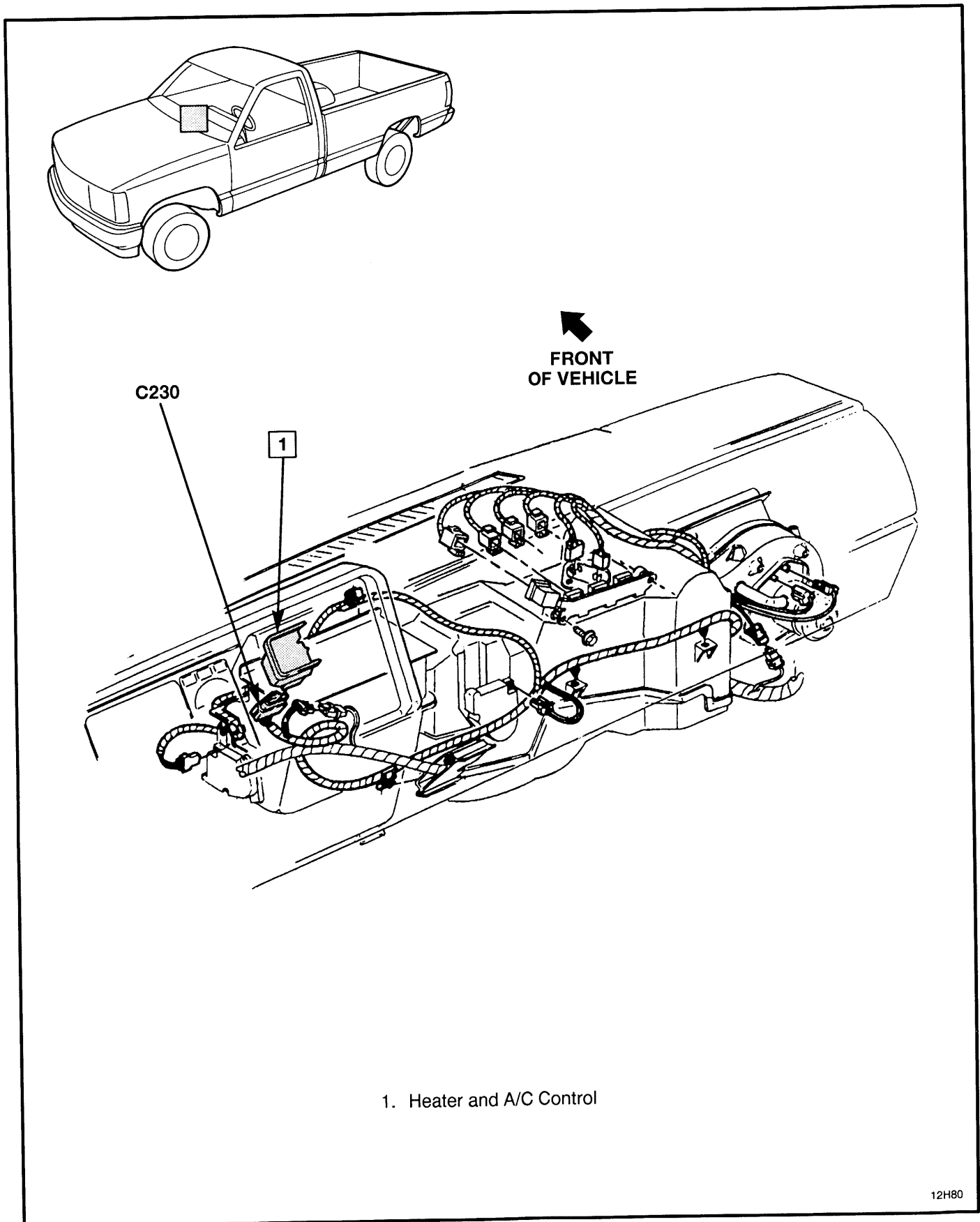


Figure 4 — Power Window and Door Lock Crossbody Wiring — Suburban

## 8A-11-34 FUSE BLOCK DETAILS



12H80

Figure 5 — Heater and A/C Harness Wiring

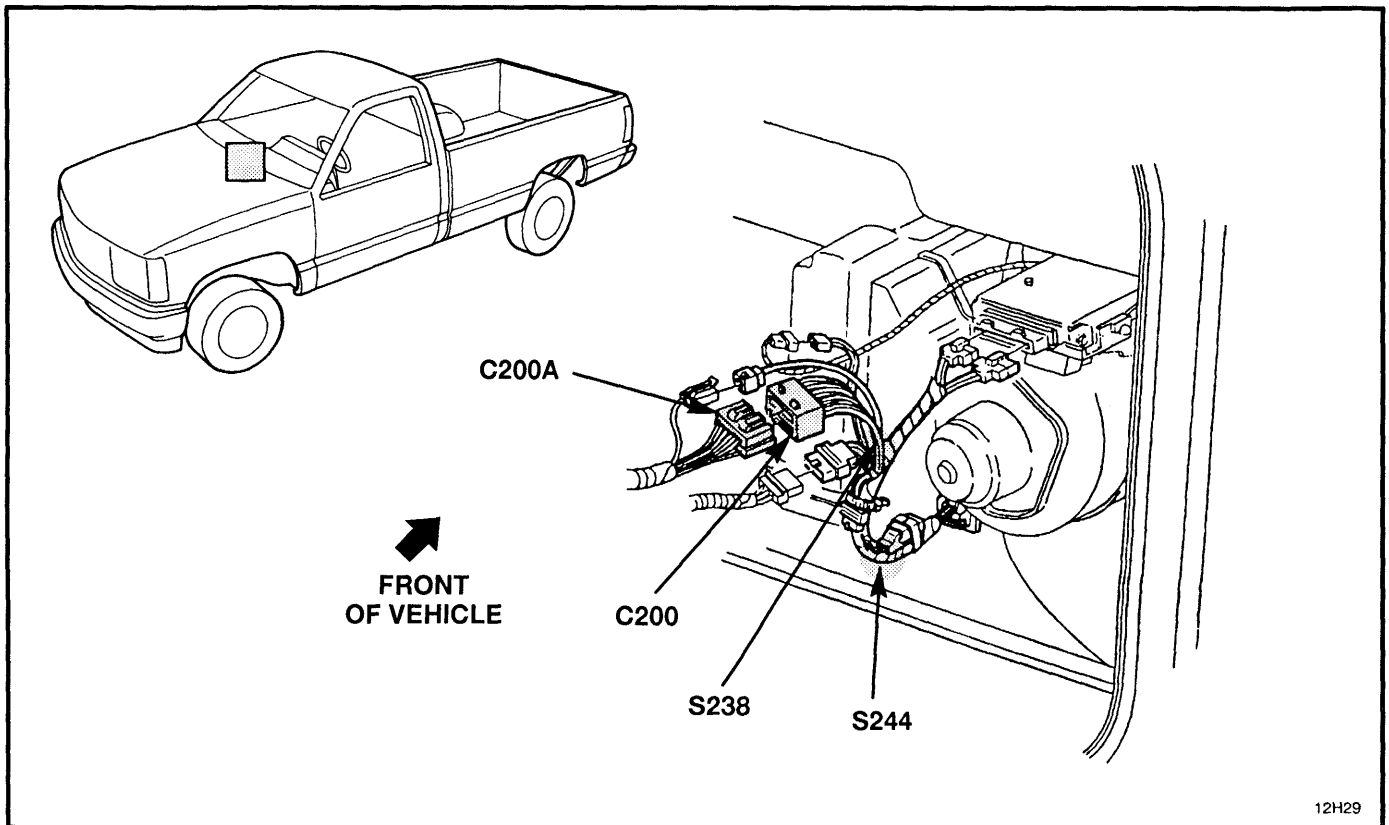


Figure 6 — Behind RH Side of I/P

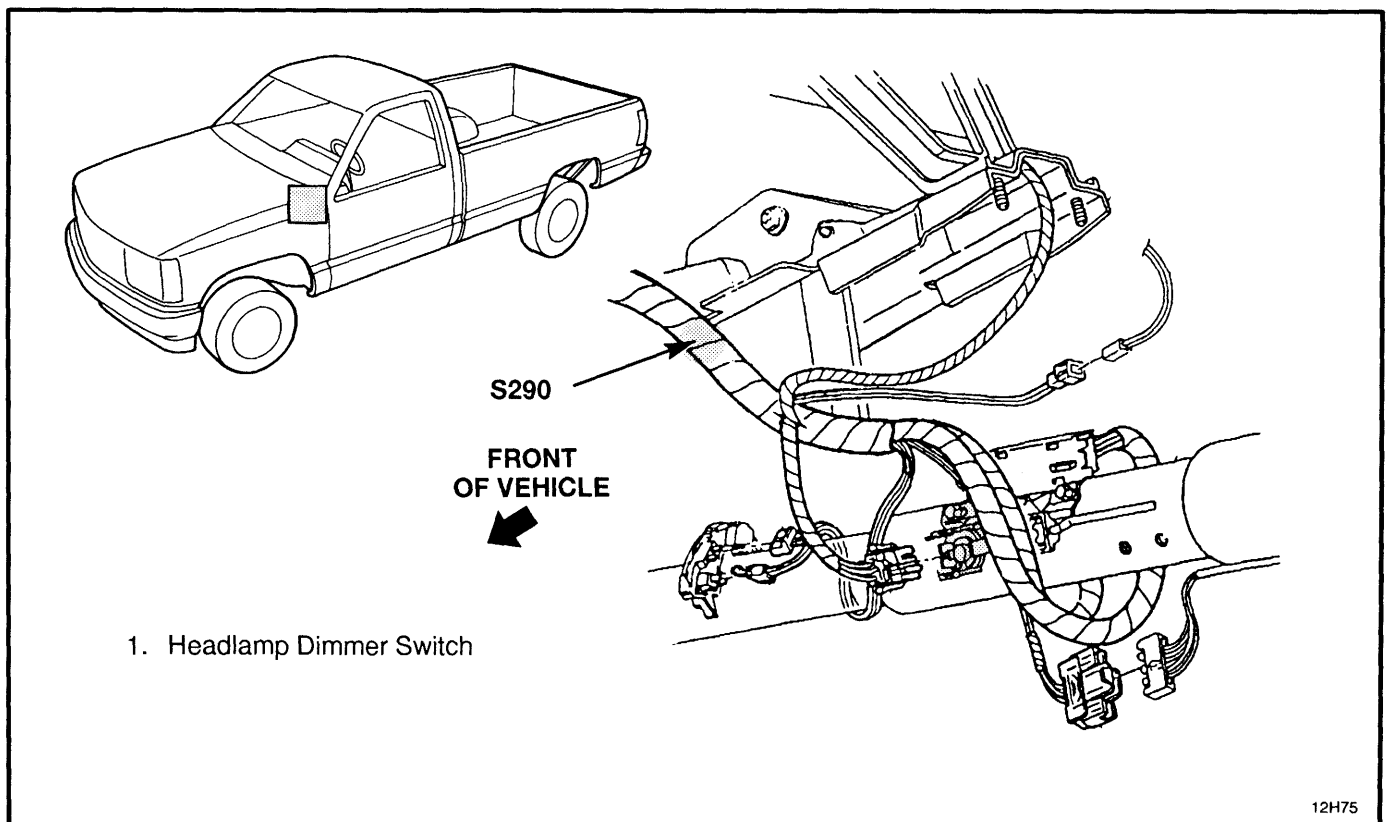


Figure 7 — Steering Column Wiring, LH Side



## 8A-11-36 FUSE BLOCK DETAILS

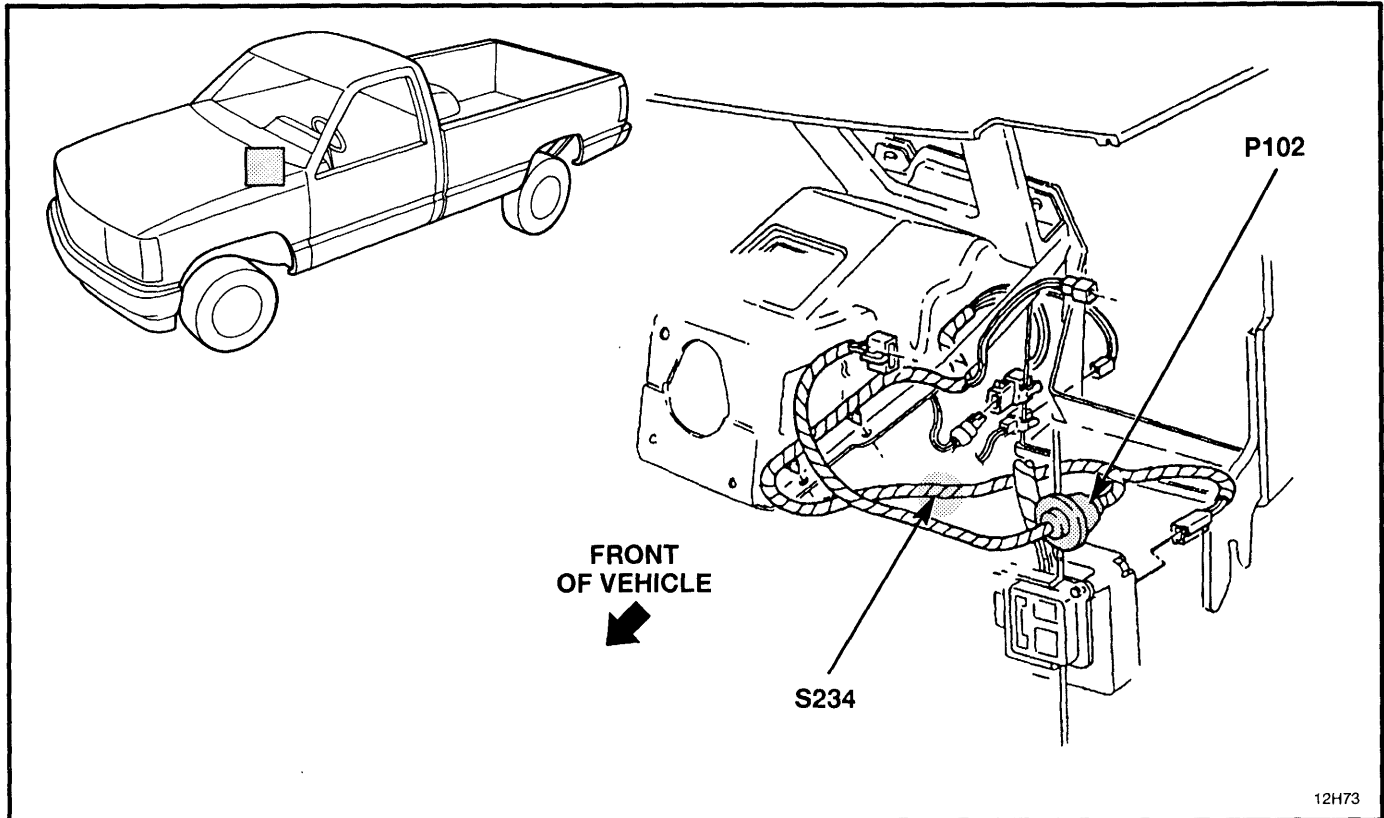


Figure 8 — Cruise Control Wiring

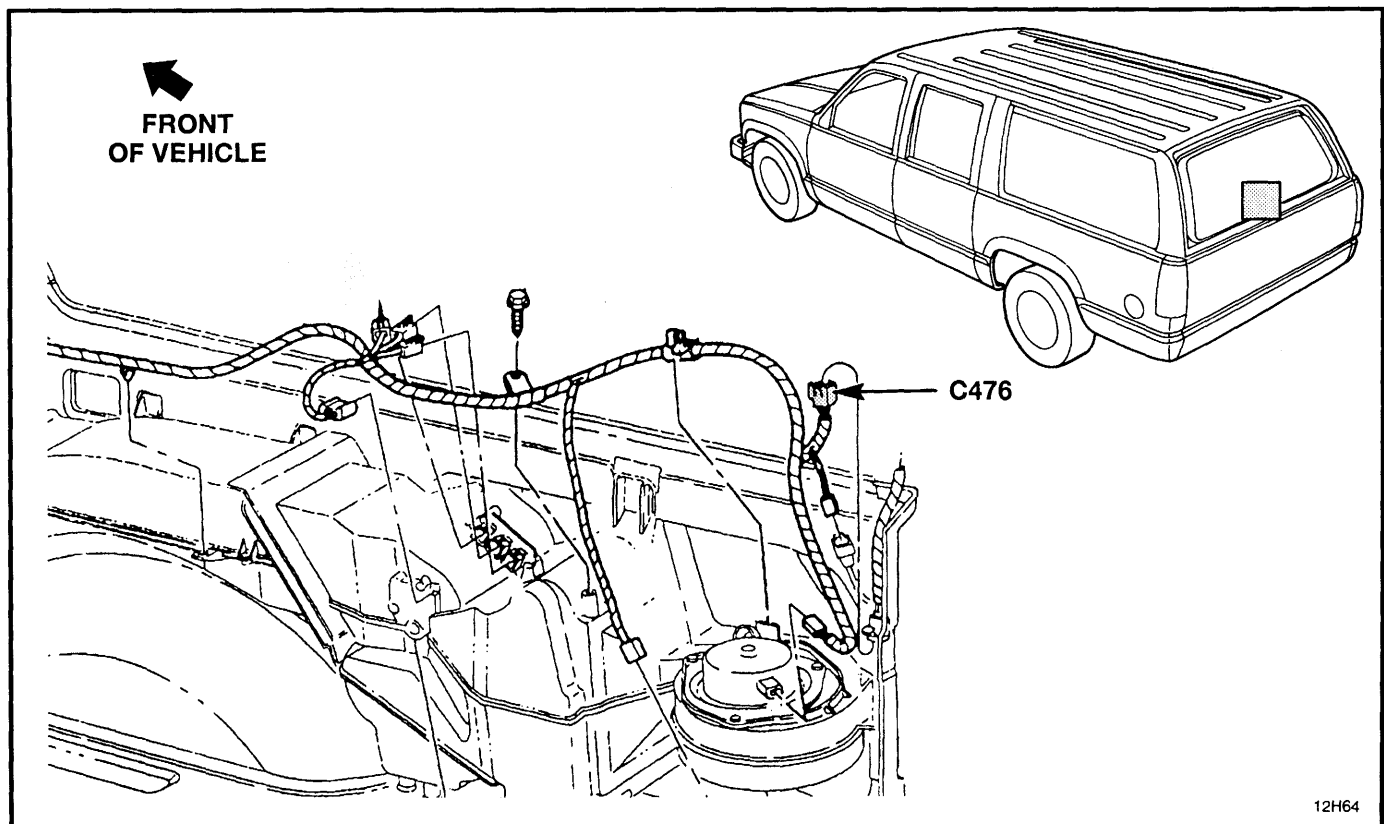


Figure 9 — Auxiliary Heater and A/C Wiring

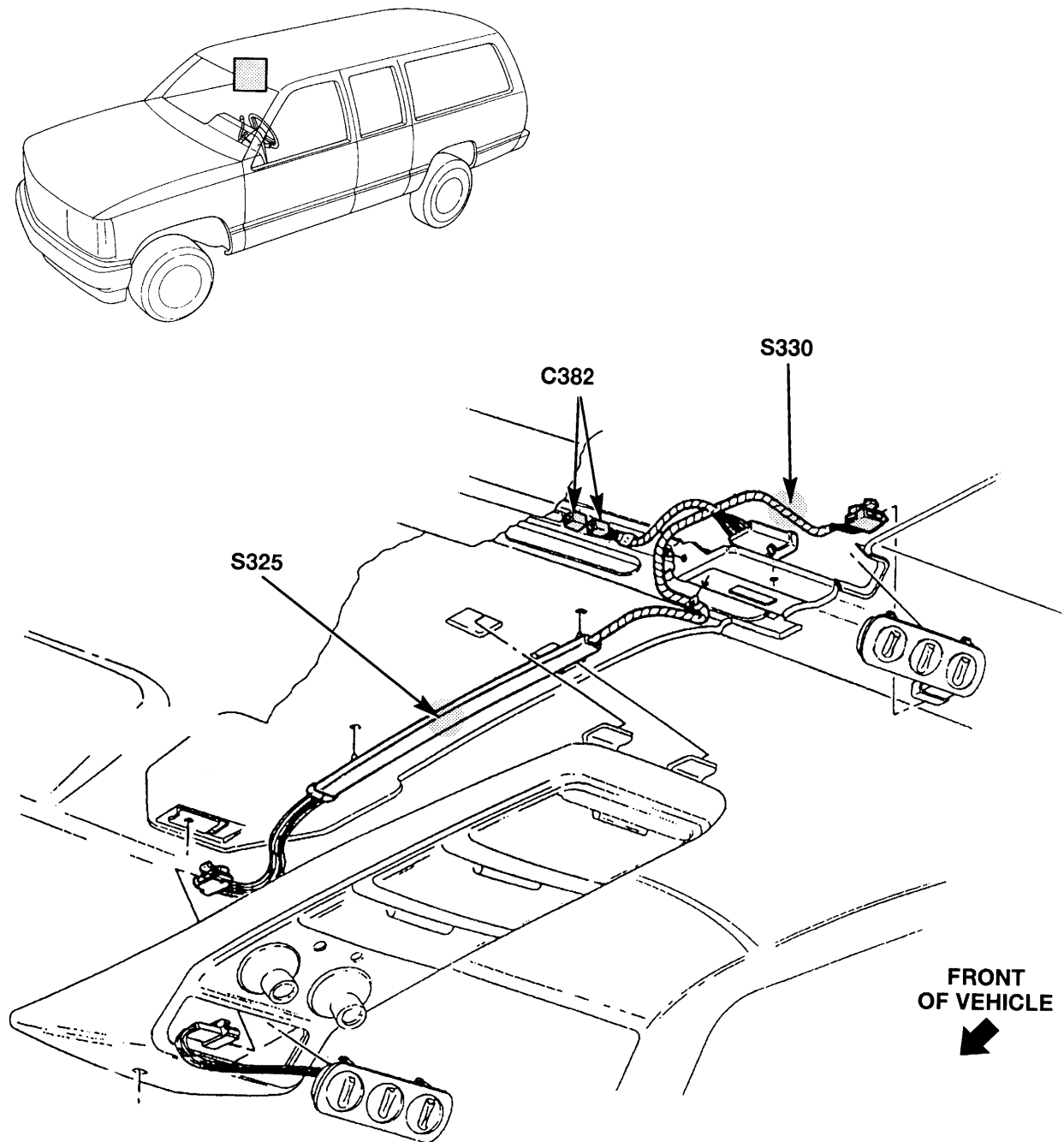


Figure 10 — Auxiliary Heater and A/C Controls

**BLANK**

**COMPONENT LOCATION**

**Page — Figure**

|                           |                            |      |   |
|---------------------------|----------------------------|------|---|
| Convenience Center .....  | Under LH side of I/P ..... | 12-8 | 4 |
| Fuse Block .....          | Lower LH side of I/P ..... | 12-7 | 3 |
| Light Switch .....        | Upper LH side of I/P ..... | 12-7 | 3 |
| Panel Dimmer Switch ..... | LH end of I/P .....        | 12-7 | 3 |

**CONNECTORS:**

|            |                                 |       |   |
|------------|---------------------------------|-------|---|
| C100 ..... | At bulkhead connector .....     | 12-9  | 6 |
| C101 ..... | At bulkhead connector .....     | 12-6  | 1 |
| C102 ..... | At bulkhead connector .....     | 12-9  | 6 |
| C230 ..... | At heater and A/C control ..... | 12-6  | 2 |
| C400 ..... | At LH taillamp .....            | 12-10 | 7 |
| C401 ..... | At rear of LH frame rail .....  | 12-10 | 8 |

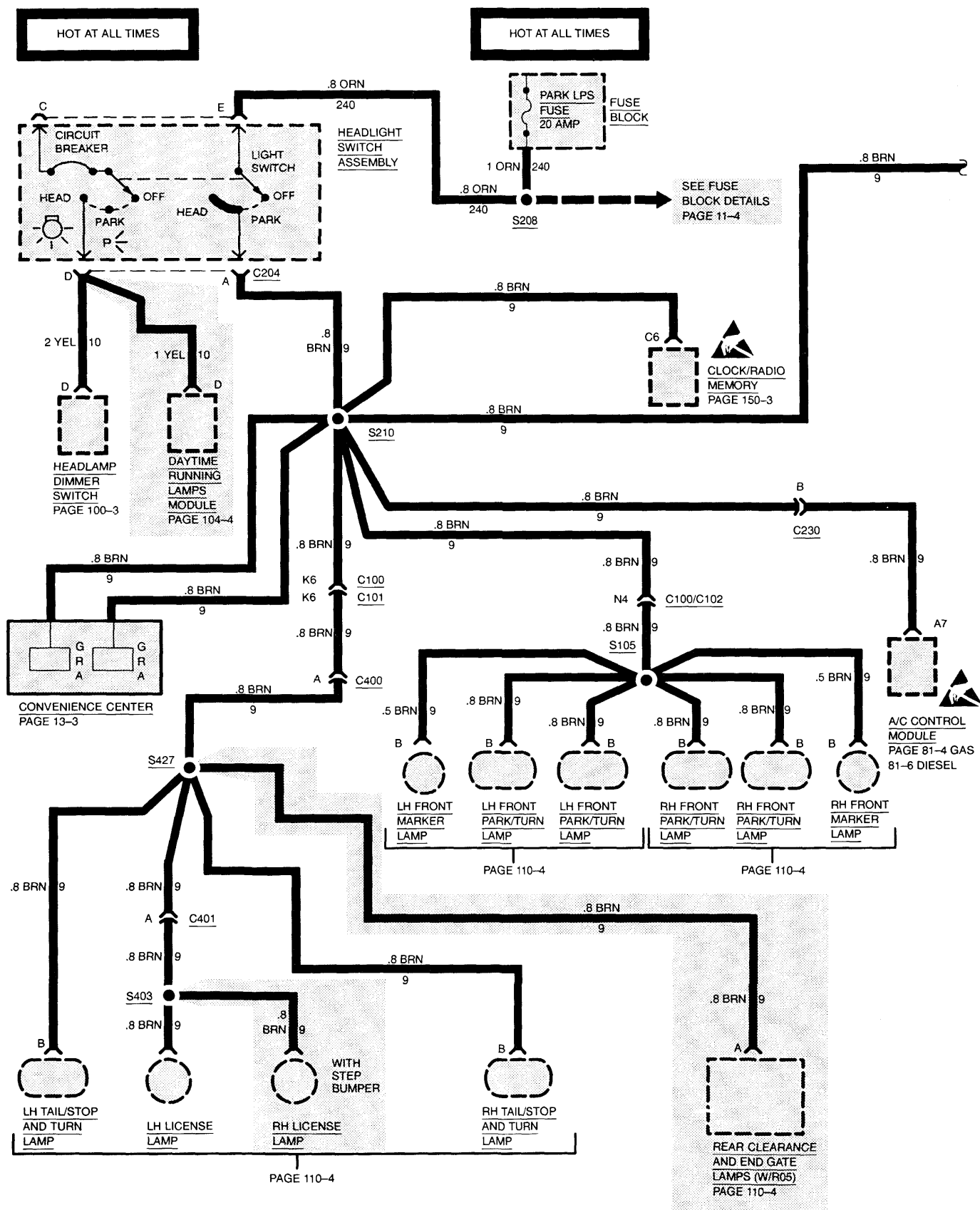
**GROUND:**

|            |              |      |   |
|------------|--------------|------|---|
| G202 ..... | At DLC ..... | 12-9 | 5 |
|------------|--------------|------|---|

**SPLICES:**

|            |                               |       |   |
|------------|-------------------------------|-------|---|
| S105 ..... | Near LH headlamp .....        | 12-6  | 1 |
| S207 ..... | Under LH side of I/P .....    | 12-7  | 3 |
| S208 ..... | Near convenience center ..... | 12-7  | 3 |
| S210 ..... | Under LH side of I/P .....    | 12-7  | 3 |
| S217 ..... | Under LH side of I/P .....    | 12-7  | 3 |
| S403 ..... | At LH frame rail .....        | 12-10 | 8 |
| S427 ..... | Near LH frame rail .....      | 12-10 | 8 |

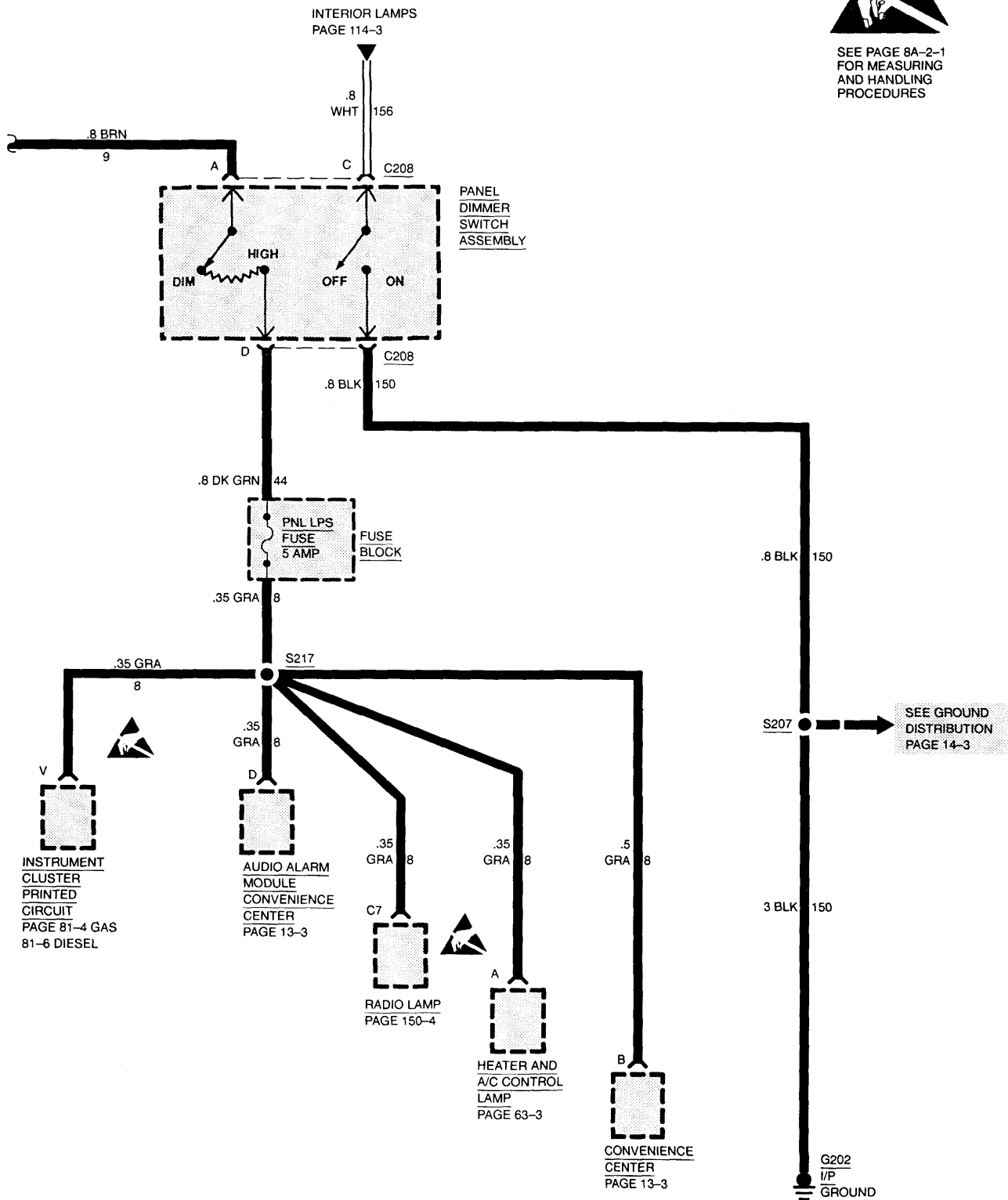
## 8A-12-2 LIGHT SWITCH DETAILS



# LIGHT SWITCH DETAILS 8A-12-3



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## 8A-12-4 LIGHT SWITCH DETAILS

### LAMP BULB DATA

AC type guide lamps are recommended when replacement becomes necessary.

| Lamp Usage                              | Quantity | Trade No.            | Power Rating at 12.8V, Watts |
|-----------------------------------------|----------|----------------------|------------------------------|
| Headlamps (2) Headlamp System           | 2<br>2   | 6052<br>H6054 (Opt.) | 55/65<br>35/65               |
| Headlamps (4) Headlamp System           | 2<br>2   | 9005<br>9006         | 65<br>55                     |
|                                         |          |                      | <b>Candle Power</b>          |
| Taillamp and Stoplamp                   | 2        | 3057                 | 32-2                         |
| Backup Lamp                             | 1        | 3156                 | 32                           |
| Dome Lamps                              | 1        | 211-2                | 12                           |
| Oil Pressure Lamp <sup>1</sup>          | 1        | 194                  | 2                            |
| Battery Indicator Lamp                  | 1        | 194                  | 2                            |
| Instrument Cluster Illuminating Lamps   | 5        | 194                  | 2                            |
| Headlamp Beam Indicator Lamp            | 1        | 161                  | 1                            |
| Temperature Indicator Lamp <sup>1</sup> | 1        | 194                  | 2                            |
| Turn Signal Indicator Lamp              | 2        | 194                  | 2                            |
| Brake Warning Indicator                 | 1        | 194                  | 2                            |
| Wait Lamp <sup>2</sup>                  | 1        | 194                  | 2                            |
| Heater or A/C Control                   | 2        | 194                  | .5                           |
| Radio Dial Lamp                         | 1        | 1893                 | 2                            |
| Four-Wheel Drive Shift Indicator        | 1        | 161                  | 2                            |
| Courtesy Lamp                           | 1        | 1003                 | 15                           |
| Low Coolant Lamp                        | 1        | 194                  | 2                            |
| Safety Belt Warning                     | 1        | 194                  | 2                            |
| Four-Wheel Drive Shift Lever            | 1        | 194                  | 1                            |
| Service Fuel Filter Lamp <sup>2</sup>   | 1        | 194                  | 2                            |
| Dome and Reading Lamp                   | 3        | 211-2                | 12                           |
| Check Gages Lamp <sup>3</sup>           | 1        | 194                  | 2                            |
| Service Engine Soon                     | 1        | 194                  | 2                            |
| Upshift Lamp                            | 1        | 161                  | 1                            |
| Front Parking/Turn Signal Lamp          | 4        | 2357NA               | 28                           |
| Front Side Marker Lamp                  | 2        | 194                  | 2                            |
| Rear Fender Marker Lamp <sup>4</sup>    | 4        | 194                  | 2                            |
| Roof Marker Lamp                        | 5        | 194                  | 2                            |
| License Lamp                            | 2        | 194                  | 2                            |
| Ashtray Lamp                            | 1        | 194                  | 2                            |
| Cargo Lamp                              | 1        | 570                  | 32                           |

<sup>1</sup>Cluster w/o gages only

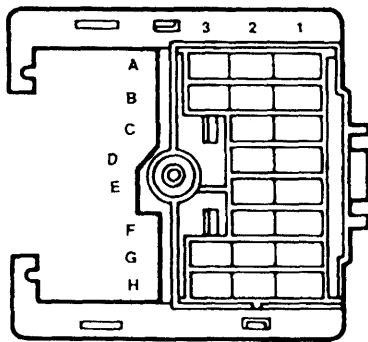
<sup>2</sup>Diesel only

<sup>3</sup>Cluster w/gages only

<sup>4</sup>Dual rear wheels only

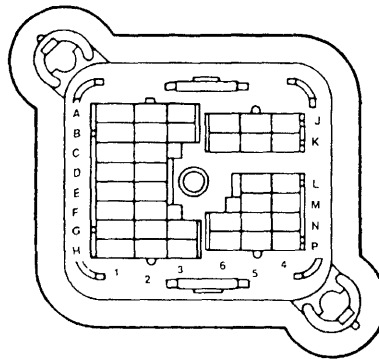
# **LIGHT SWITCH DETAILS 8A-12-5**

**12020183**



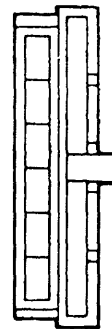
**GRAY**  
Metri-Pack  
**C100**  
**Bulkhead Connector – Eng**

**12020184**



**GRAY**  
Metri-Pack  
**C100**  
**Bulkhead Connector – I/P**

**12034061**



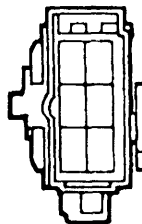
**NATURAL**  
Metri-Pack 480  
**C204**  
**Light Switch**

**12034060**



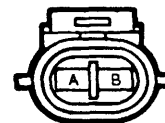
**NATURAL**  
Metri-Pack 480  
**C208**  
**Panel Dimmer Switch**

**12020099**



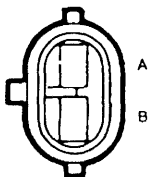
**C101**  
**Bulkhead – Rear Lamps**

**12052641**



**BLACK**  
Metri-Pack 150  
**C401**  
**Rear Lamps to License Lamps  
In-Line**

**12052647**



**BLACK**  
Metri-Pack  
**C401**  
**License Lamps to Rear Lamps  
In-Line**



## 8A-12-6 LIGHT SWITCH DETAILS

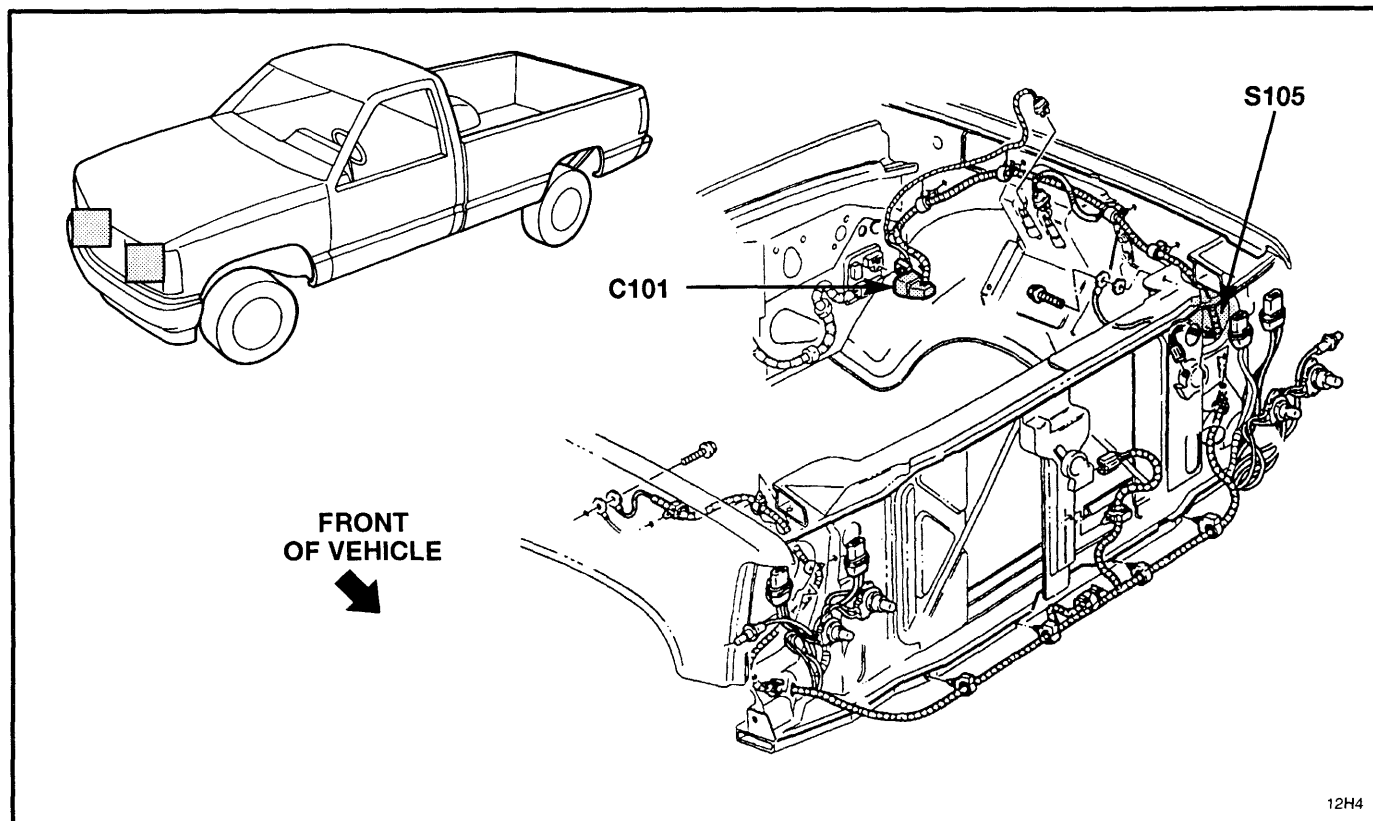
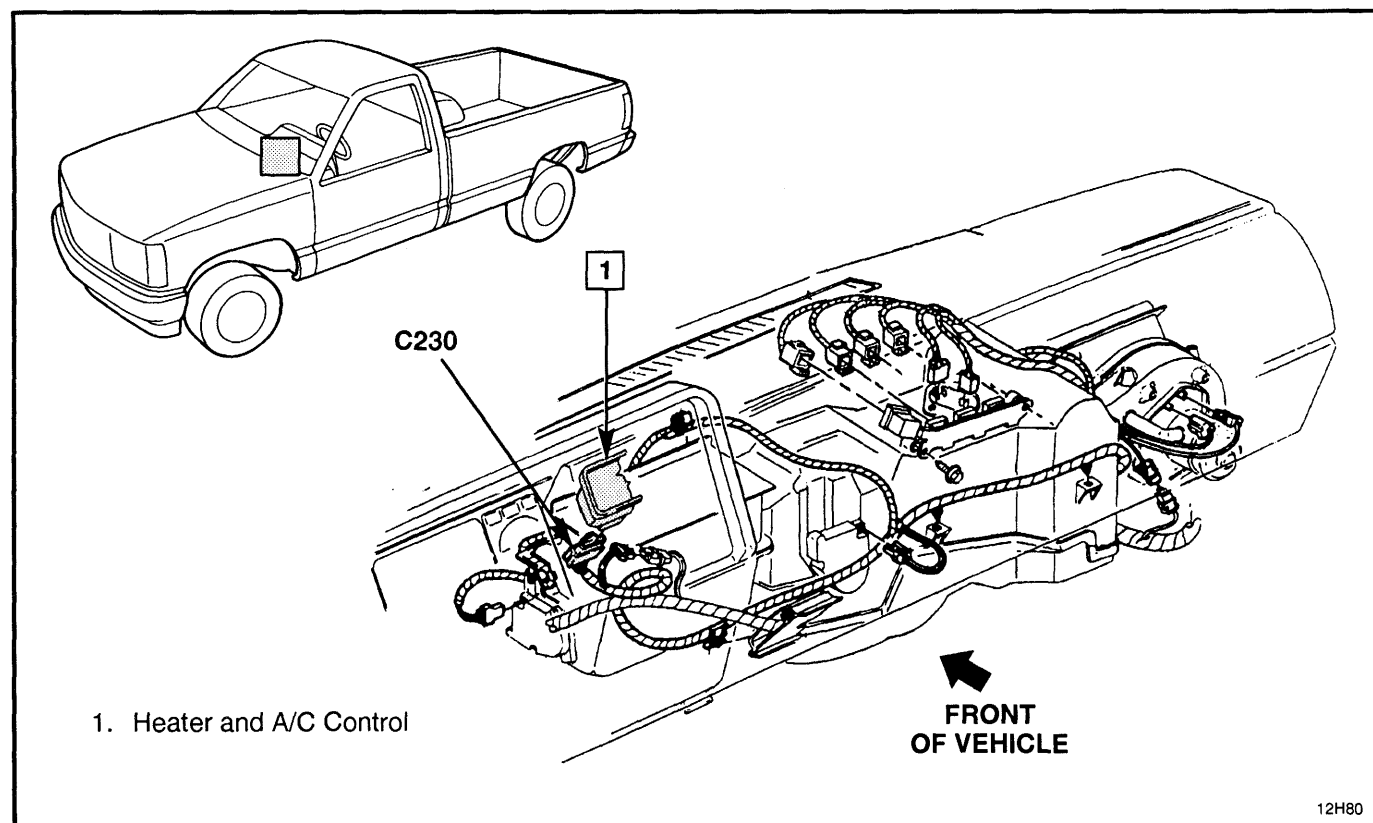


Figure 1 — Forward Lamp Harness — Quad Headlamps



1. Heater and A/C Control

Figure 2 — Heater and A/C Harness Wiring

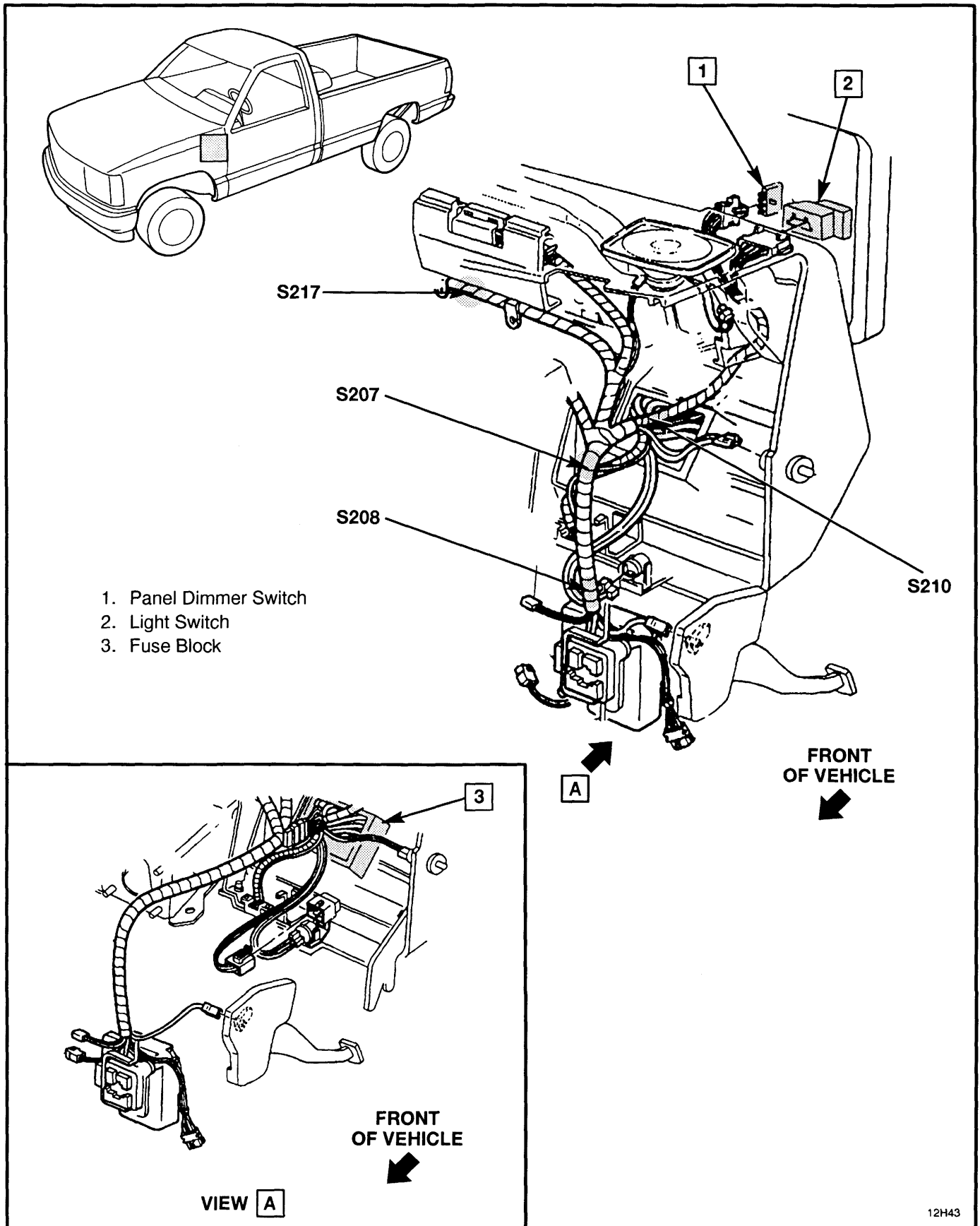
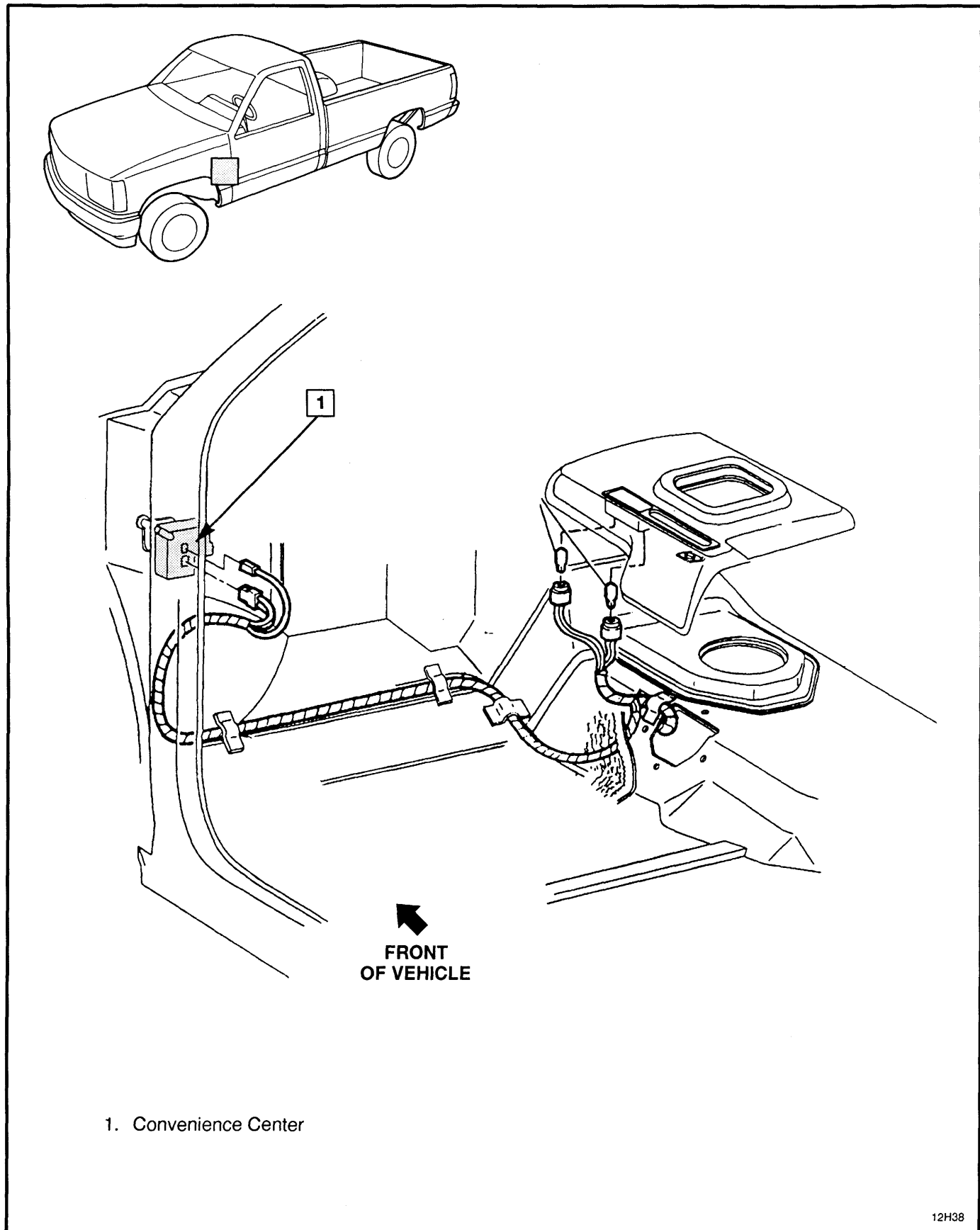


Figure 3 — Instrument Panel, LH Side

## 8A-12-8 LIGHT SWITCH DETAILS



12H38

Figure 4 — Four-Wheel Drive Wiring

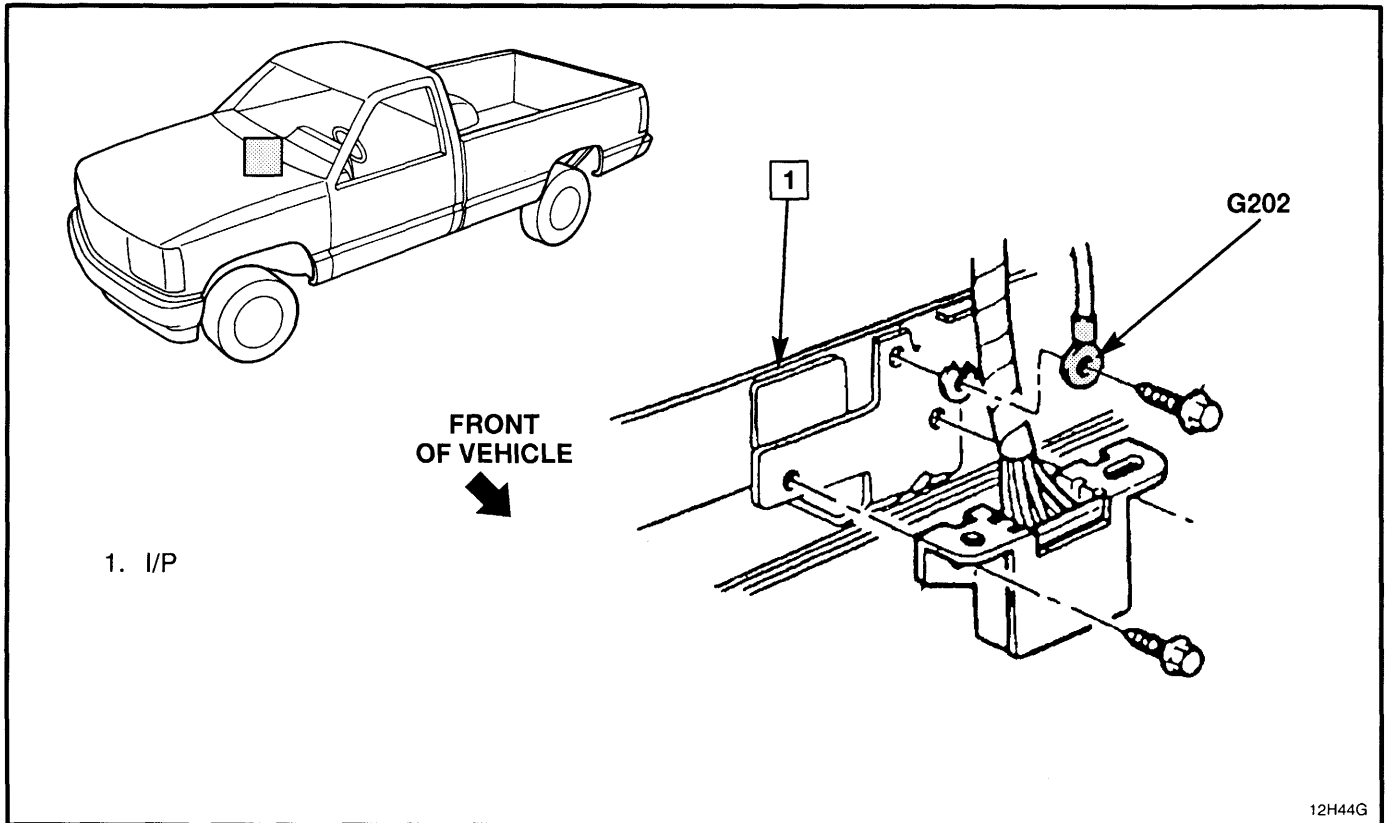


Figure 5 — I/P Ground Wiring

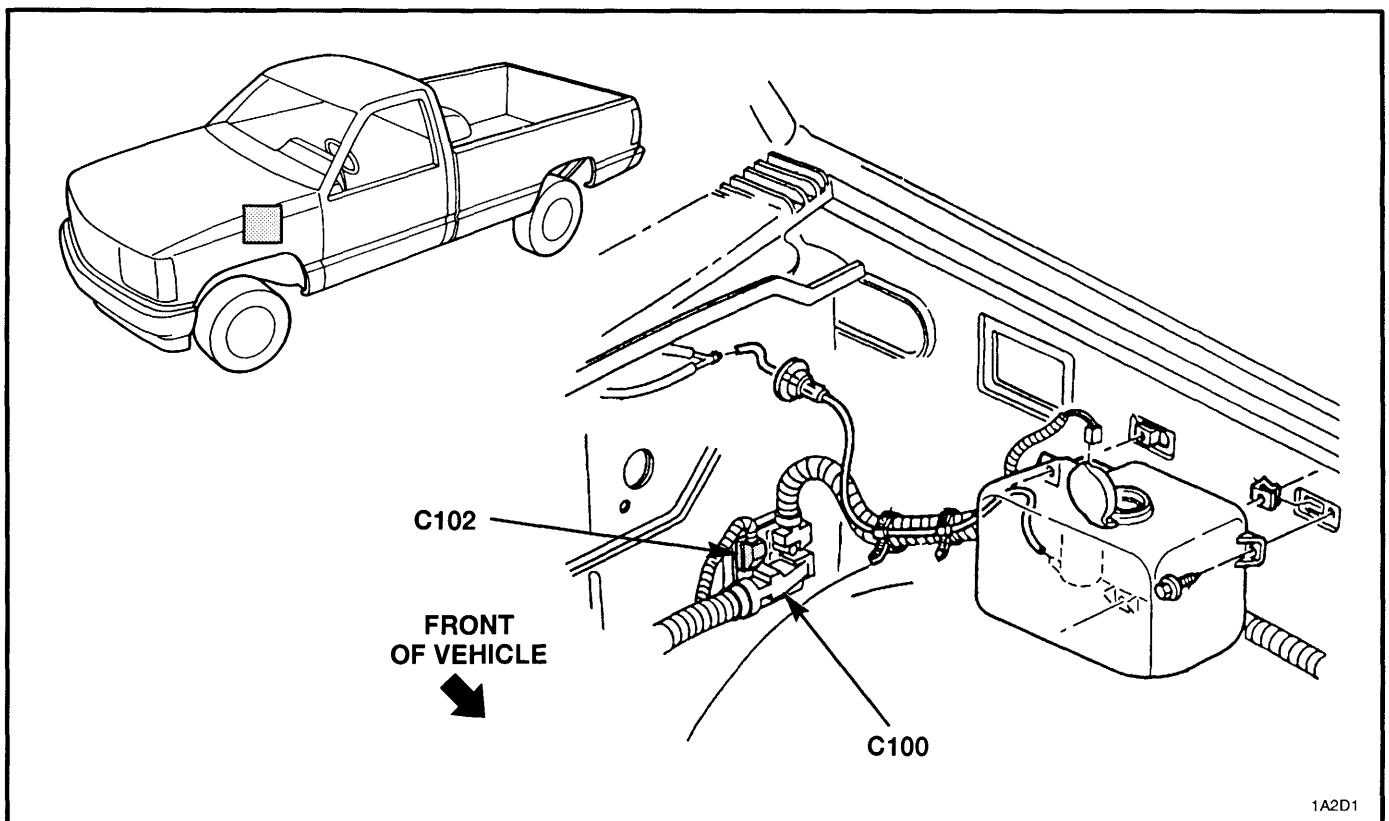


Figure 6 — Windshield Washer Reservoir and Pump — Except Suburban and Utility

## 8A-12-10 LIGHT SWITCH DETAILS

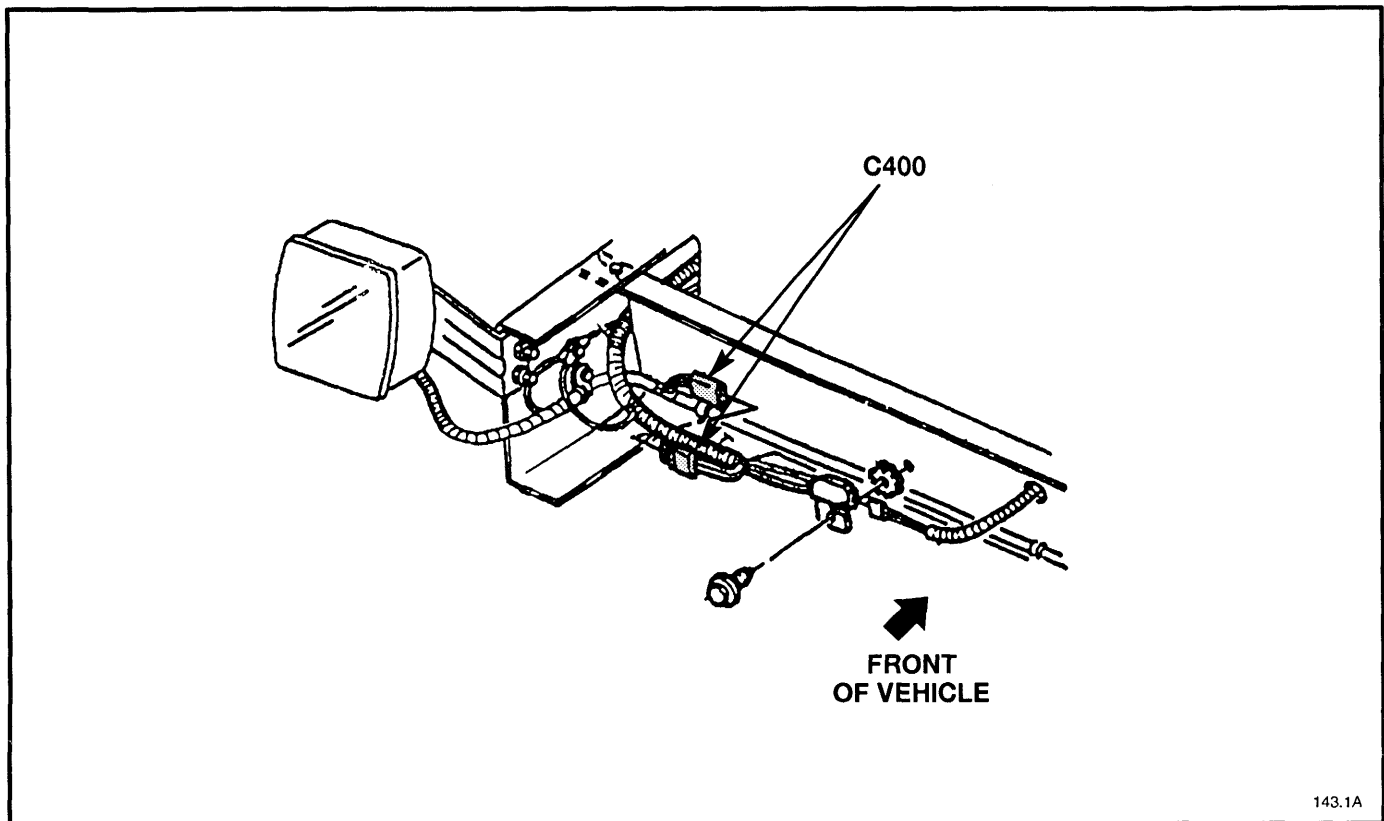


Figure 7 — Rear Lamp Wiring — Chassis Cab

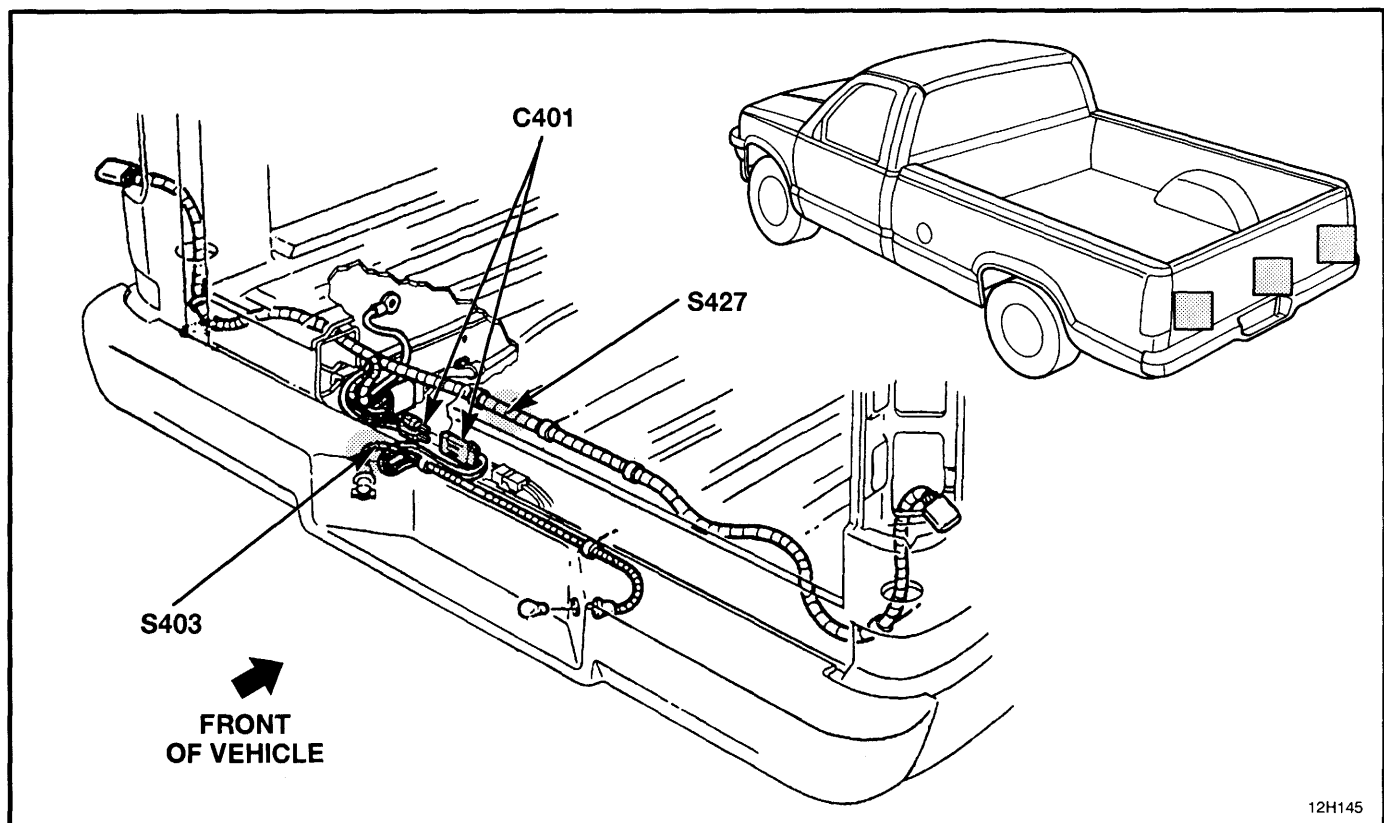


Figure 8 — Tail and Stoplamp Harness Wiring

## COMPONENT LOCATION

Page — Figure

|                                    |                             |       |   |
|------------------------------------|-----------------------------|-------|---|
| Audio Alarm Module .....           | On convenience center ..... | 13-20 | 6 |
| Convenience Center .....           | Under LH side of I/P .....  | 13-20 | 6 |
| Fuse Block .....                   | Lower LH side of I/P .....  | 13-18 | 4 |
| Horn Relay .....                   | On convenience center ..... | 13-20 | 6 |
| In-Line Fuse (Power Mirrors) ..... | .....                       | 13-19 | 5 |
| Light Switch .....                 | Upper LH side of I/P .....  | 13-18 | 4 |
| Panel Dimmer Switch .....          | LH end of I/P .....         | 13-18 | 4 |
| Turn Signal Flasher .....          | On Convenience center ..... | 13-20 | 6 |

## CONNECTORS:

|             |                                                     |           |    |
|-------------|-----------------------------------------------------|-----------|----|
| C100 .....  | At bulkhead connector .....                         | 13-18     | 4  |
| C152 .....  | Under floor at transfer case control .....          | Not Shown |    |
| C206 .....  | Under I/P, RH side of steering column .....         | 13-26     | 17 |
| C240A ..... | Under LH side of I/P .....                          | Not Shown |    |
| C293 .....  | Behind LH side of I/P near convenience center ..... | 13-21     | 8  |
| C325 .....  | LH body hinge pillar .....                          | 13-19     | 5  |
| C326 .....  | LH body hinge pillar .....                          | 13-19     | 5  |
| C327 .....  | LH body hinge pillar .....                          | 13-19     | 5  |
| C328 .....  | RH body hinge pillar .....                          | 13-19     | 5  |
| C330 .....  | RH body hinge pillar .....                          | 13-19     | 5  |
| C331 .....  | RH body hinge pillar .....                          | 13-19     | 5  |
| C341 .....  | At LH B-pillar .....                                | 13-28     | 19 |
| C382 .....  | At roof bow near front dome lamp .....              | 13-27     | 18 |
| C476 .....  | At RH D-pillar .....                                | 13-23     | 11 |

## GROMMETS:

|            |                                                         |       |    |
|------------|---------------------------------------------------------|-------|----|
| P101 ..... | RH cowl (engine compartment) .....                      | 13-17 | 3  |
| P102 ..... | Lower LH cowl above convenience center .....            | 13-24 | 13 |
| P105 ..... | Lower LH side of cowl, left of bulkhead connector ..... | 13-25 | 16 |

## GROUNDS:

|                       |                                  |       |    |
|-----------------------|----------------------------------|-------|----|
| G108 .....            | LH top front of engine .....     | 13-16 | 1  |
| G109 (Gasoline) ..... | Top front center of engine ..... | 13-16 | 1  |
| G109 (Diesel) .....   | Top RH rear of engine .....      | 13-17 | 2  |
| G202 .....            | At DLC .....                     | 13-24 | 14 |

## SPLICES:

|            |                                 |       |    |
|------------|---------------------------------|-------|----|
| S206 ..... | Under LH side of I/P .....      | 13-25 | 15 |
| S207 ..... | Under LH side of I/P .....      | 13-18 | 4  |
| S208 ..... | Behind LH side of I/P .....     | 13-18 | 4  |
| S210 ..... | Under LH side of I/P .....      | 13-18 | 4  |
| S211 ..... | Center of cowl .....            | 13-21 | 7  |
| S212 ..... | Behind instrument cluster ..... | 13-21 | 7  |
| S213 ..... | Under LH side of I/P .....      | 13-18 | 4  |
| S214 ..... | Center of cowl .....            | 13-18 | 4  |
| S217 ..... | Under LH side of I/P .....      | 13-18 | 4  |
| S234 ..... | Near convenience center .....   | 13-24 | 14 |
| S240 ..... | Behind LH side of I/P .....     | 13-23 | 12 |
| S242 ..... | Under LH side of I/P .....      | 13-18 | 4  |
| S251 ..... | Behind LH side of I/P .....     | 13-18 | 4  |
| S255 ..... | Behind instrument cluster ..... | 13-18 | 4  |
| S277 ..... | LH side of I/P .....            | 13-19 | 5  |

## 8A-13-2 CONVENIENCE CENTER DETAILS

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### COMPONENT LOCATION

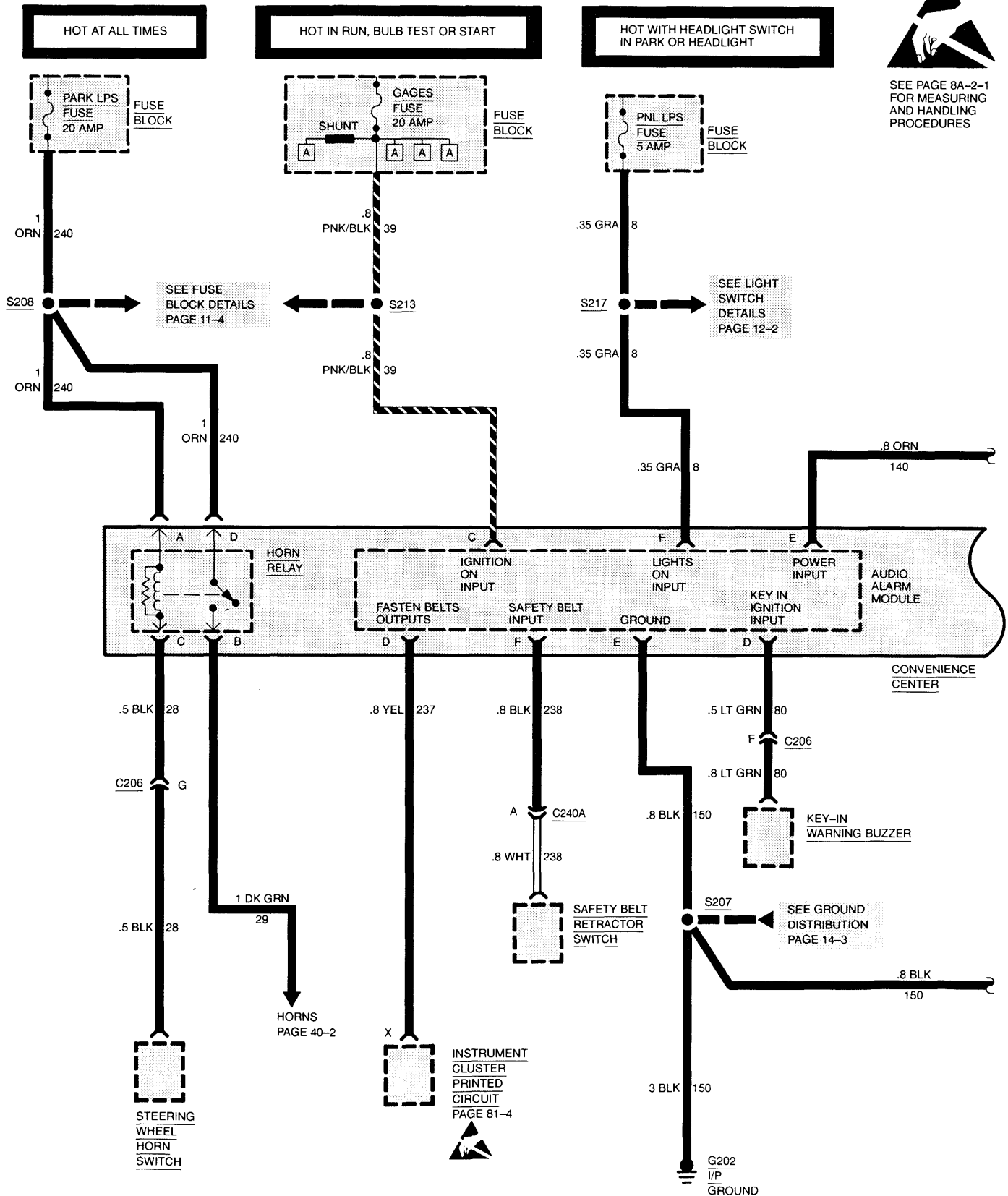
Page — Figure

#### SPLICES (Continued):

|      |                                   |       |    |
|------|-----------------------------------|-------|----|
| S278 | ..... LH side of I/P .....        | 13-19 | 5  |
| S279 | ..... LH side of I/P .....        | 13-19 | 5  |
| S310 | ..... LH side of headliner .....  | 13-22 | 9  |
| S325 | ..... Lower LH side of I/P .....  | 13-27 | 18 |
| S330 | ..... Lower RH side of I/P .....  | 13-27 | 18 |
| S400 | ..... Bottom of LH B-pillar ..... | 13-22 | 10 |
| S410 | ..... Bottom of LH B-pillar ..... | 13-22 | 10 |

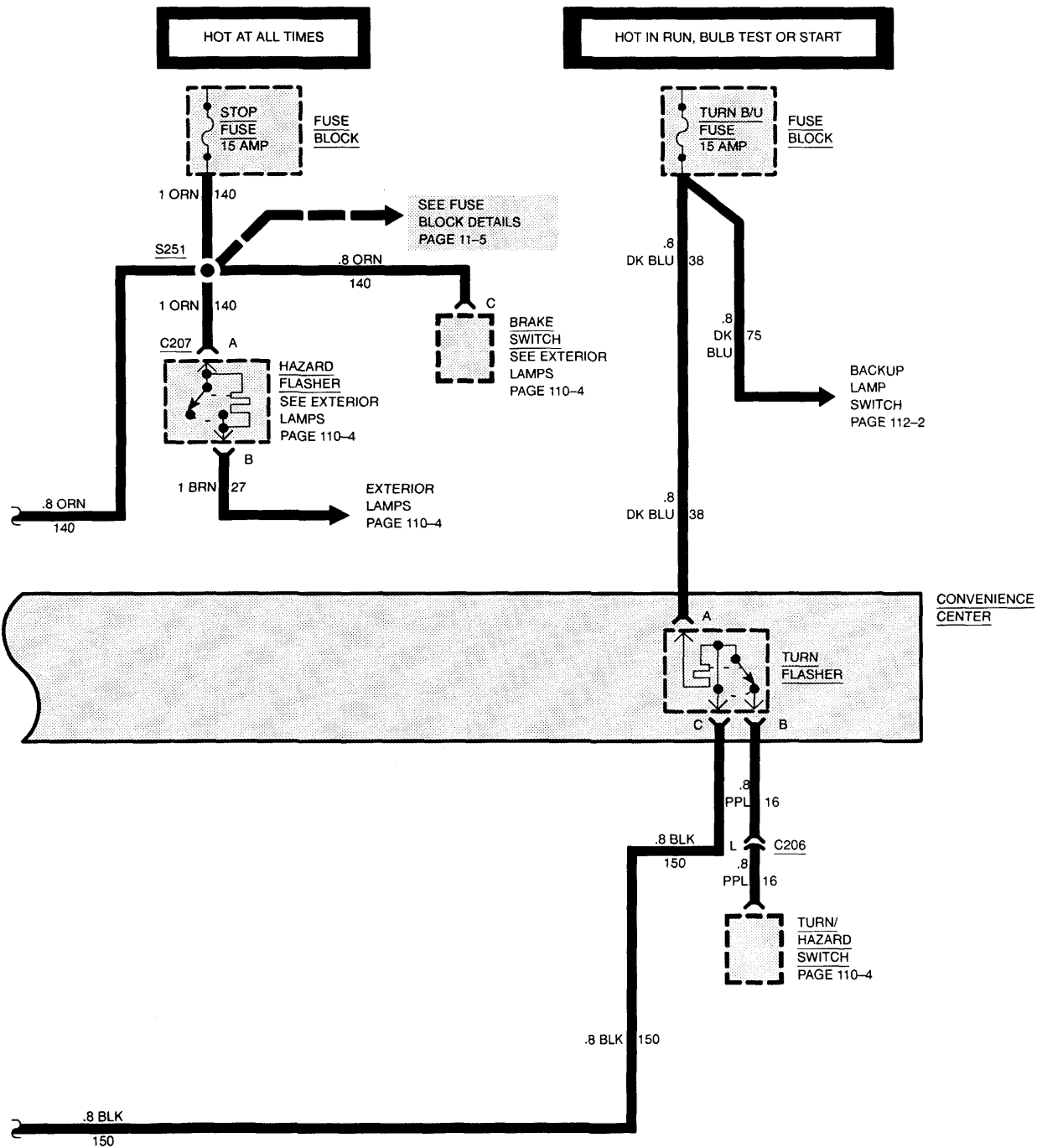


SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

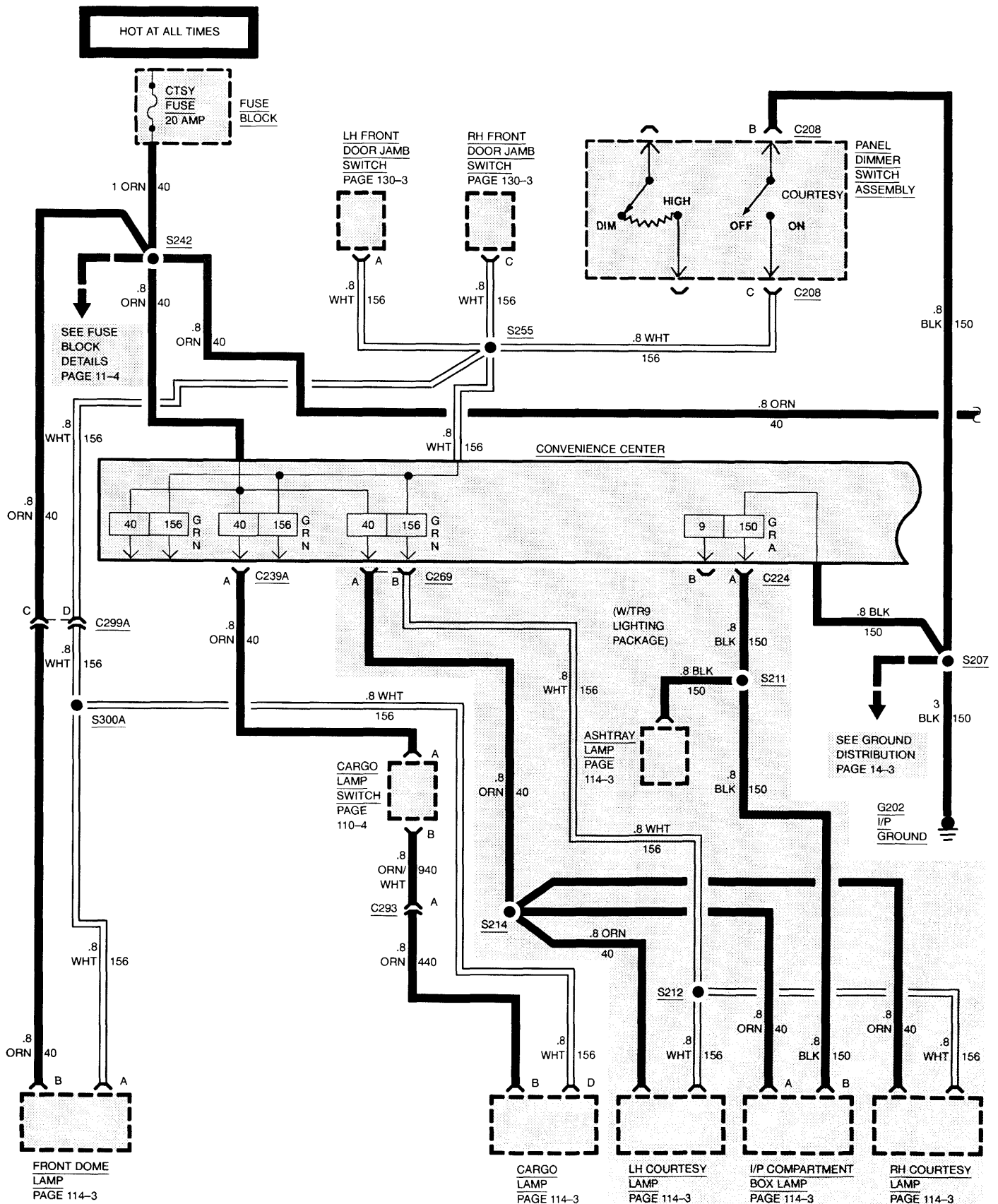




# 8A-13-4 CONVENIENCE CENTER DETAILS

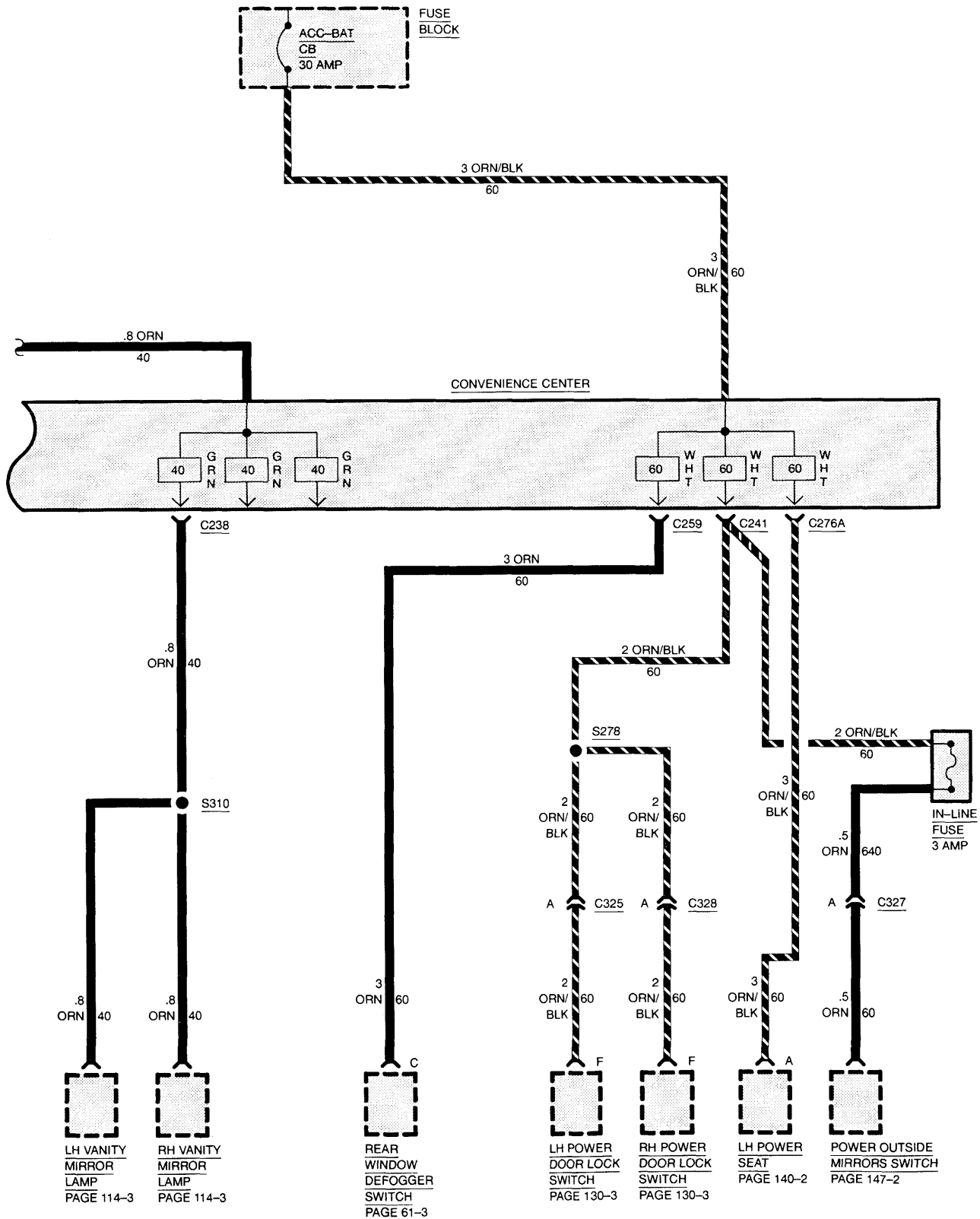


## PICKUP

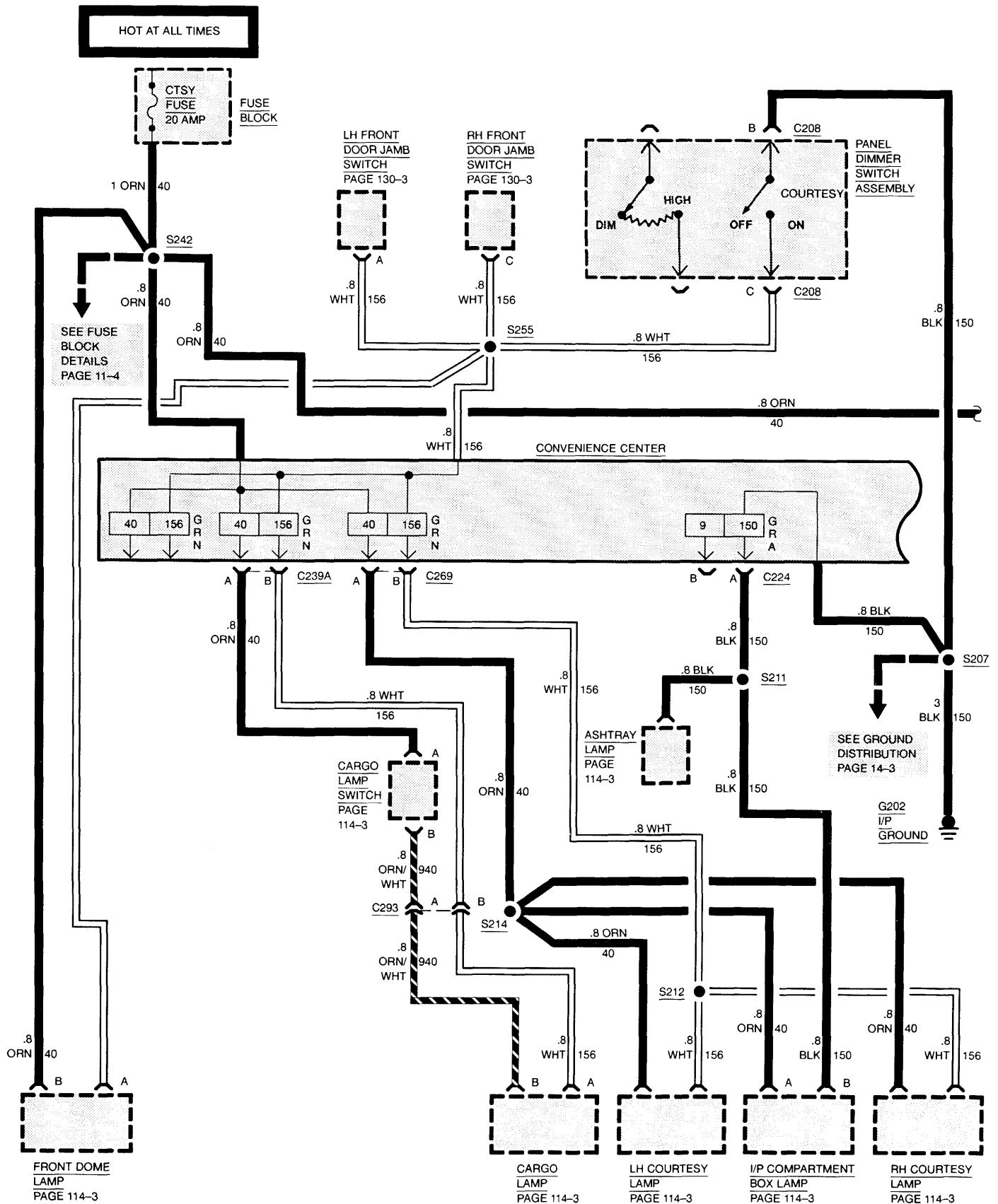


# 8A-13-6 CONVENIENCE CENTER DETAILS

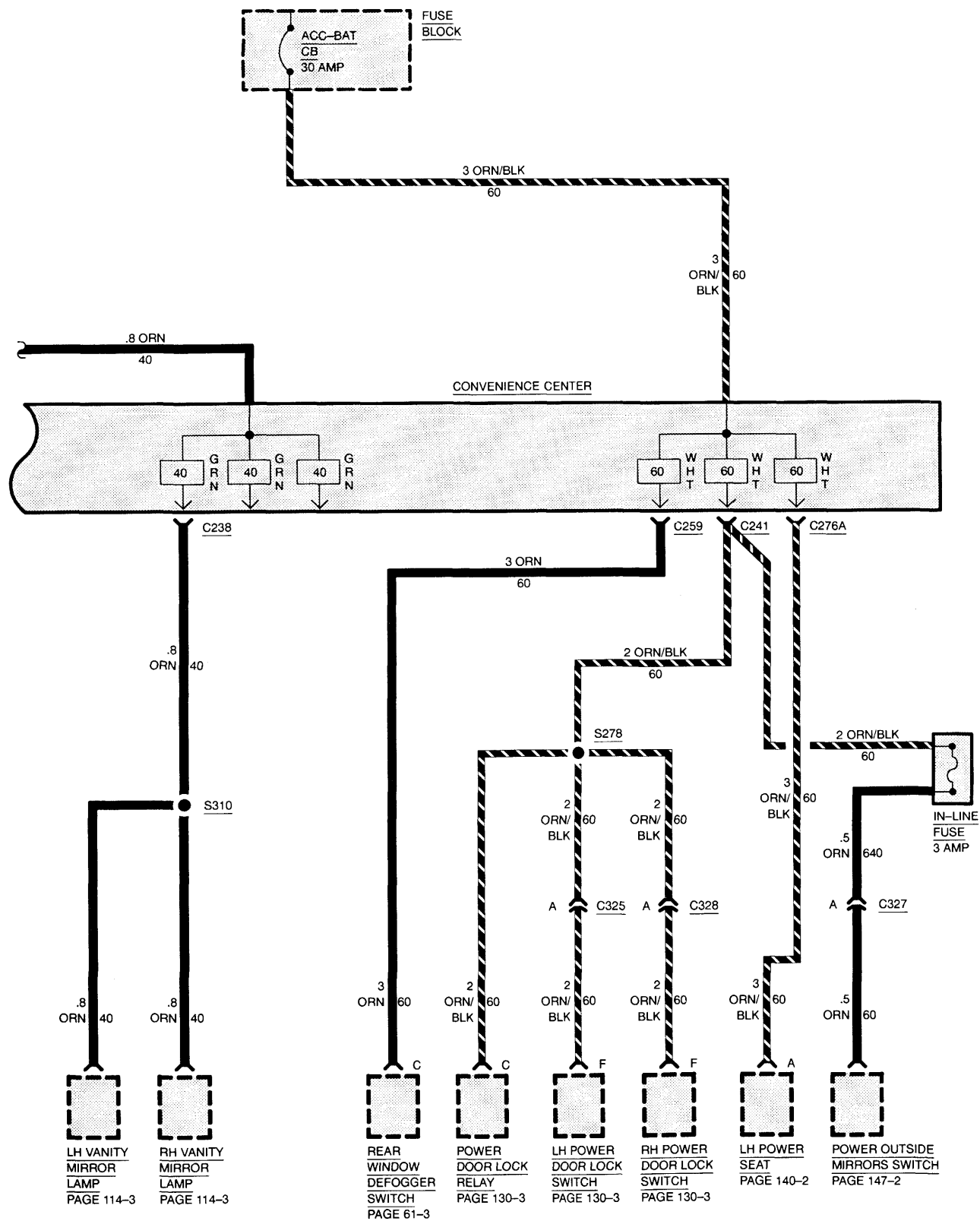
## PICKUP



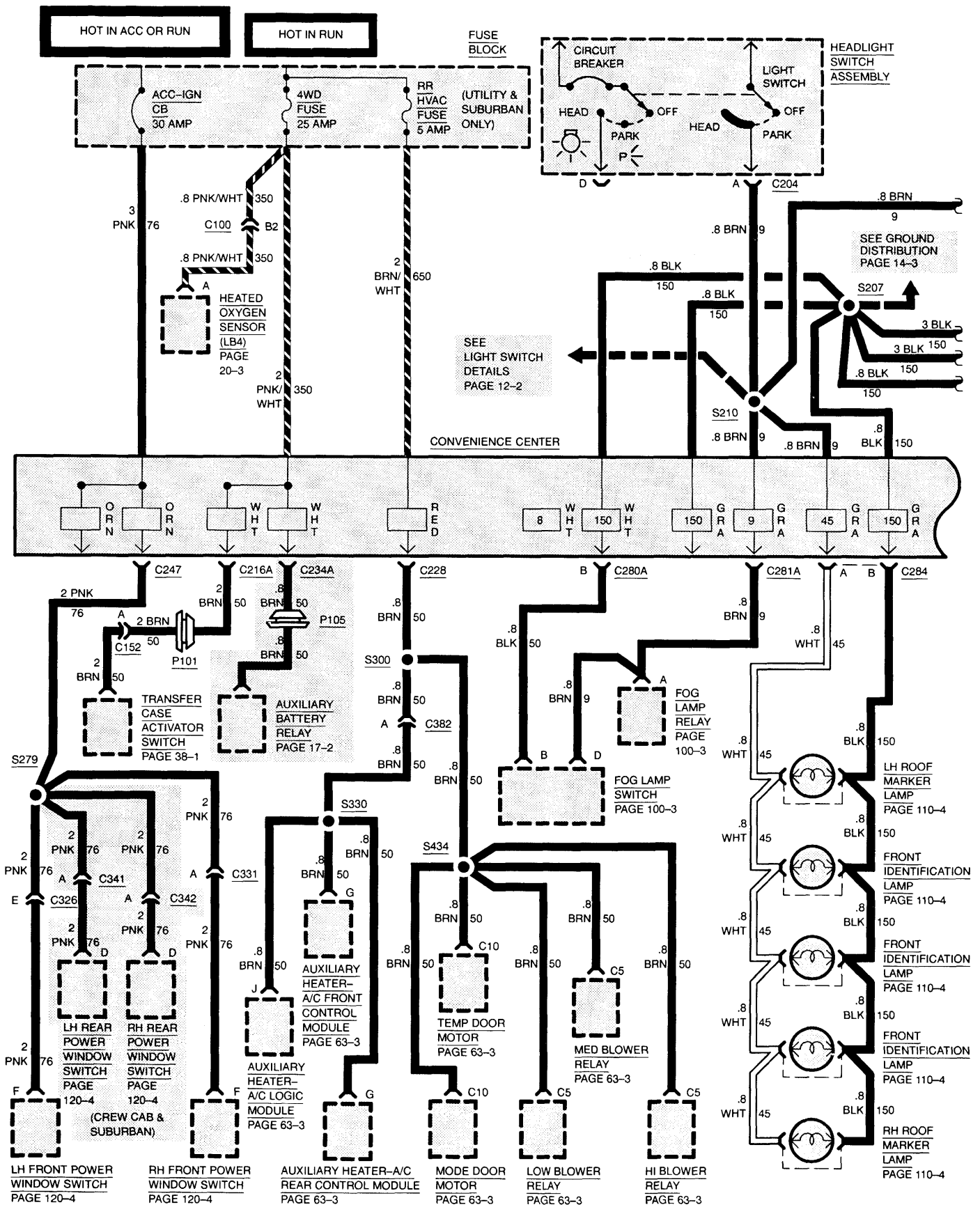
**CREW CAB, SUBURBAN, UTILITY**



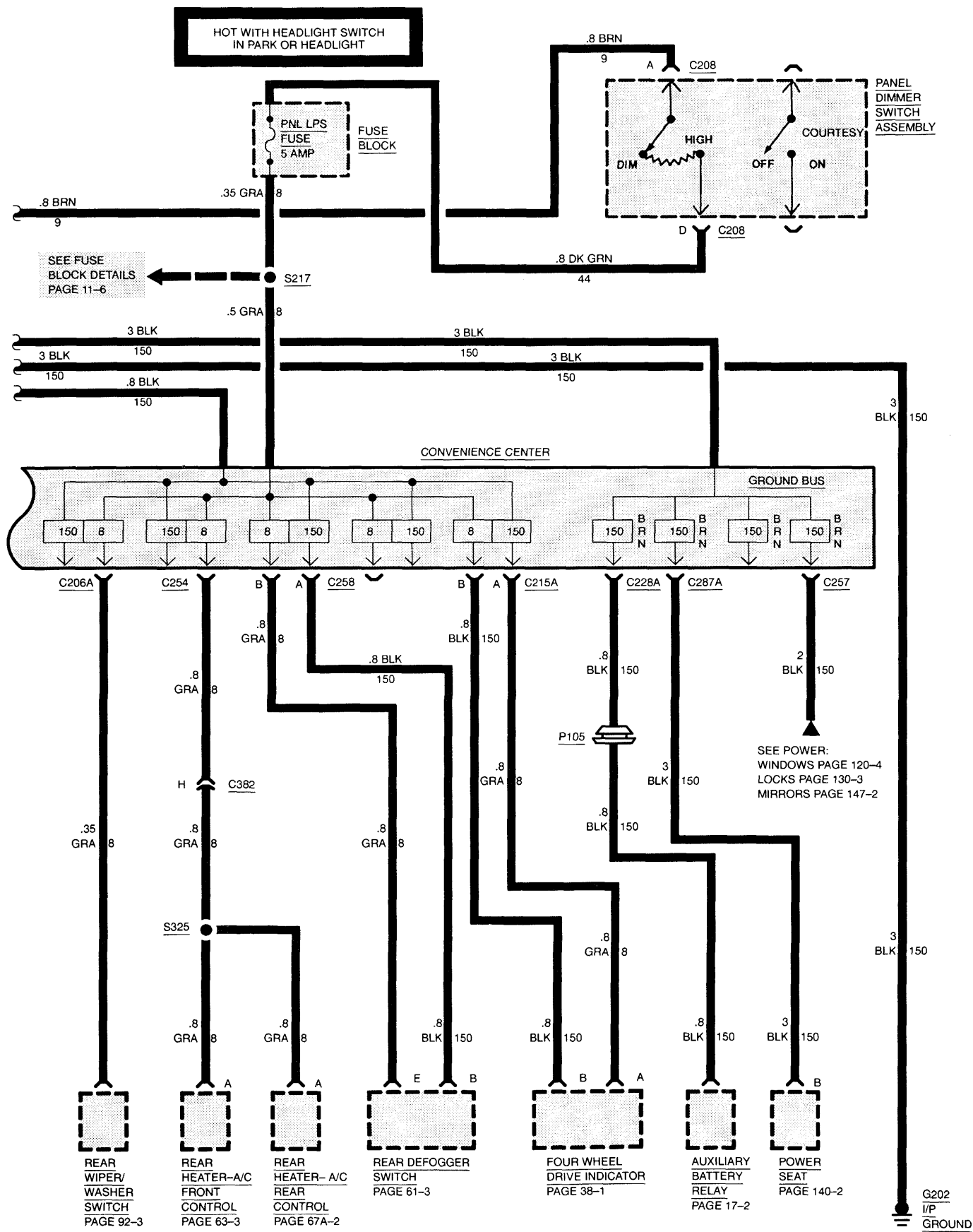
**CREW CAB, SUBURBAN, UTILITY**

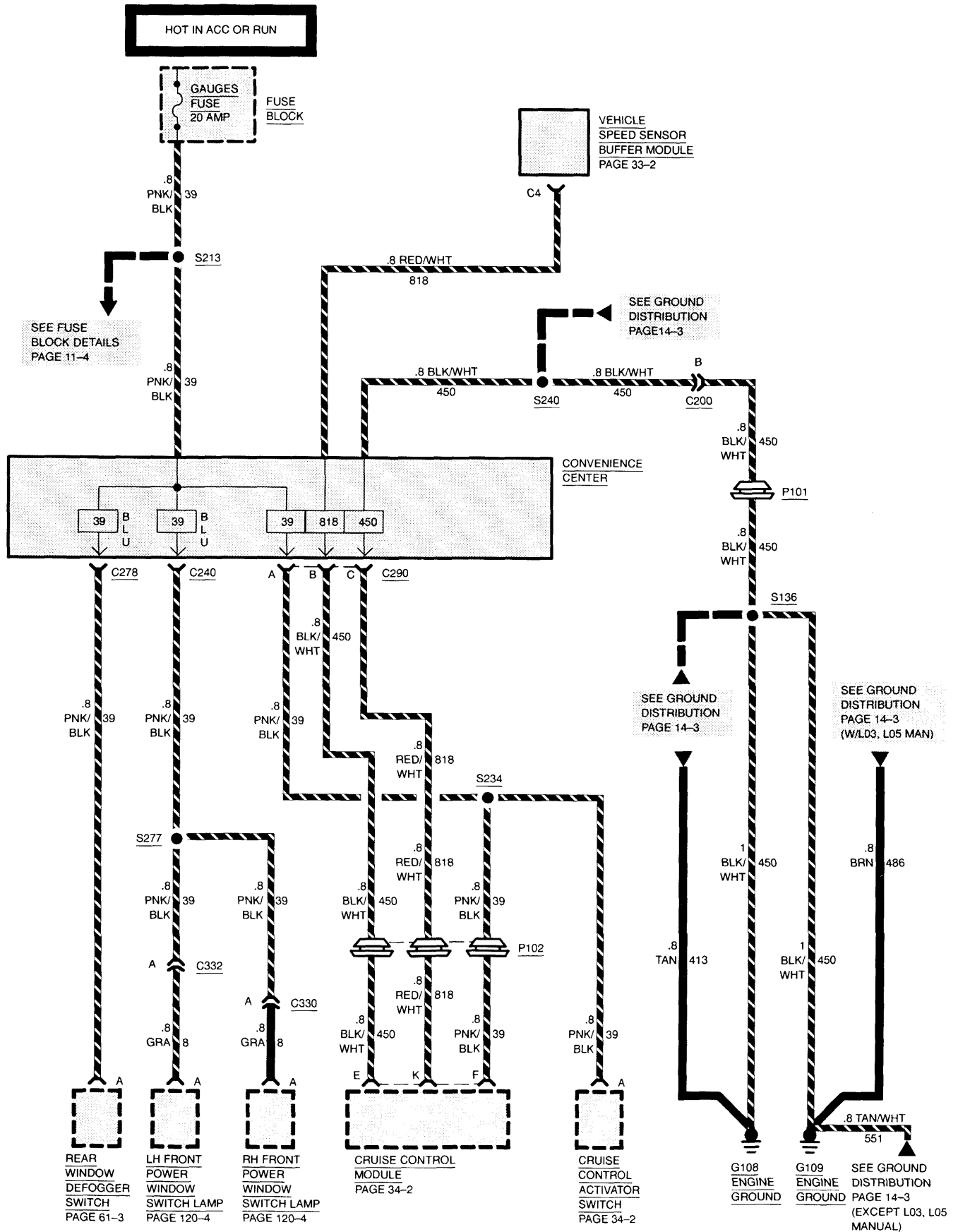


## CONVENIENCE CENTER DETAILS 8A-13-9



## 8A-13-10 CONVENIENCE CENTER DETAILS

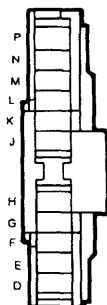






## 8A-13-12 CONVENIENCE CENTER DETAILS

12004147



**BLACK**  
Pac/on  
**C206**  
Turn Signal Switch

12004148



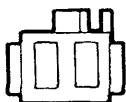
**BLACK**  
Pac/on  
**C206**  
Turn Signal Switch

12034060



**NATURAL**  
Metri-Pack 480  
**C208**  
Panel Dimmer Switch

12033701



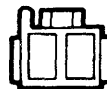
**C224**  
Convenience Center

12033700



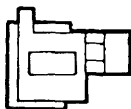
**C269**  
Convenience Center

12033700



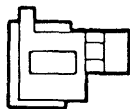
**C239A**  
Convenience Center

12059233



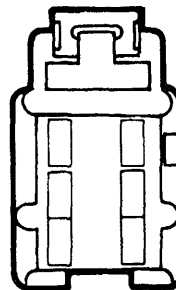
**C259**  
Convenience Center

12059233



**C241**  
Convenience Center

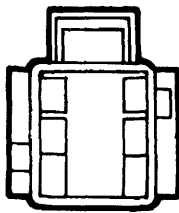
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**BLACK**  
Metri-Pack 280  
**C325**  
LH Door to Convenience Center

# CONVENIENCE CENTER DETAILS 8A-13-13

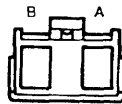
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**BLACK**  
Metri-Pack 280

**C325**  
Convenience Center to LH Door

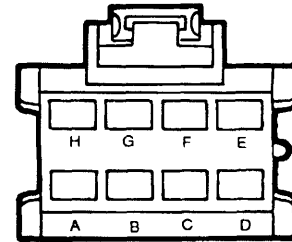
12015199



**NATURAL**  
Metri-Pack 280

**C293**  
Cargo Lamp Switch to Cargo Lamp

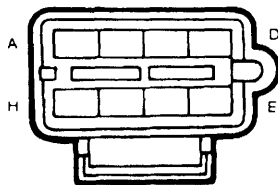
12064998



**BLACK**  
Metri-Pack 280

**C328**  
RH Door to Convenience Center

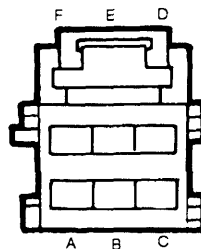
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**BLACK**  
Metri-Pack 280

**C328**  
Convenience Center to RH Door

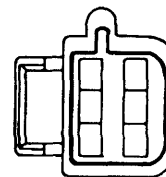
12064762



**GRAY**  
Metri-Pack 150

**C327**  
Power Mirror Switch to Convenience Center

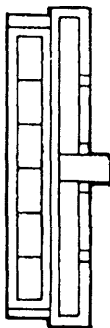
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**GRAY**  
Metri-Pack 150

**C327**  
Convenience Center to Power Mirror Switch

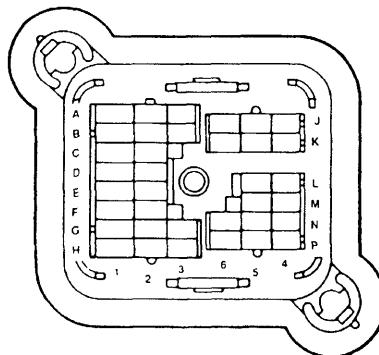
12034061



**NATURAL**  
Metri-Pack 480

**C204**  
Light Switch

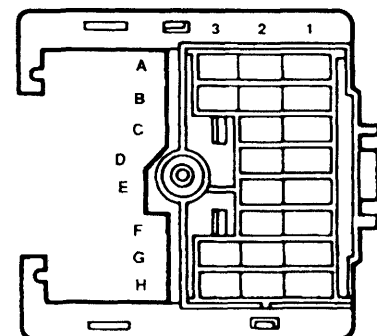
12020184



**GRAY**  
Metri-Pack

**C100**  
Bulkhead Connector - I/P

12020183

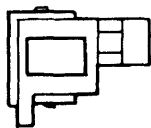


**GRAY**  
Metri-Pack

**C100**  
Bulkhead Connector - Eng

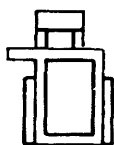
# 8A-13-14 CONVENIENCE CENTER DETAILS

12059235



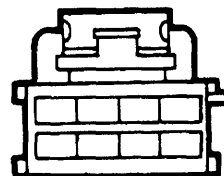
**C247**  
Convenience Center

12059232



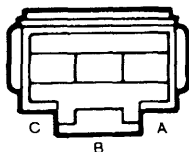
**C228**  
Convenience Center

12064766



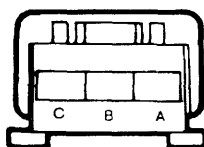
**BLUE**  
Metri-Pack 150  
**C382**  
Convenience Center to  
Heater-A/C Module

12020398



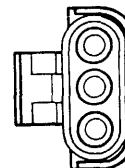
**BLACK**  
Metri-Pack 180  
**C331**  
RH Door to Convenience Center

12020397



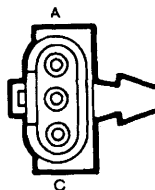
**BLACK**  
Metri-Pack 280  
**C331**  
Convenience Center to RH Door

12020829



**BLACK**  
Weather-Pack  
**C152**  
Transfer Case Switch to  
Convenience Center

12033852



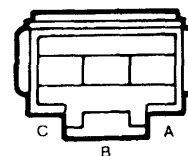
**BLACK**  
Weather-Pack  
**C152**  
Convenience Center to Transfer  
Case Switch

12059236



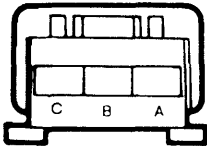
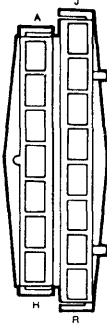
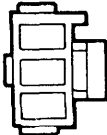
**C257**  
Convenience Center

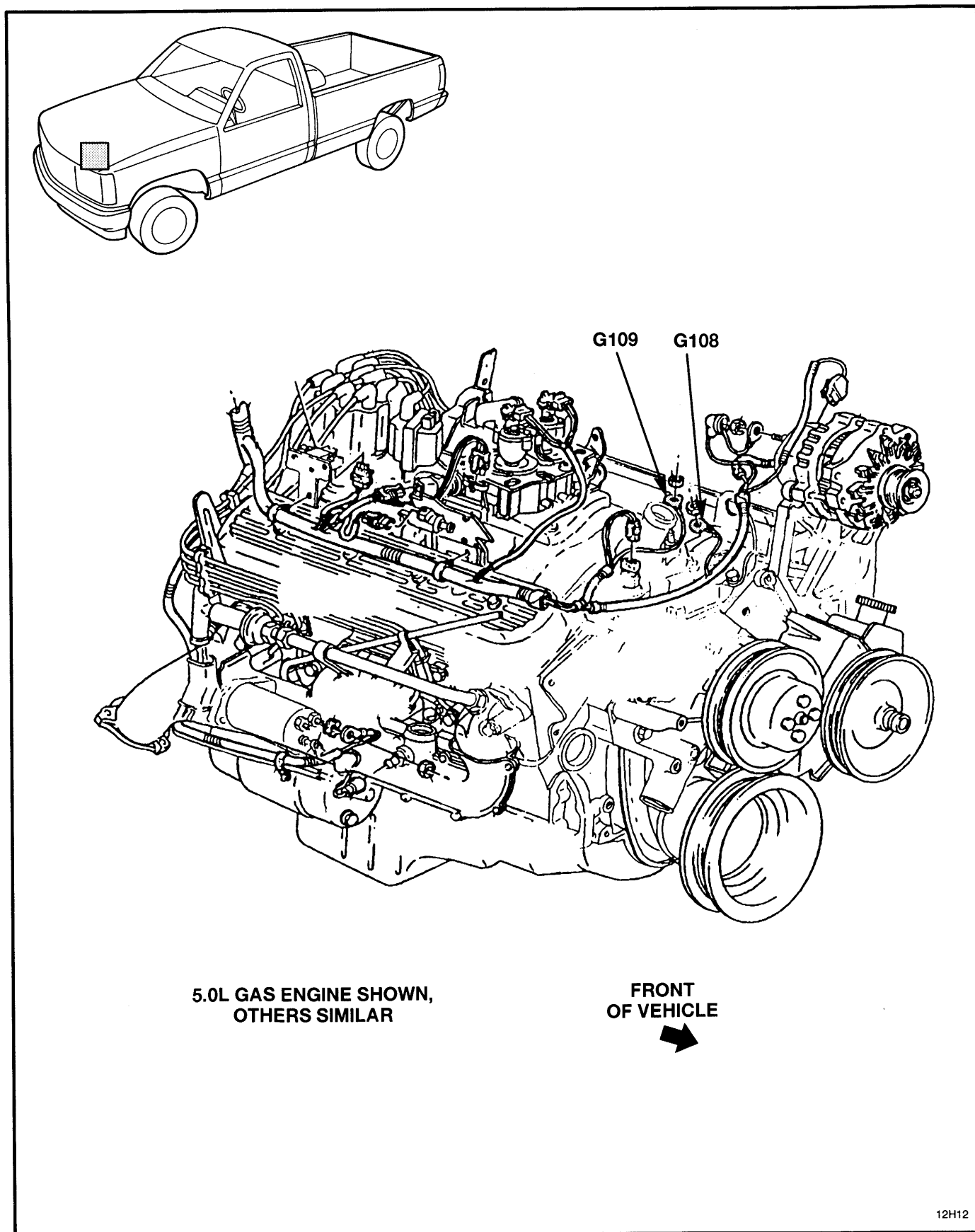
12020398



**BLACK**  
Metri-Pack 180  
**C326**  
LH Door to Convenience Center

CONVENIENCE CENTER DETAILS 8A-13-15

|                                                                                                                                                                                            |                                                                                                                                                          |                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>12020397</p>  <p><b>BLACK</b><br/>Metri-Pack 280<br/><b>C326</b><br/>Convenience Center to LH Door</p> | <p>12059236</p>  <p><b>C287A</b><br/>Convenience Center</p>             | <p>12033713</p>  <p><b>C215A</b><br/>Convenience Center</p> |
| <p>12041254</p>  <p><b>C200</b><br/>Convenience Center to Bulkhead</p>                                   | <p>12020213</p>  <p><b>C200</b><br/>Bulkhead to Convenience Center</p> | <p>12033698</p>  <p><b>C290</b><br/>Convenience Center</p> |
|                                                                                                                                                                                            |                                                                                                                                                          |                                                                                                                                                |



12H12

Figure 1 — LH Side of Engine, 5.0L (305 CID) Engine — Gasoline

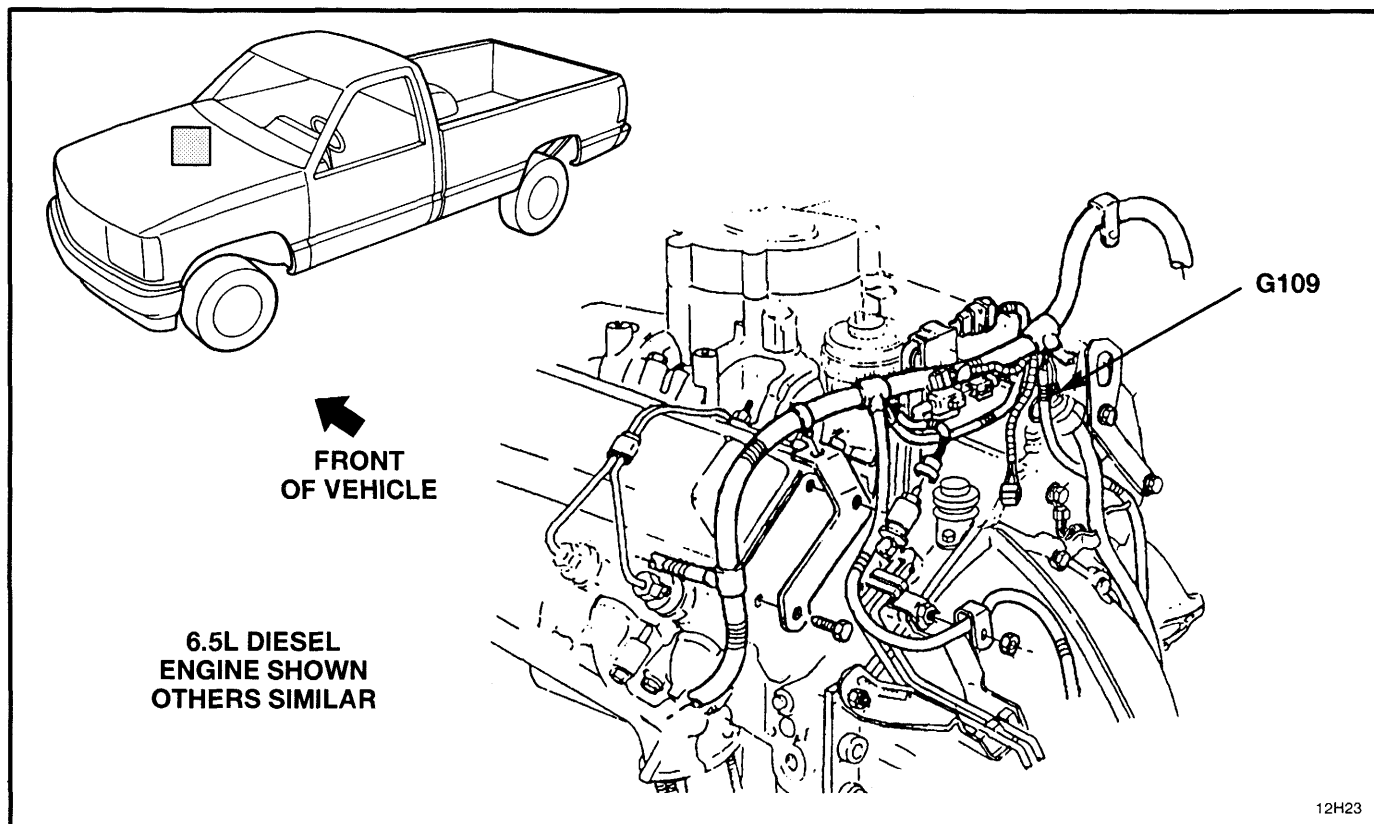


Figure 2 — Engine Wiring, Rear — Diesel

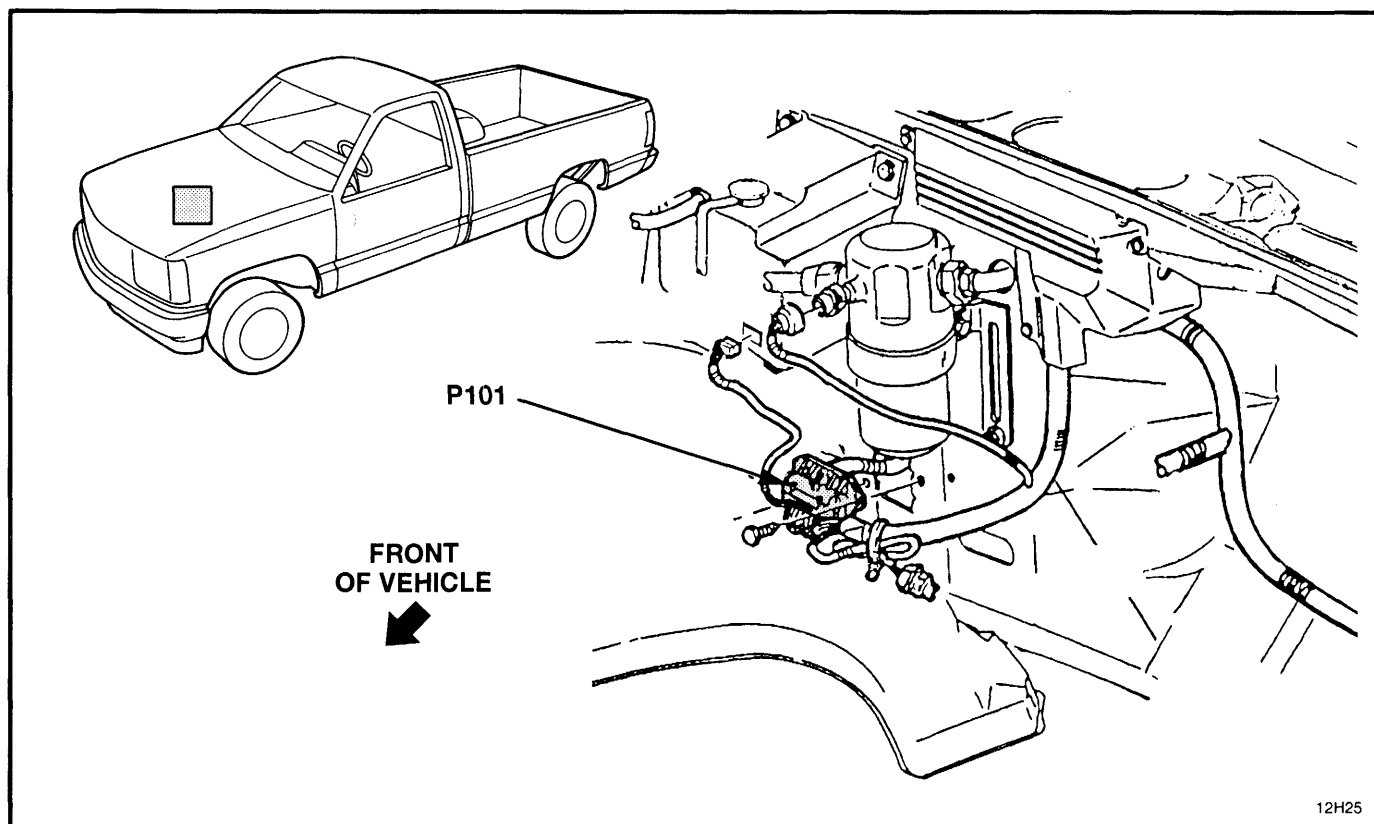


Figure 3 — Engine Wiring to Dash

# 8A-13-18 CONVENIENCE CENTER DETAILS

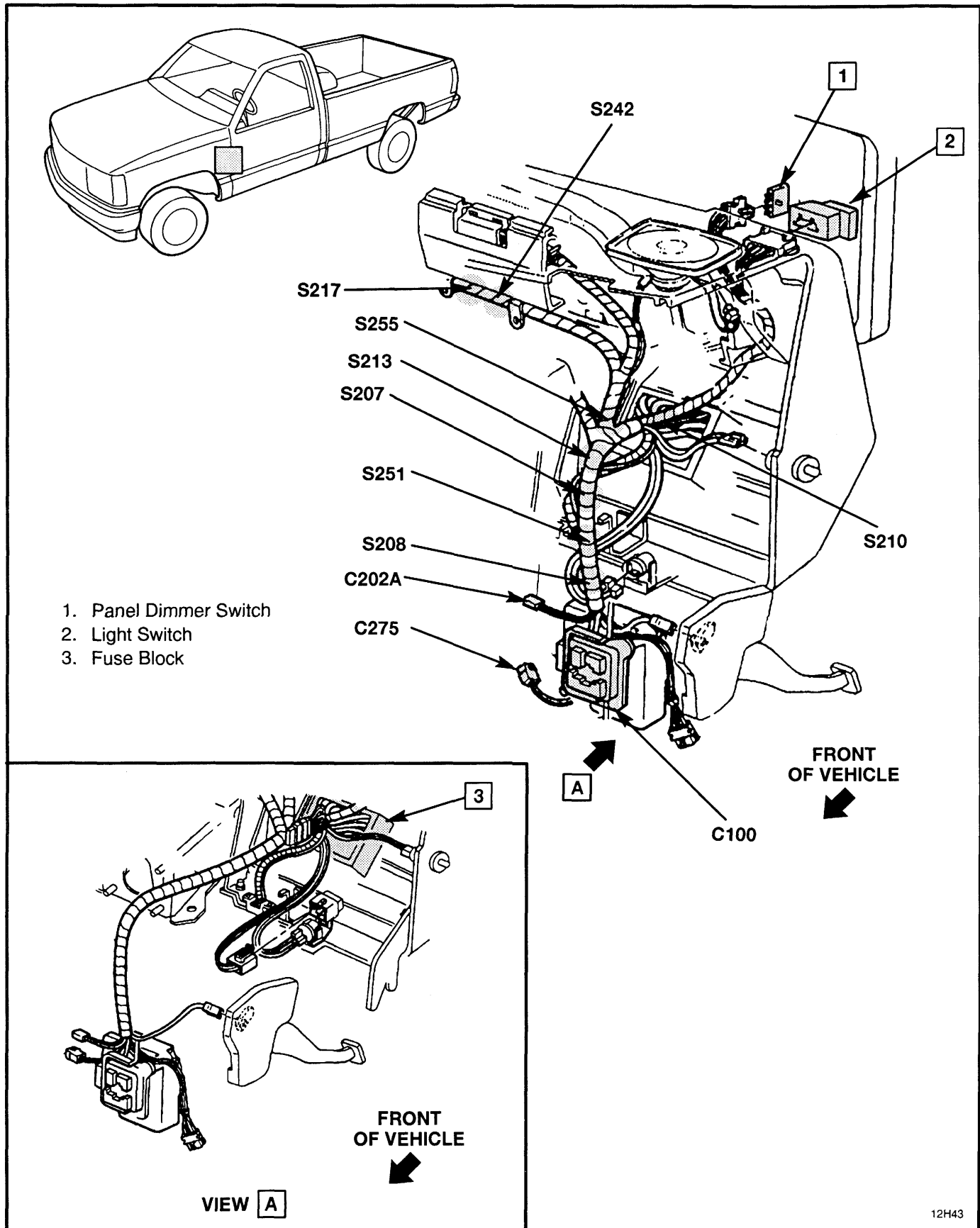


Figure 4 — LH Side of Instrument Panel

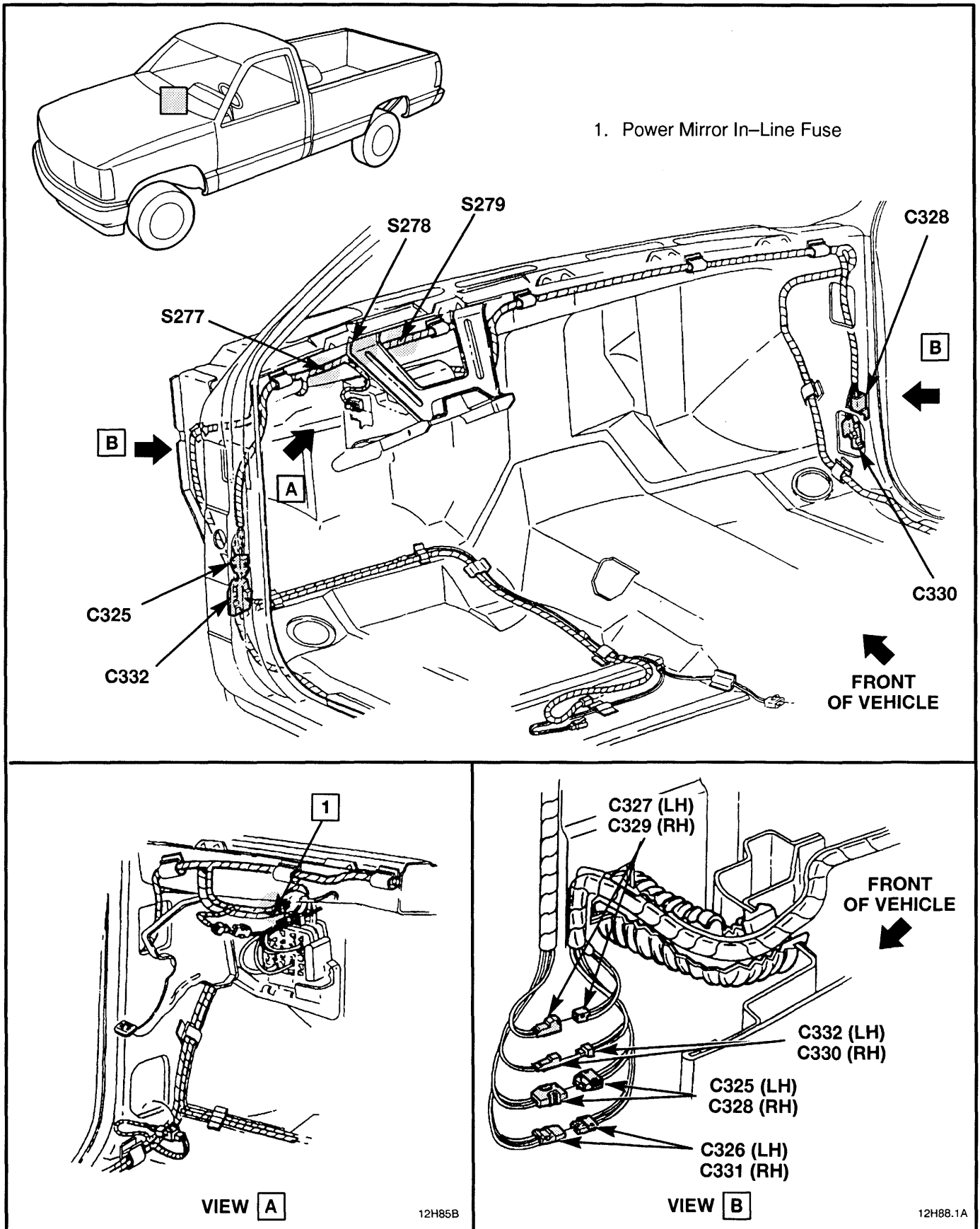


Figure 5 — Power Window and Door Lock Crossbody Wiring – Suburban



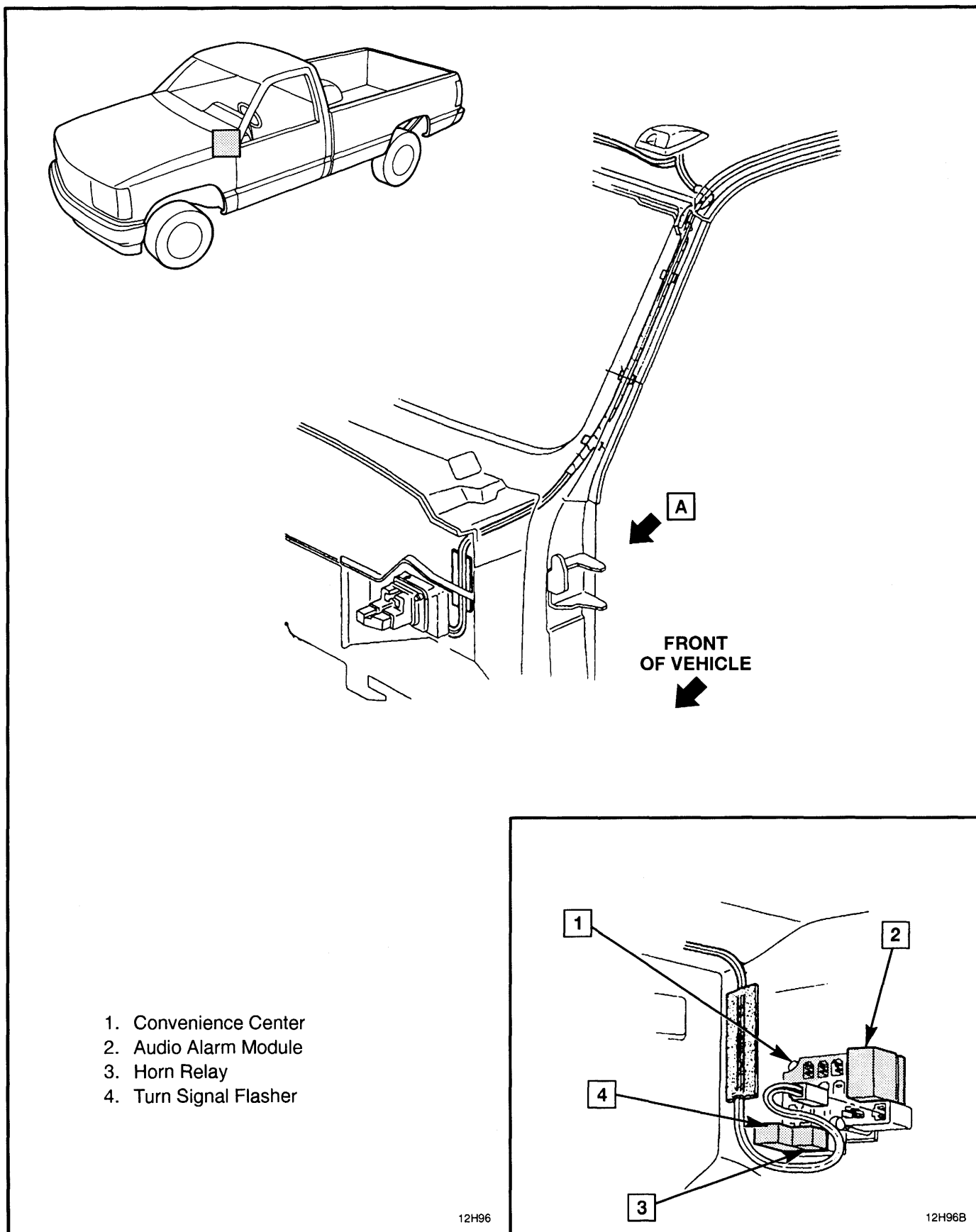


Figure 6 — Roof Marker Lamp Wiring

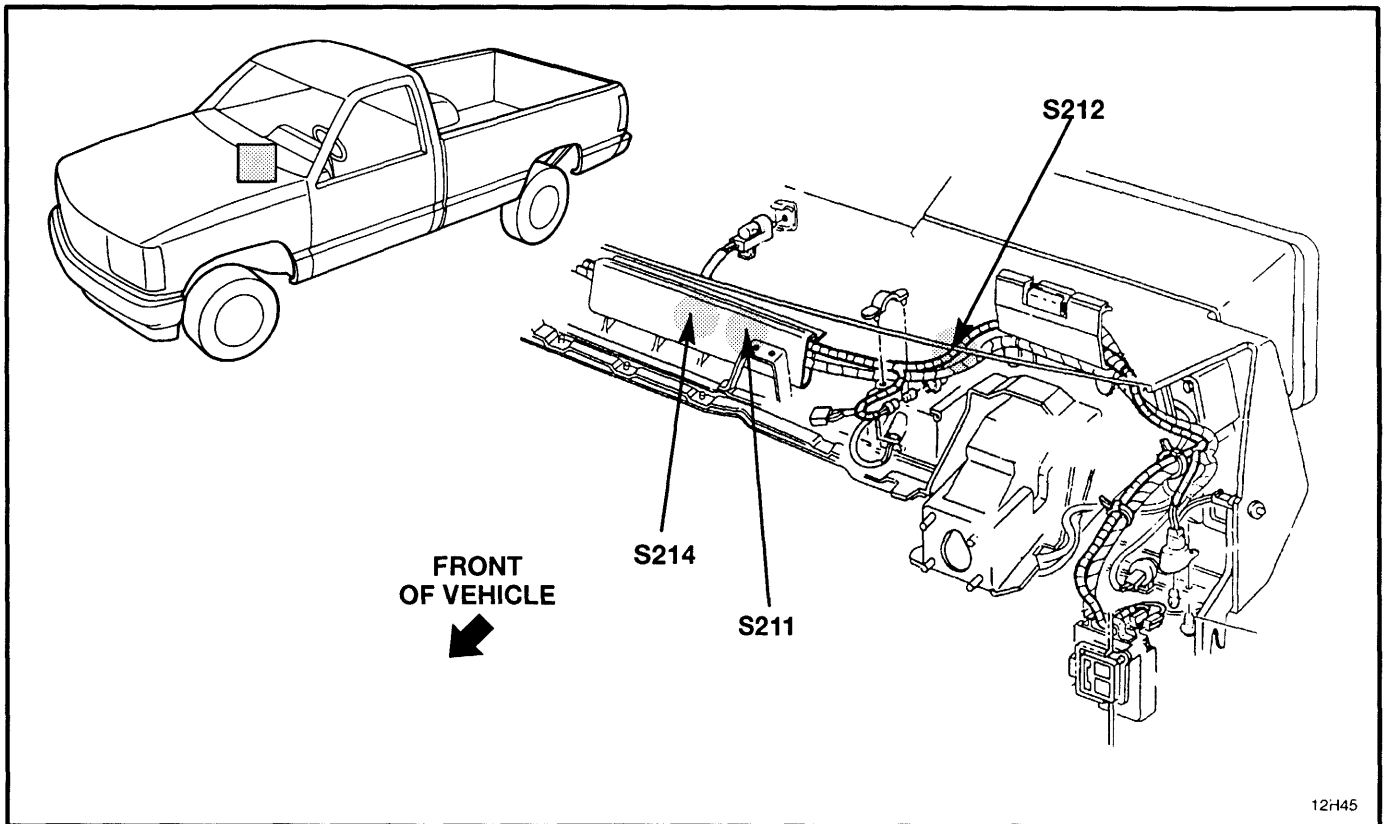


Figure 7 — Convenience Lighting

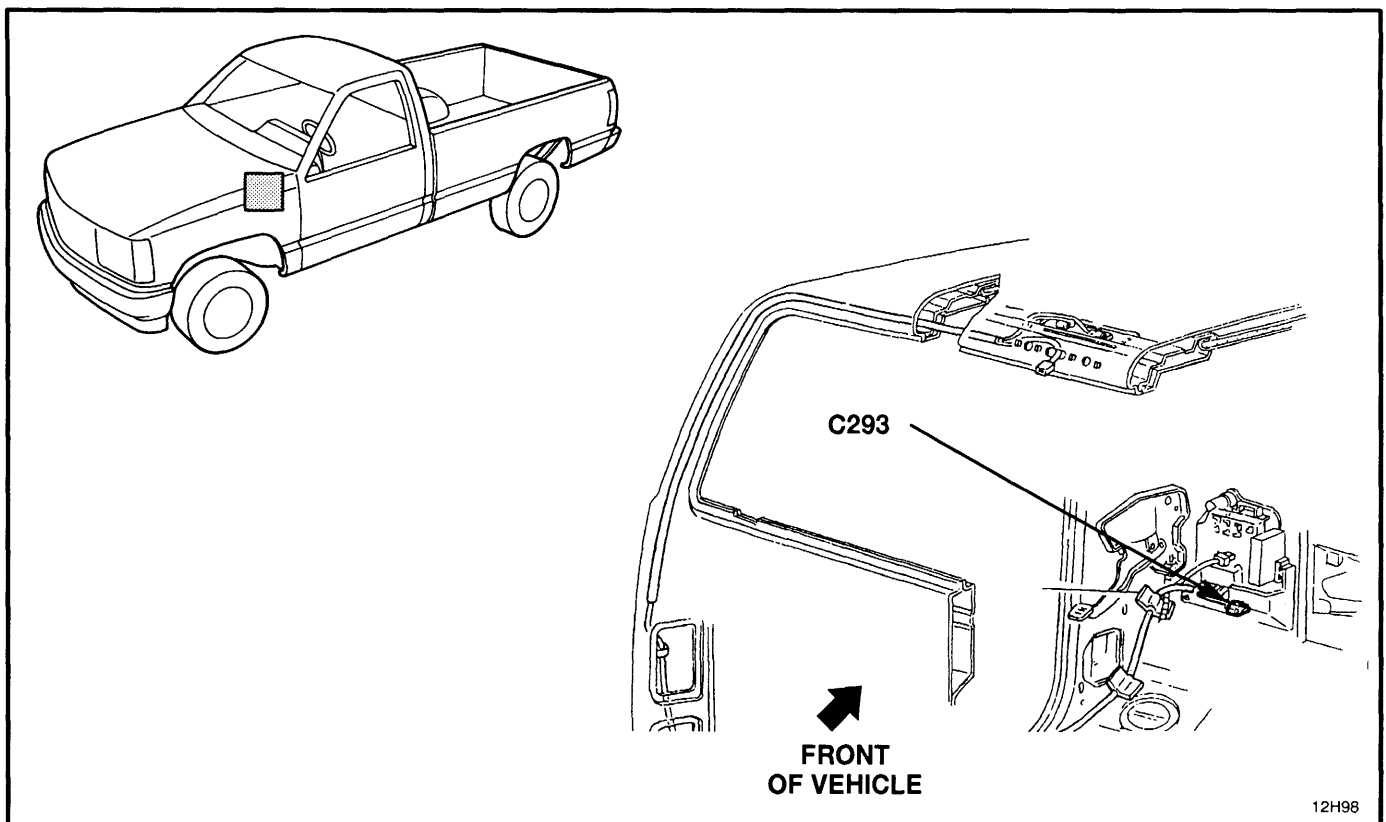


Figure 8 — Cargo CHMSL and Dome Lamp Wiring

## 8A-13-22 CONVENIENCE CENTER DETAILS

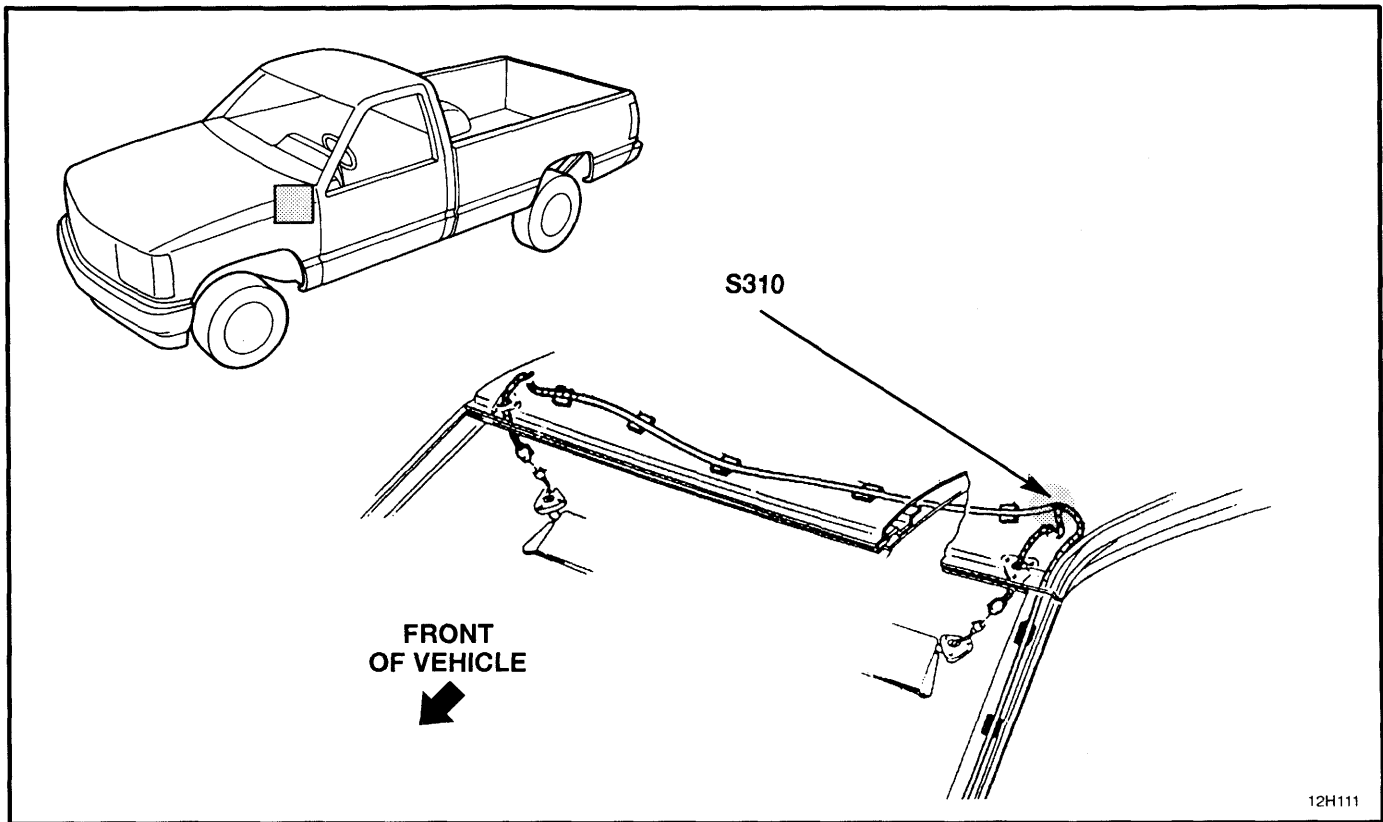


Figure 9 — Sunshade Vanity Mirror Wiring

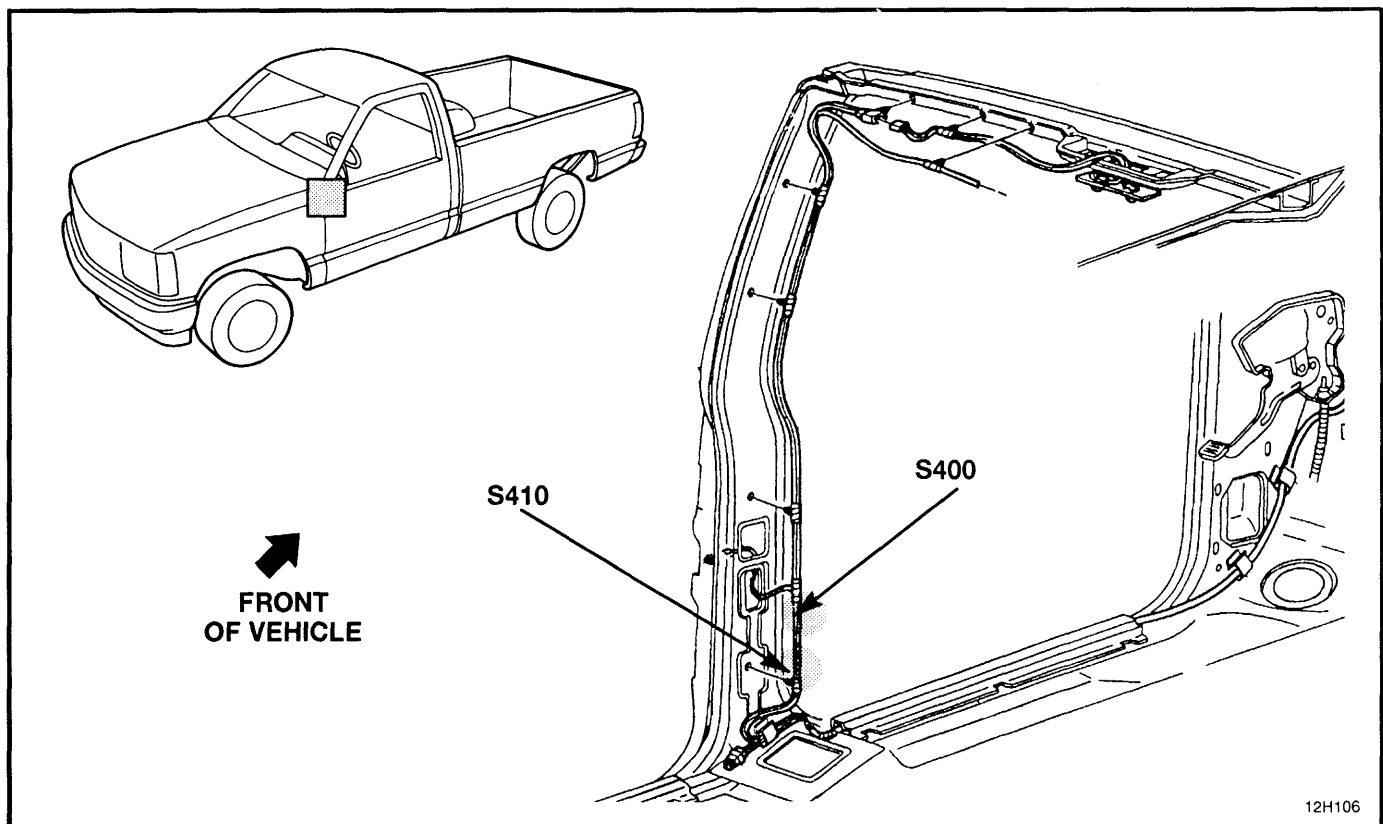


Figure 10 — Front Dome Lamp Harness – Crew Cab W/Convenience Package

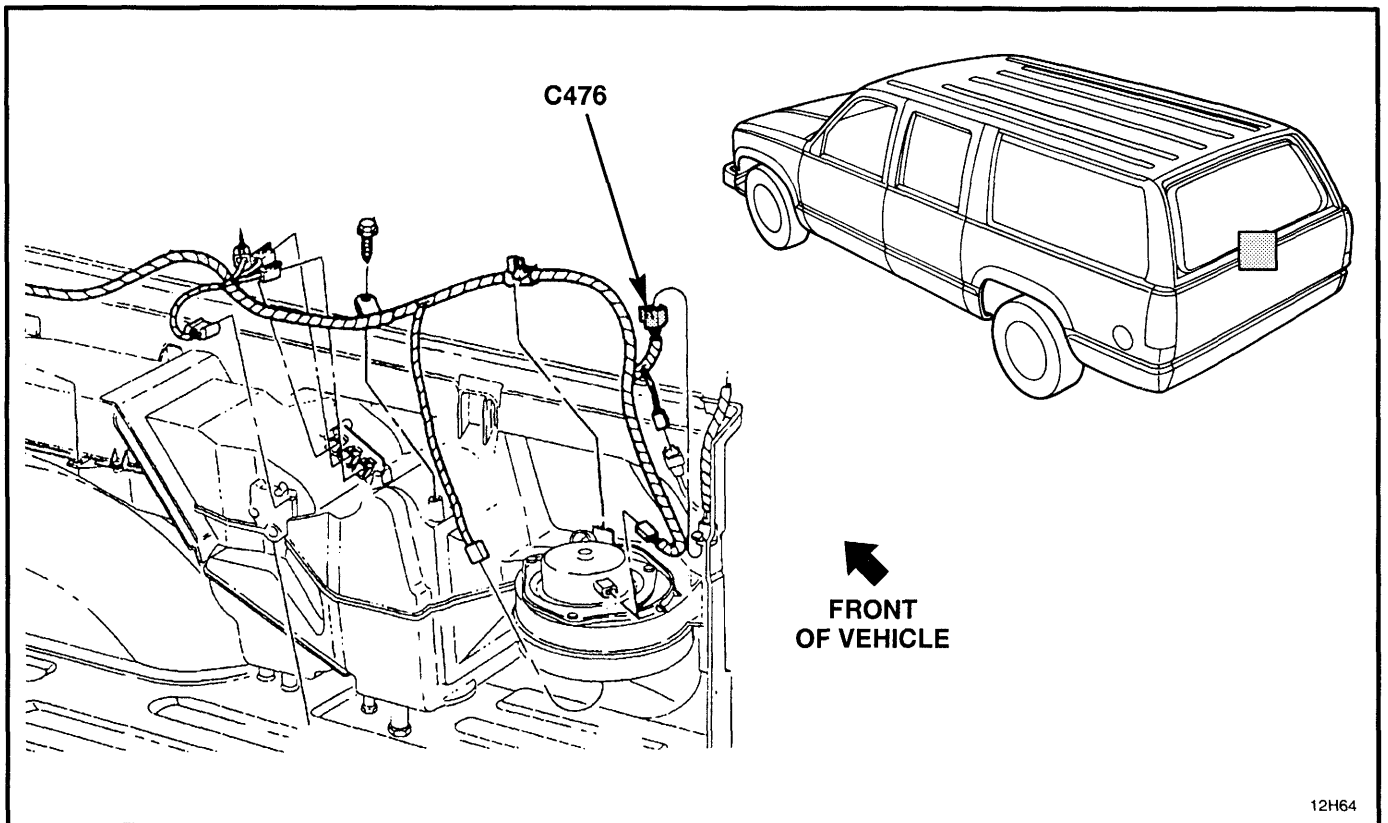


Figure 11 — Auxiliary Heater and A/C Wiring

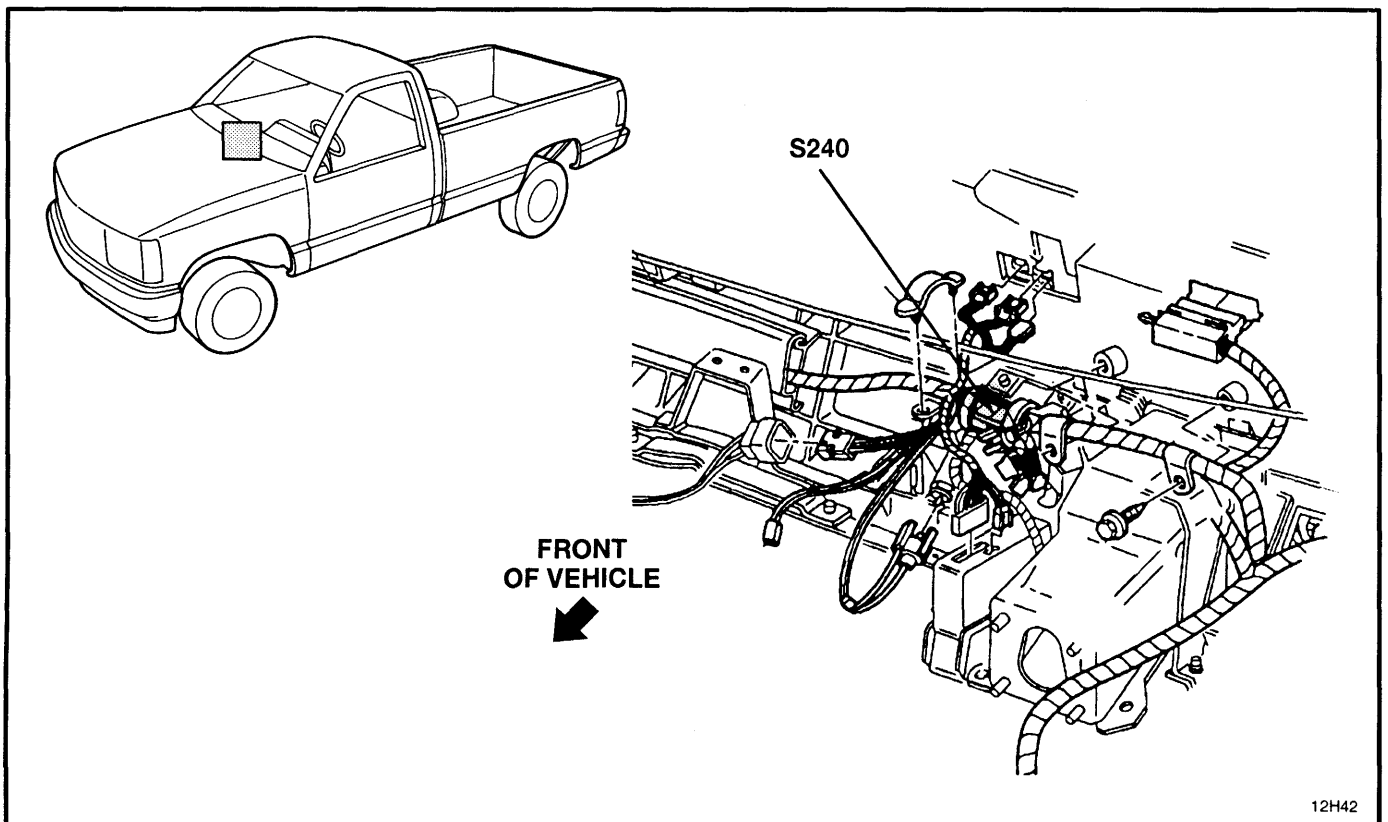


Figure 12 — Instrument Panel Wiring – RH Side

## 8A-13-24 CONVENIENCE CENTER DETAILS

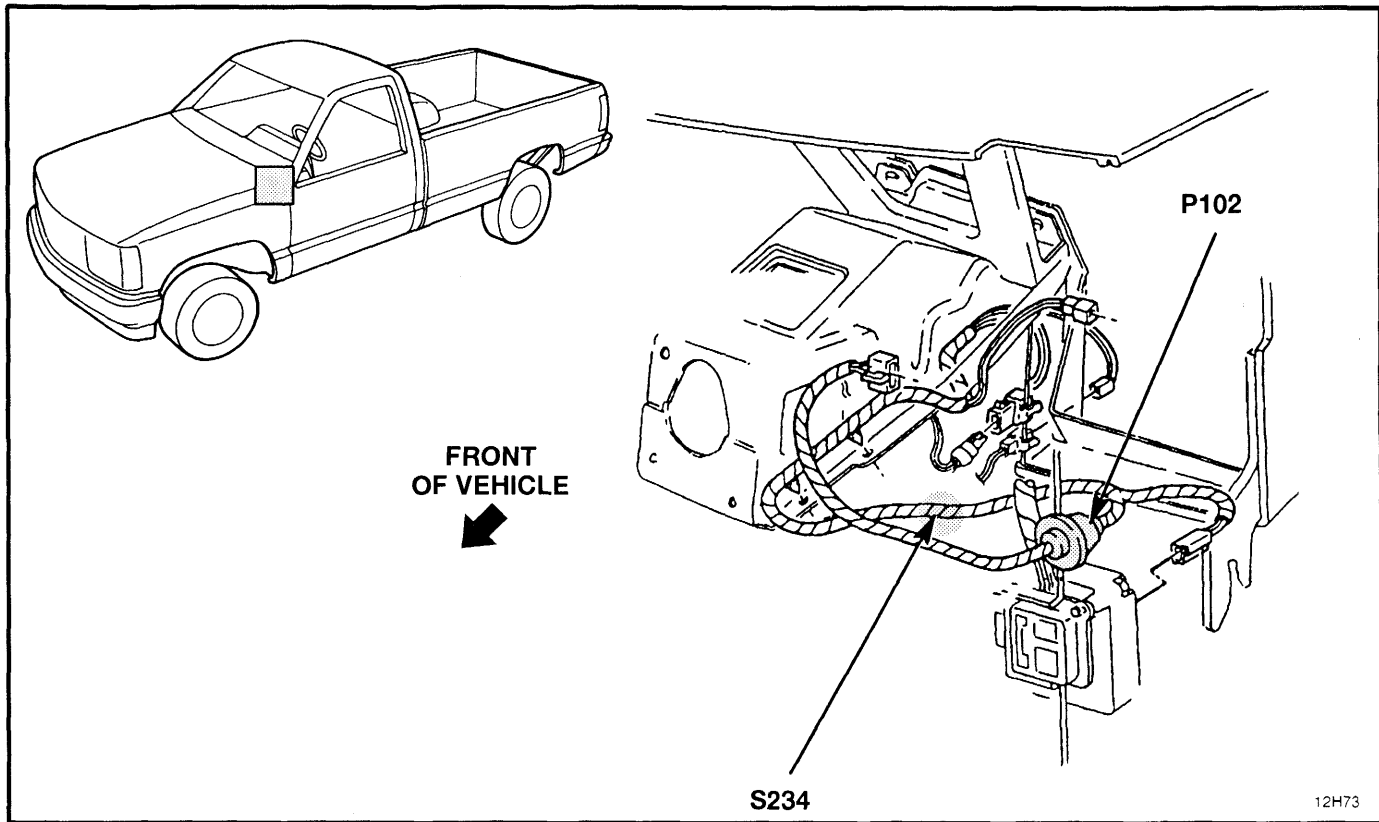


Figure 13 — Cruise Control Wiring

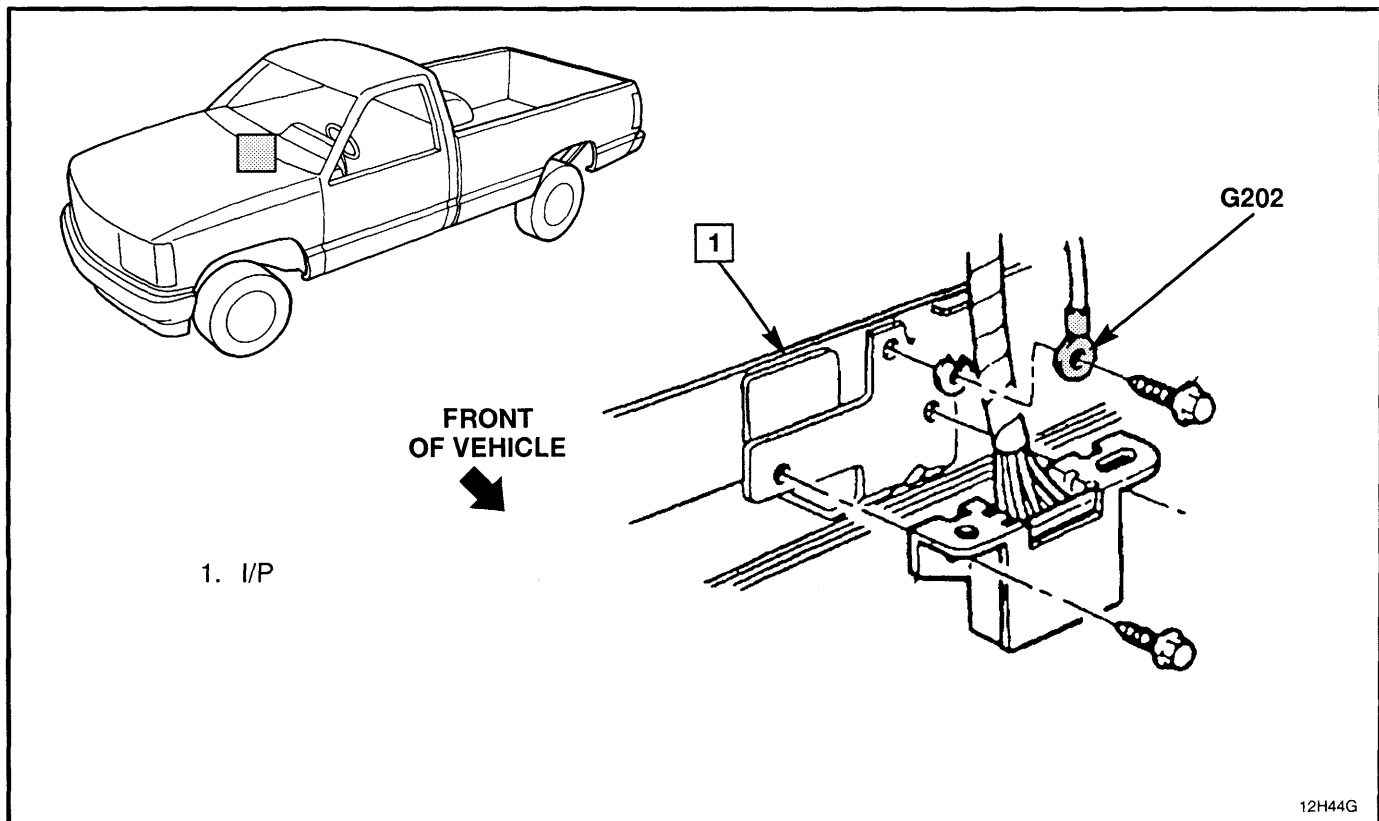


Figure 14 — I/P Ground

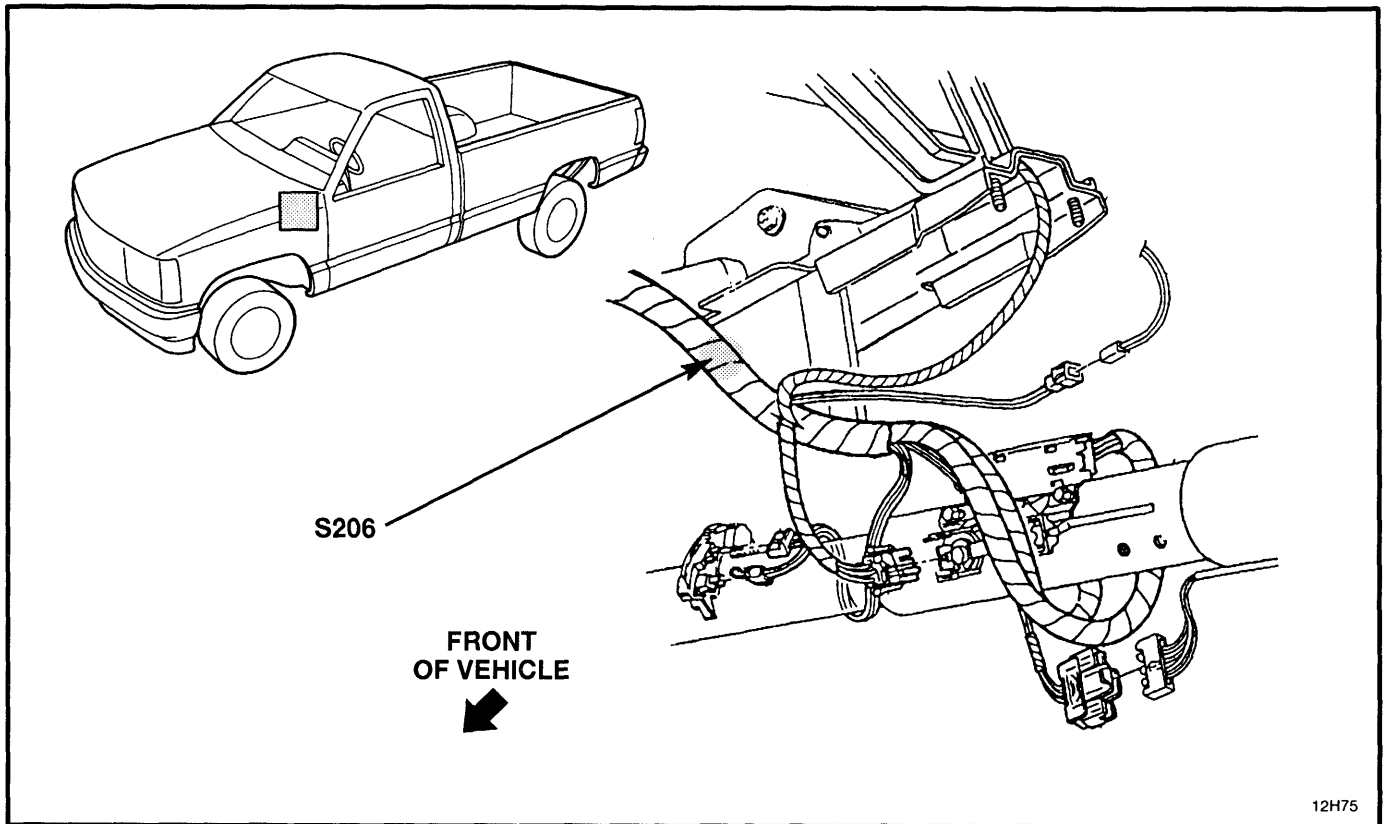


Figure 15 — LH Side of Steering Column Wiring

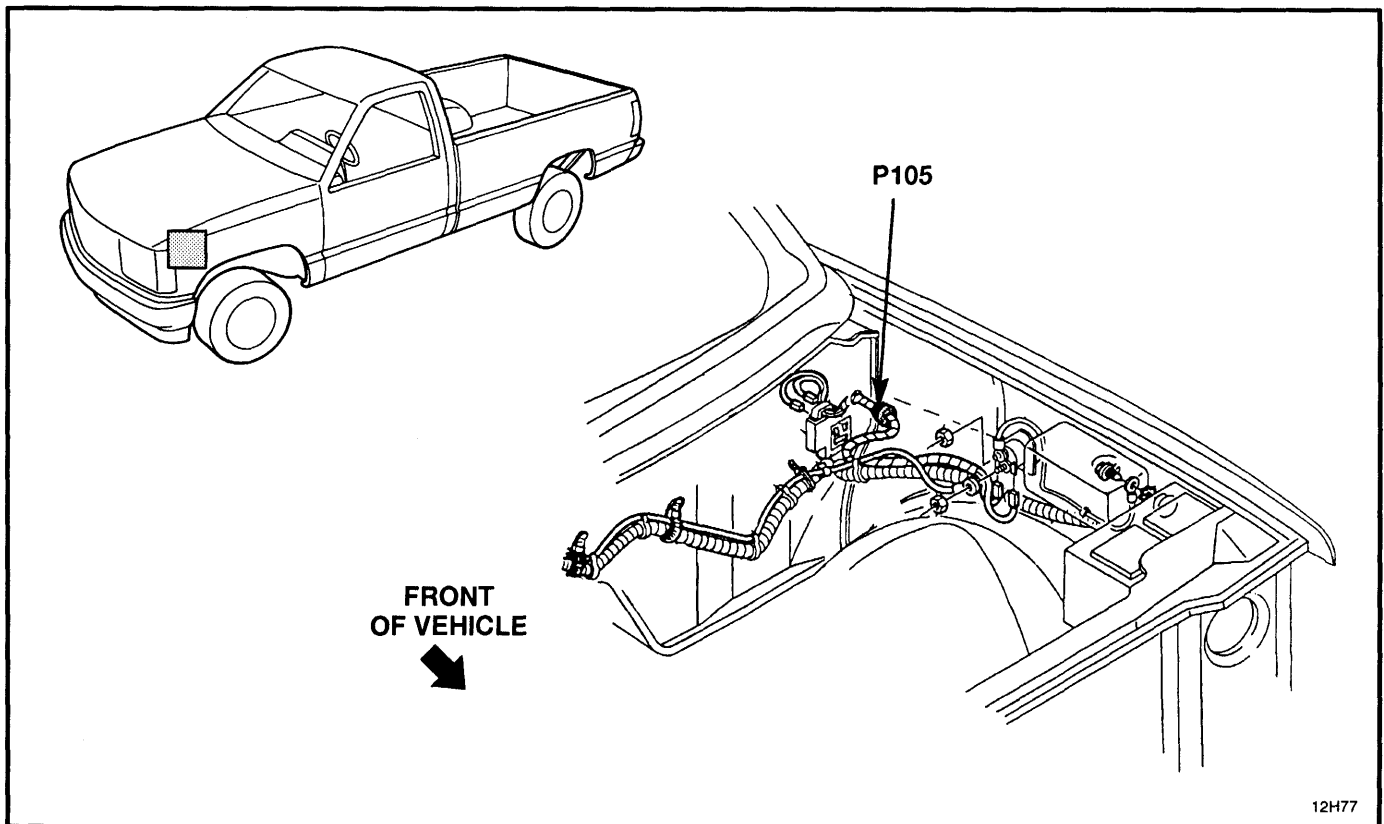
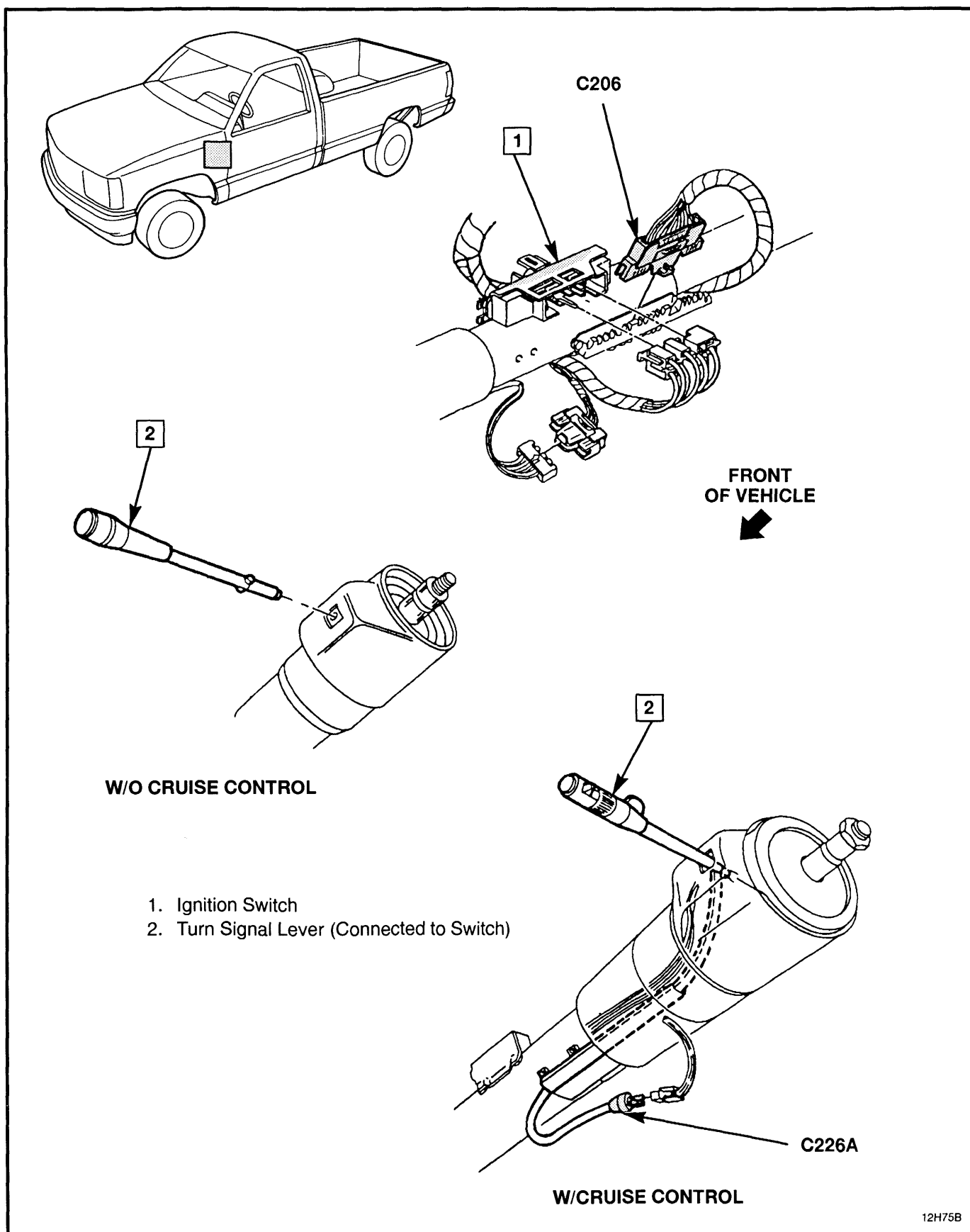


Figure 16 — Auxiliary Battery Wiring

## 8A-13-26 CONVENIENCE CENTER DETAILS



12H75B

Figure 17 — RH Steering Column Wiring

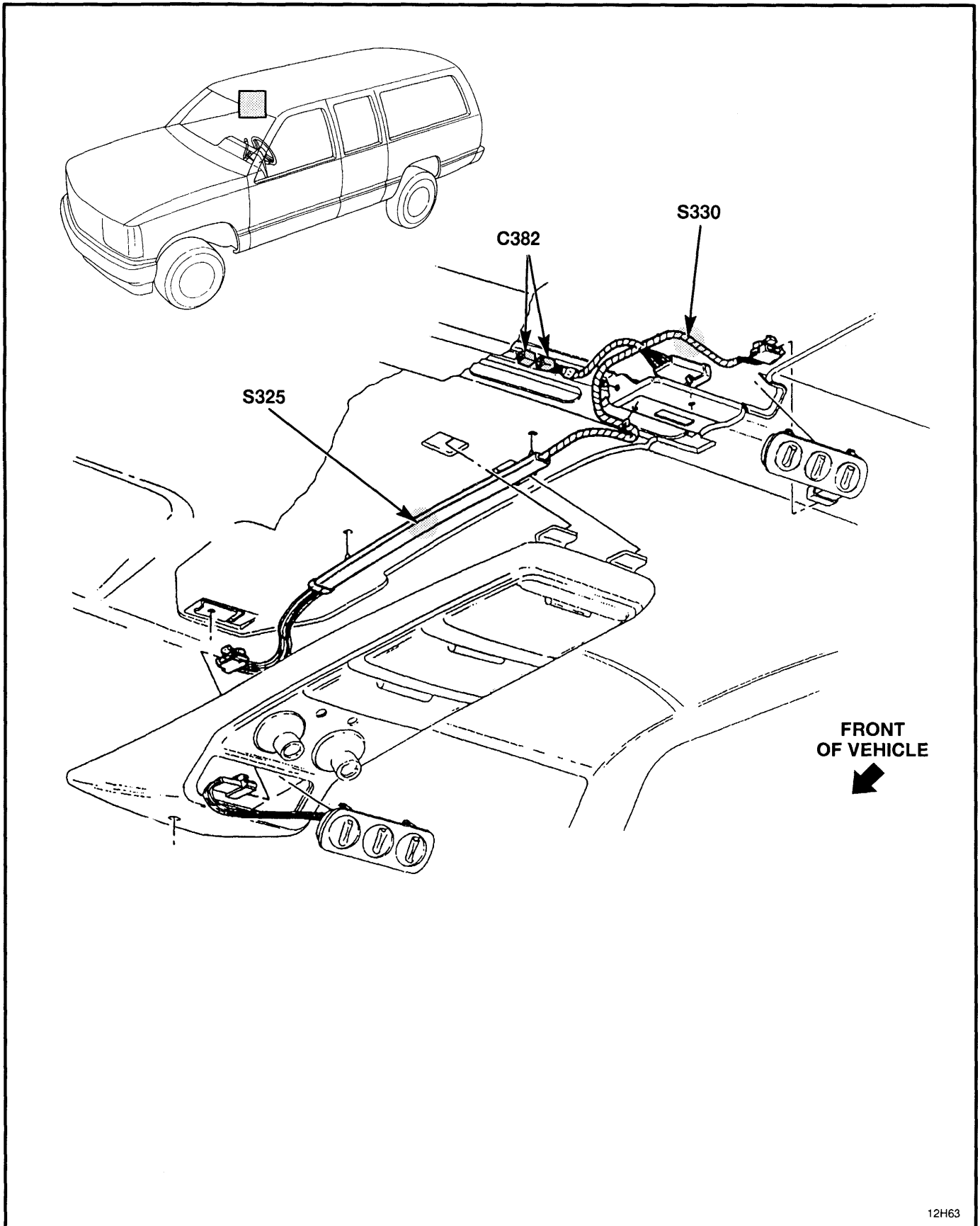


Figure 18 — Auxiliary Heater and A/C Controls



## 8A-13-28 CONVENIENCE CENTER DETAILS

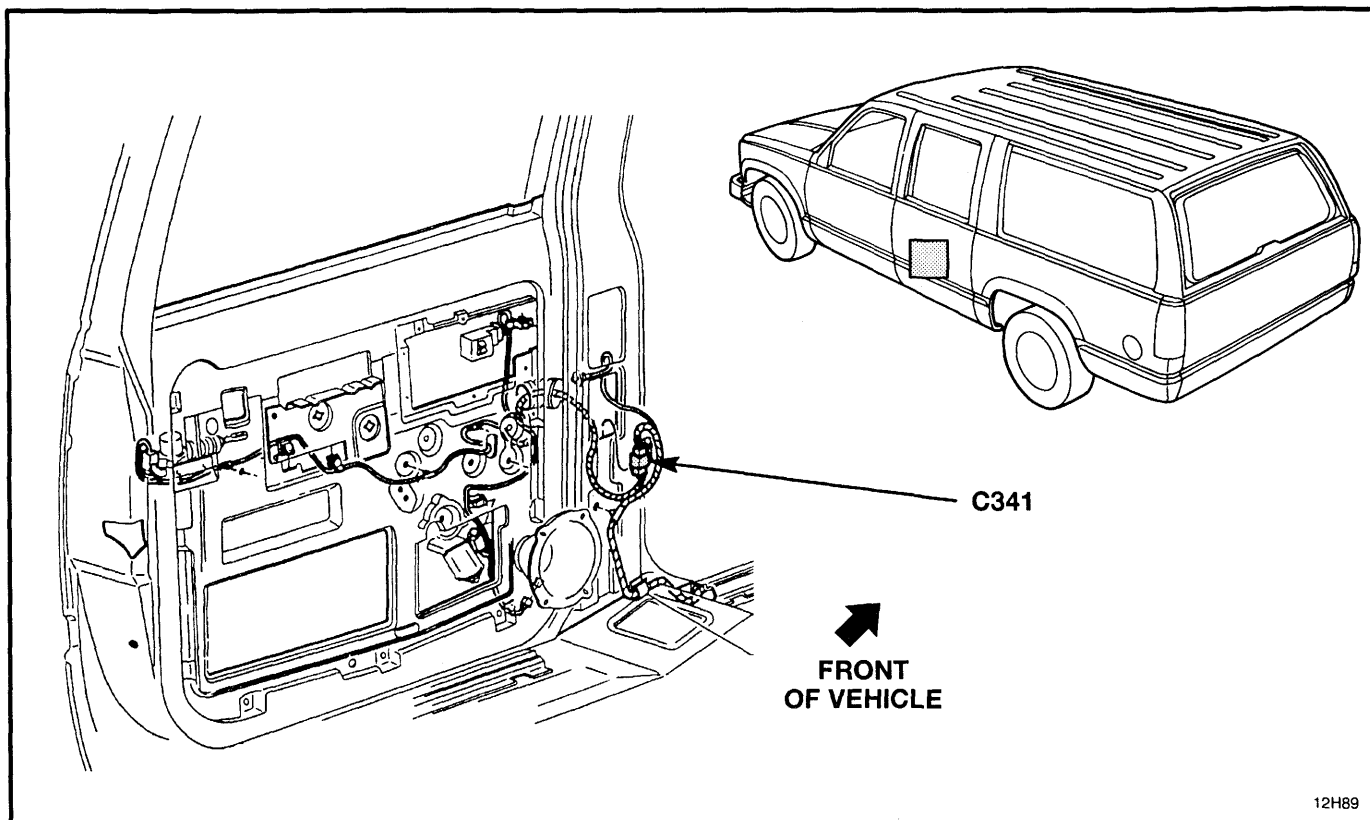


Figure 19 — Rear Side Door Wiring — Suburban and 4-Door

**COMPONENT LOCATION****Page — Figure**

|                                   |                                      |           |    |
|-----------------------------------|--------------------------------------|-----------|----|
| Battery, LH (Diesel) .....        | LH front of engine compartment ..... | Not Shown |    |
| Battery, RH .....                 | RH front of engine compartment ..... | 14-17     | 1  |
| Convenience Center .....          | Under LH side of I/P .....           | 14-22     | 10 |
| Daytime Running Lamps Relay ..... | Under LH side of I/P .....           | 14-21     | 8  |
| Turn Signal Flasher .....         | At convenience center .....          | 14-23     | 12 |

**CONNECTORS:**

|             |                                                    |           |    |
|-------------|----------------------------------------------------|-----------|----|
| C100 .....  | At bulkhead connector .....                        | 14-17     | 1  |
| C102 .....  | At bulkhead connector .....                        | 14-20     | 5  |
| C106A ..... | Near bulkhead connector (engine compartment) ..... | Not Shown |    |
| C230 .....  | Below center of I/P near heater outlet .....       | 14-24     | 13 |
| C382 .....  | At roof bow, near front dome lamp .....            | Not Shown |    |
| C387 .....  | Under driver's seat .....                          | 14-25     | 14 |
| C401 .....  | Behind center of rear bumper .....                 | 14-25     | 15 |
| C403 .....  | Behind center of rear bumper .....                 | 14-25     | 15 |
| C404 .....  | LH rear body pillar .....                          | Not Shown |    |
| C406 .....  | RH upper rear body .....                           | 14-28     | 18 |
| C475 .....  | At RH D-pillar .....                               | 14-31     | 23 |
| C494 .....  | In LH D-pillar .....                               | 14-26     | 16 |
| C496 .....  | In RH D-pillar .....                               | Not Shown |    |
| C905 .....  | At lower rear body endgate opening .....           | 14-28     | 19 |
| C921 .....  | Inside RH rear cargo door .....                    | 14-27     | 17 |
| C922 .....  | Inside LH rear cargo door .....                    | 14-26     | 16 |

**GROMMETS:**

|            |                                            |           |    |
|------------|--------------------------------------------|-----------|----|
| P101 ..... | RH cowl (engine compartment) .....         | Not Shown |    |
| P105 ..... | LH cowl, near bulkhead connector .....     | 14-23     | 11 |
| P405 ..... | At endgate window frame .....              | 14-28     | 18 |
| P409 ..... | At lower rear body endgate opening .....   | 14-28     | 19 |
| P410 ..... | Lower rear body to endgate .....           | 14-28     | 19 |
| P416 ..... | At upper rear liftgate glass opening ..... | Not Shown |    |

**GROUNDS:**

|                                 |                                         |           |    |
|---------------------------------|-----------------------------------------|-----------|----|
| G100 (4.3L, 5.0L, 5.7L) .....   | RH front of engine .....                | 14-17     | 1  |
| G100 (7.4L) .....               | Front of RH cylinder head .....         | 14-17     | 1  |
| G101 .....                      | RH inner fender, near battery .....     | 14-19     | 4  |
| G102 .....                      | LH top front of engine .....            | Not Shown |    |
| G104 .....                      | On sheet metal, above LH headlamp ..... | 14-20     | 6  |
| G105 .....                      | RH inner fender, near battery .....     | 14-19     | 4  |
| G106 .....                      | Rear of RH cylinder head .....          | 14-19     | 3  |
| G108 (5.0L) .....               | LH top front of engine .....            | 14-18     | 2  |
| G108 (7.4L) .....               | Top front of intake manifold .....      | Not Shown |    |
| G109 .....                      | Top front center of engine .....        | 14-18     | 2  |
| G202 .....                      | At DLC .....                            | 14-22     | 9  |
| G400 .....                      | At RH D-pillar .....                    | Not Shown |    |
| G403 .....                      | At LH rear frame rail .....             | 14-29     | 21 |
| G410 (W/Platform Hitch) .....   | At LH side of hitch .....               | 14-29     | 21 |
| G410 (W/O Platform Hitch) ..... | At LH rear frame rail .....             | 14-30     | 22 |
| G900 (Pickup) .....             | Bottom center of endgate .....          | Not Shown |    |

## 8A-14-2 GROUND DISTRIBUTION

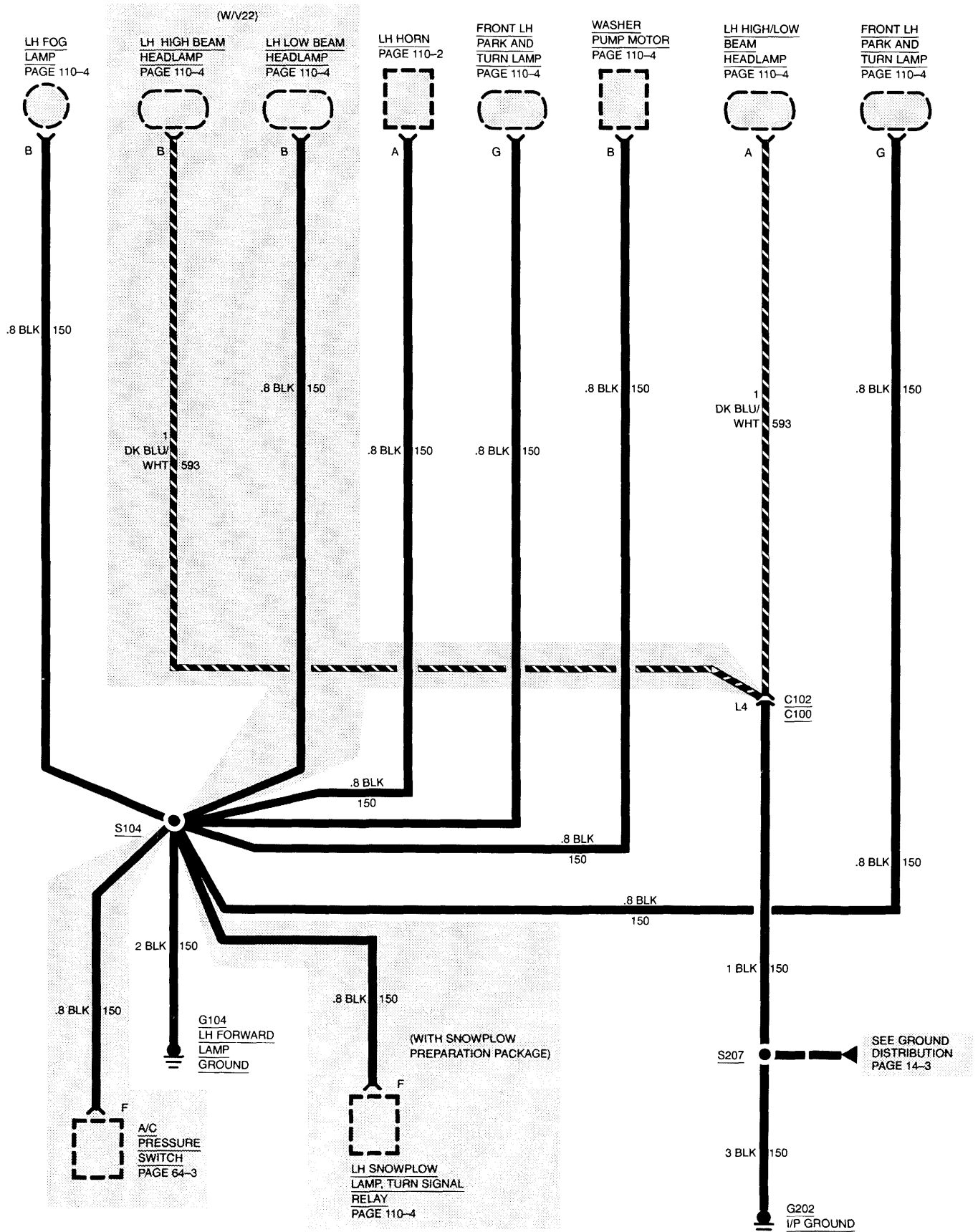
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### COMPONENT LOCATION

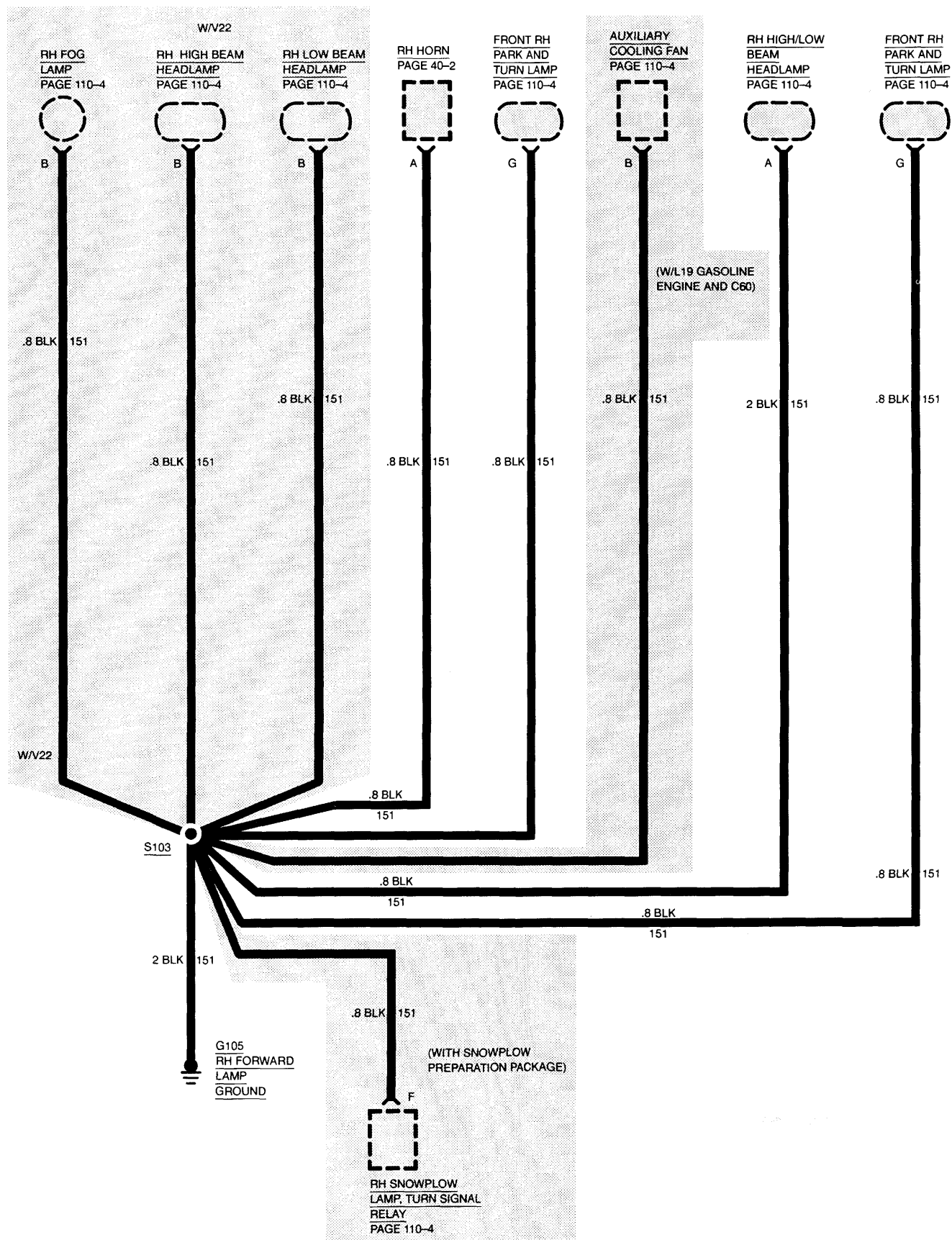
Page — Figure

### SPLICES (CONTINUED):

|      |                                                             |           |    |
|------|-------------------------------------------------------------|-----------|----|
| S100 | Positive battery cable, near battery                        | Not Shown |    |
| S103 | RH side, near headlamp                                      | Not Shown |    |
| S104 | LH side, near headlamp                                      | 14-21     | 7  |
| S118 | Engine harness, near cowl LH rear engine compartment        | Not Shown |    |
| S136 | Rear of engine compartment, near center                     | Not Shown |    |
| S207 | Under LH side of I/P                                        | 14-21     | 8  |
| S211 | Behind RH side of I/P, near compartment lamp                | 14-22     | 10 |
| S240 | Behind LH side of I/P                                       | 14-22     | 10 |
| S264 | Behind center of I/P                                        | 14-24     | 13 |
| S325 | Center of roof, above overhead console                      | 14-31     | 24 |
| S328 | Auxiliary heater – A/C control harness, behind roof console | 14-31     | 24 |
| S402 | Above rear liftgate glass opening                           | 14-29     | 20 |
| S404 | Behind LH side of rear bumper                               | 14-25     | 15 |
| S425 | Behind LH side of rear bumper, near crossmember             | 14-31     | 23 |
| S436 | Auxiliary heater – A/C harness, near blower motor           | Not Shown |    |

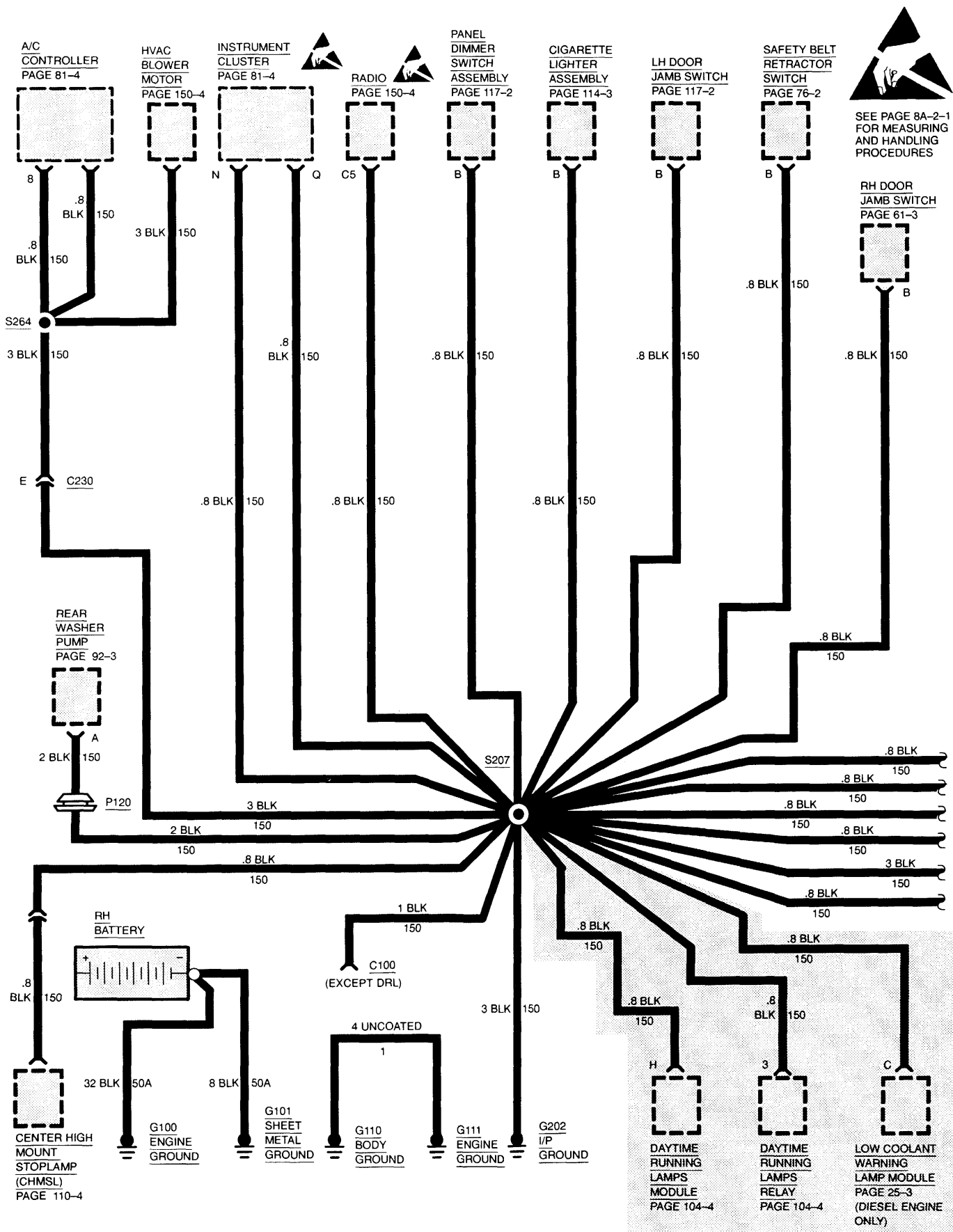


## 8A-14-4 GROUND DISTRIBUTION



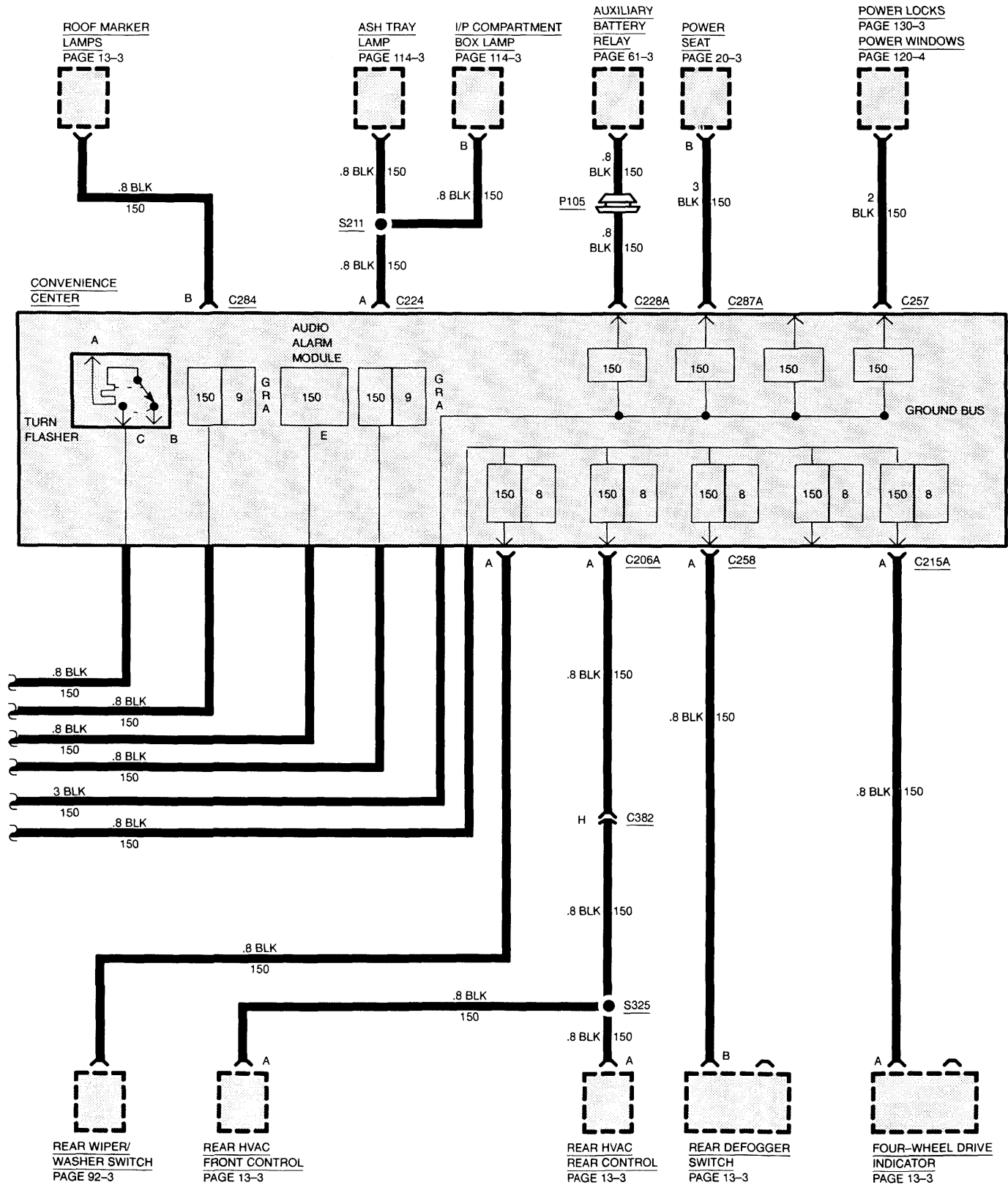


# 8A-14-6 GROUND DISTRIBUTION



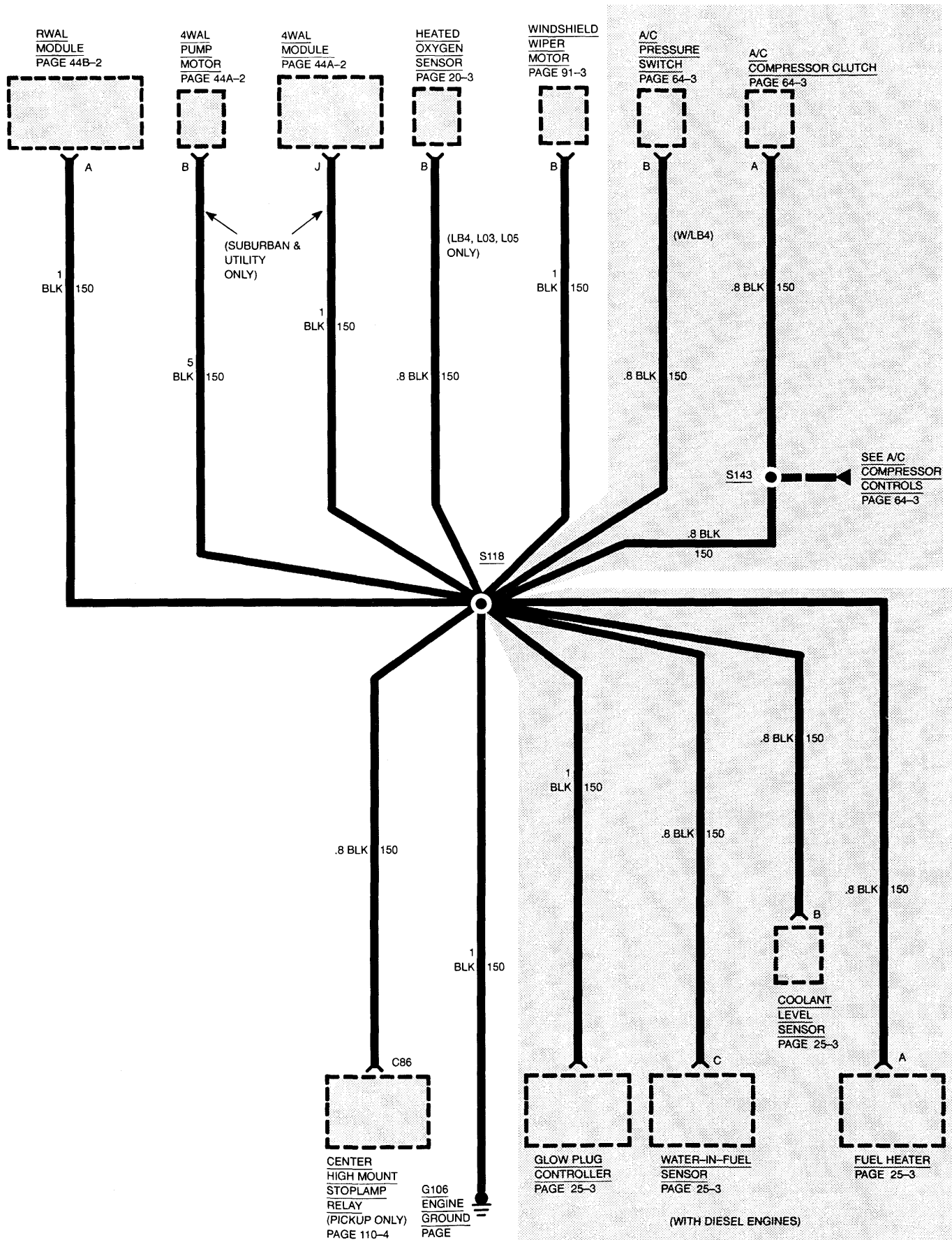
# GROUND DISTRIBUTION 8A-14-7

SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

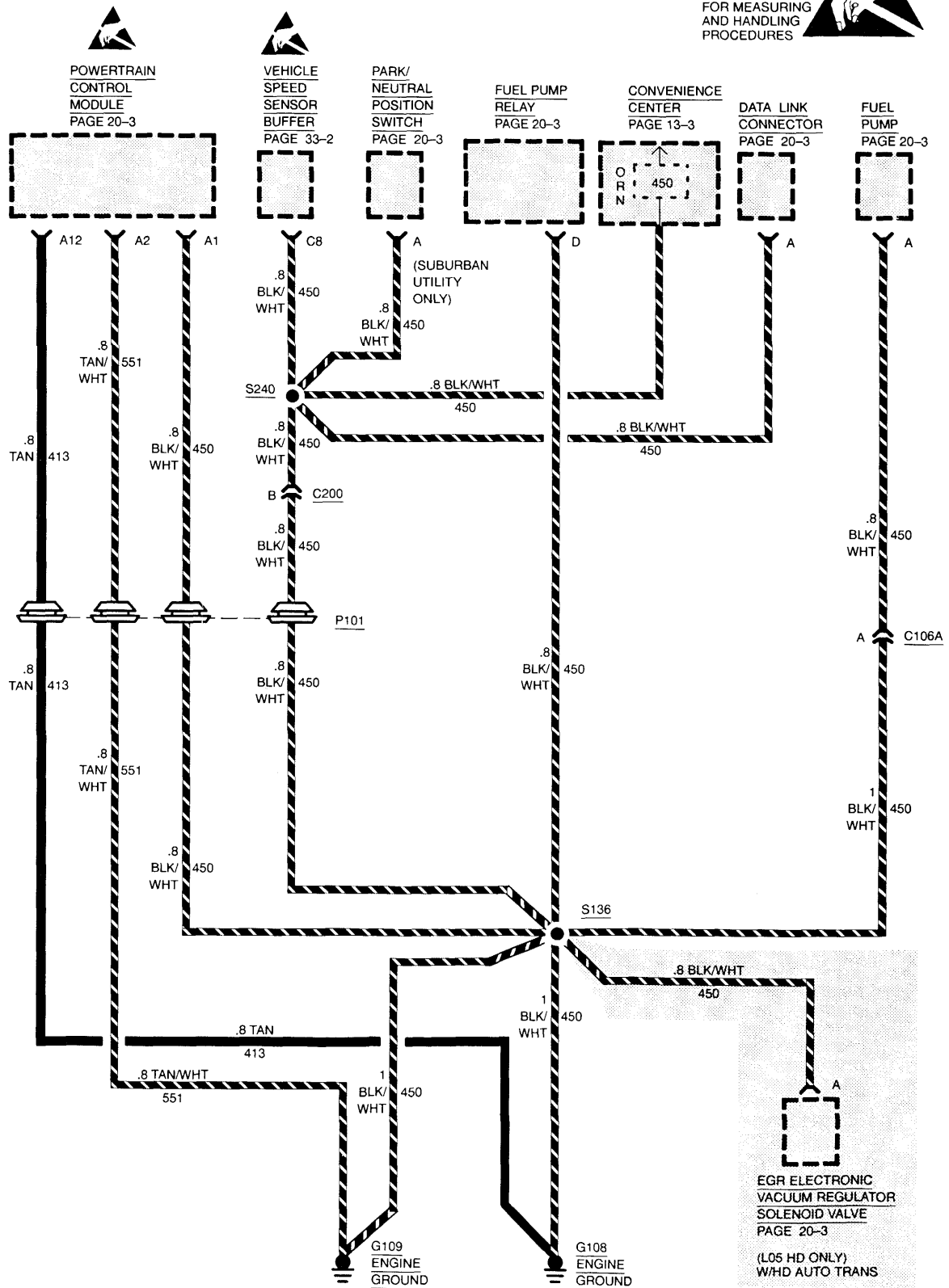




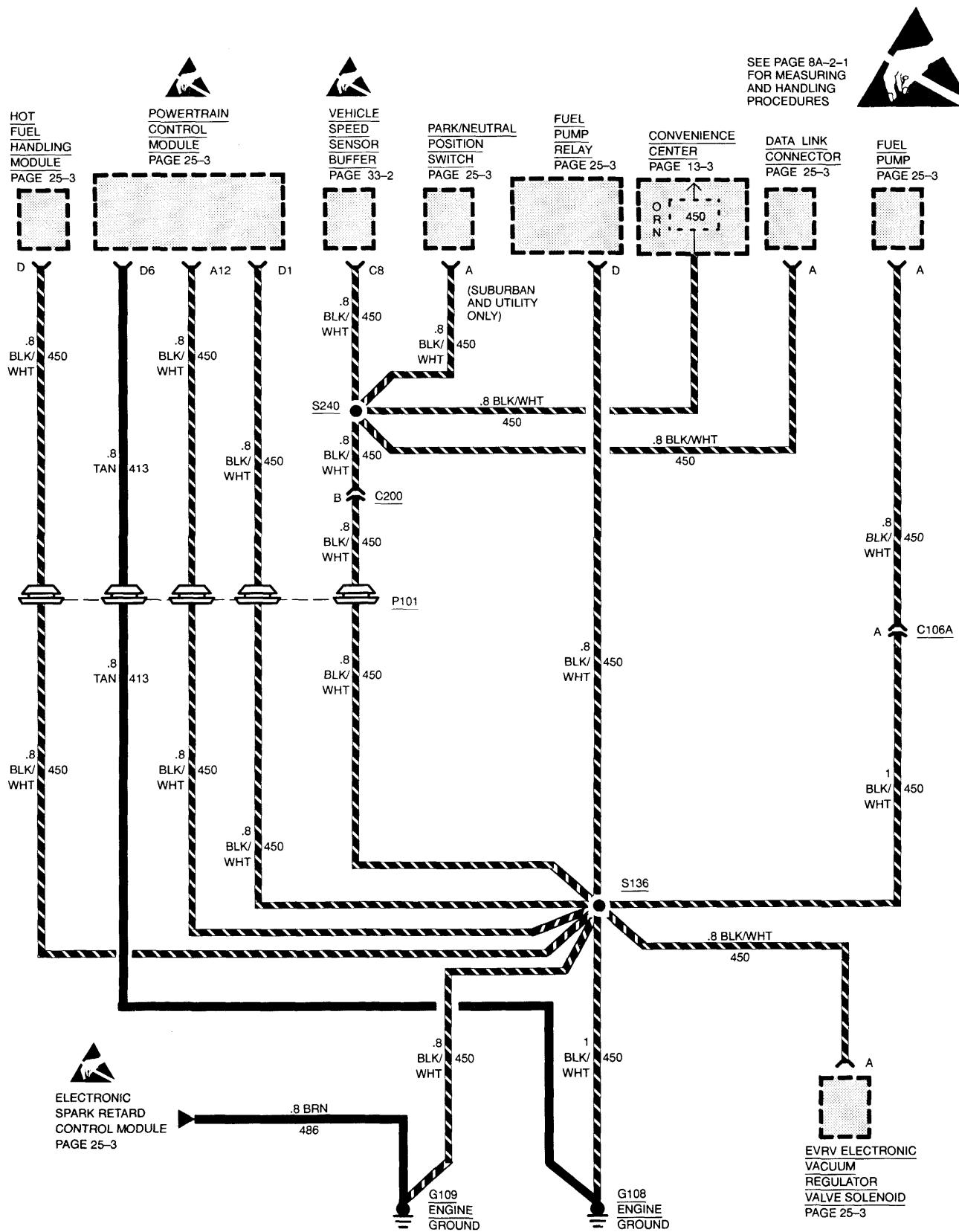
# 8A-14-8 GROUND DISTRIBUTION



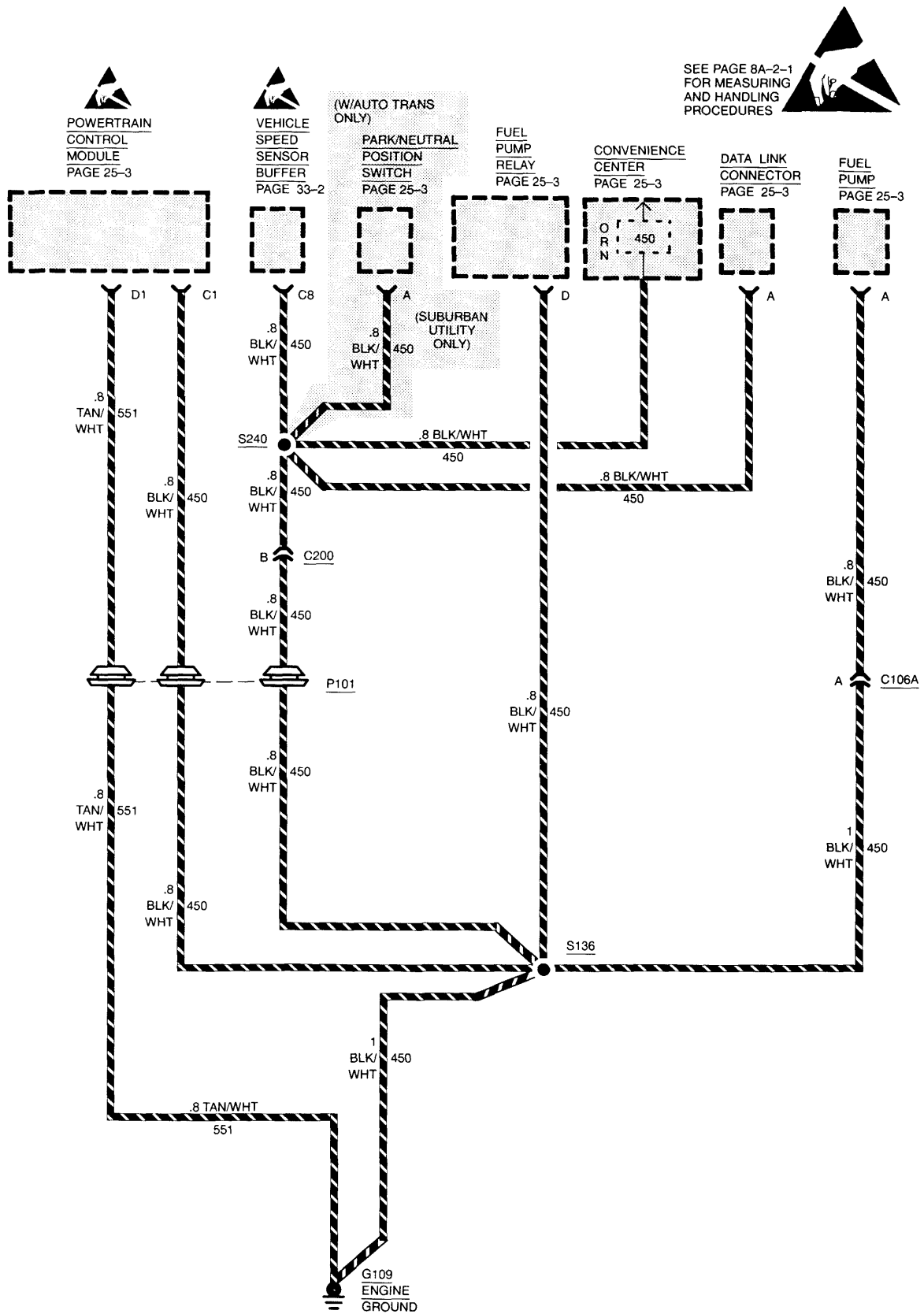
**(LB4, L03, L05, L19 GASOLINE ENGINES W/AUTO TRANS)**  
**(LB4, L19 GASOLINE ENGINES W/MAN TRANS)**



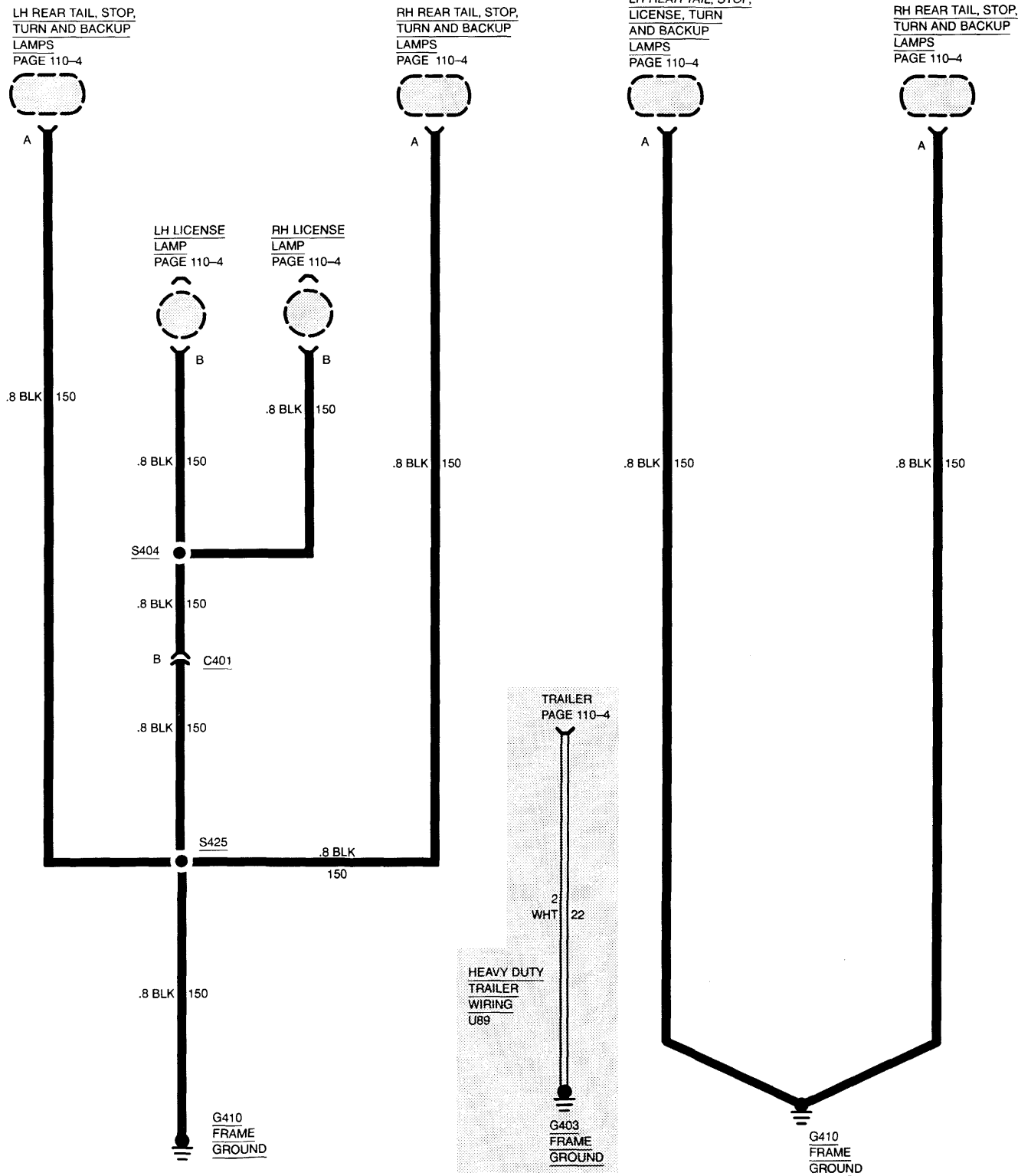
# 8A-14-10 GROUND DISTRIBUTION (L03, L05 GASOLINE ENGINE, MANUAL TRANS)



# GROUND DISTRIBUTION 8A-14-11 (L49, L56, L65 DIESEL ENGINES)



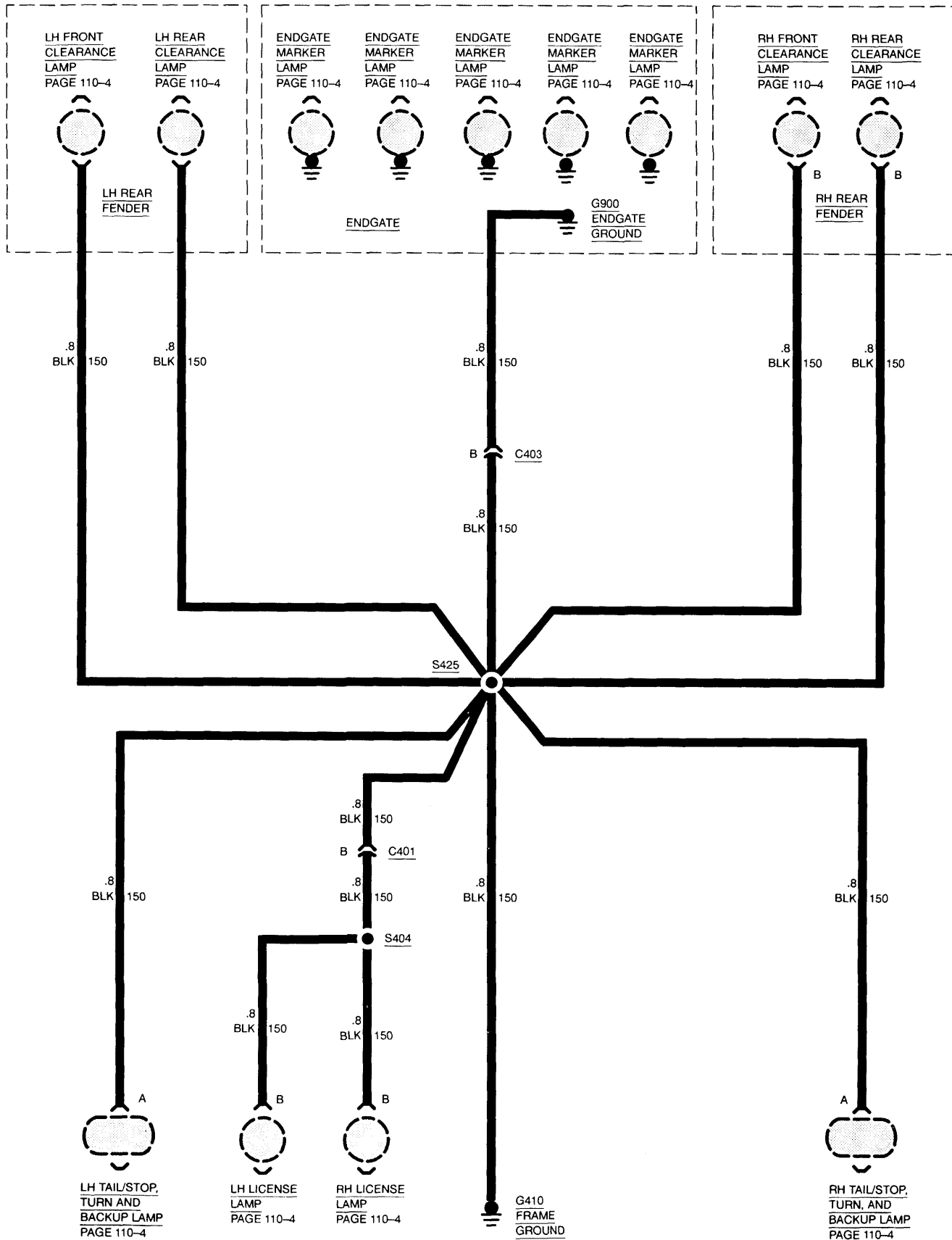
8A-14-12 GROUND DISTRIBUTION



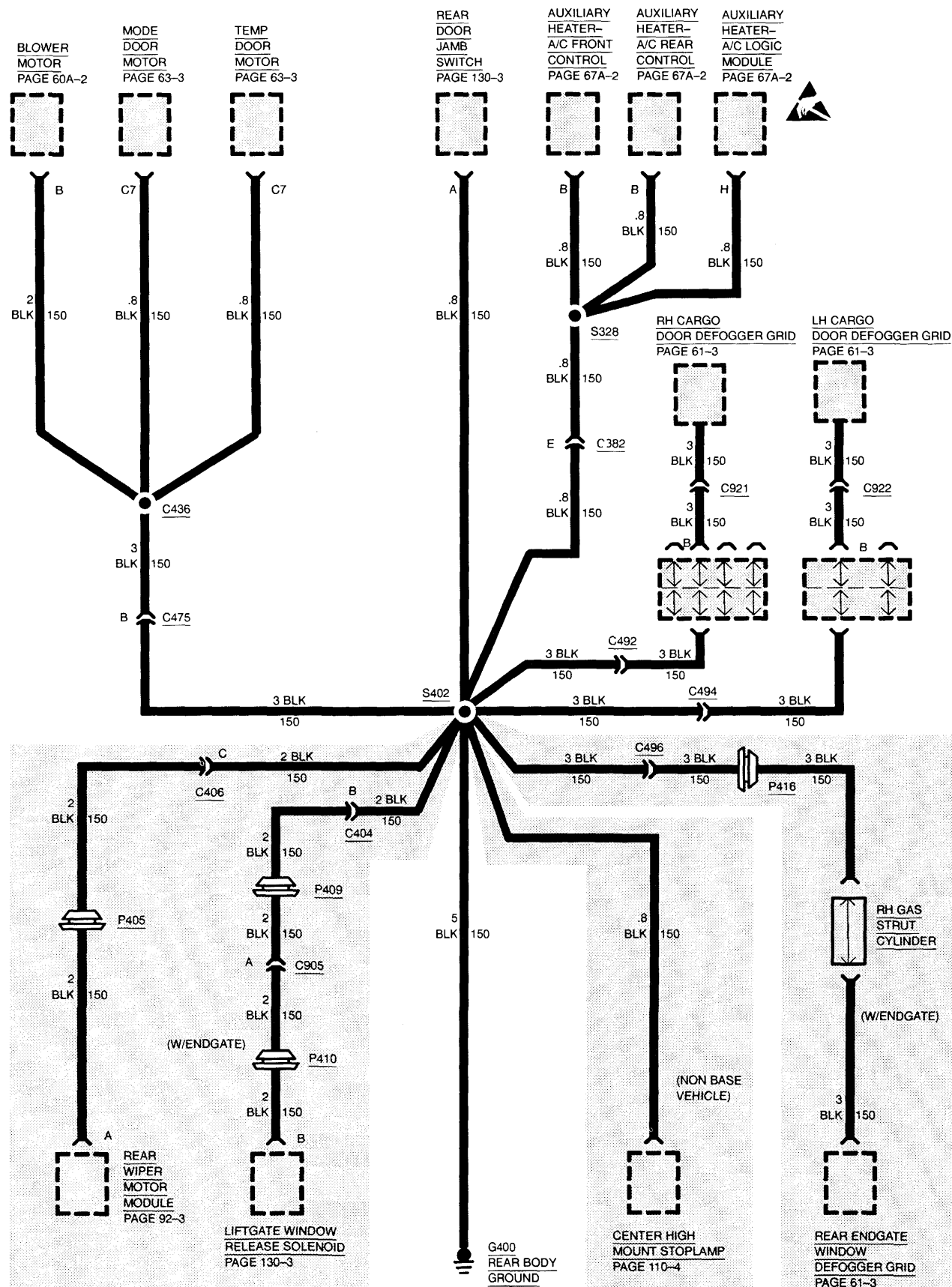
(PICKUP (W/O R05), SUBURBAN AND UTILITY)

(CHASIS CAB ONLY)

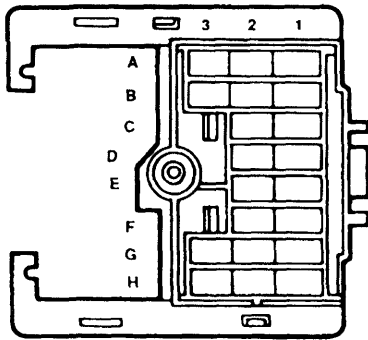
**GROUND DISTRIBUTION 8A-14-13**  
**PICKUP W/DUAL REAR WHEELS**



# 8A-14-14 GROUND DISTRIBUTION SUBURBAN AND UTILITY

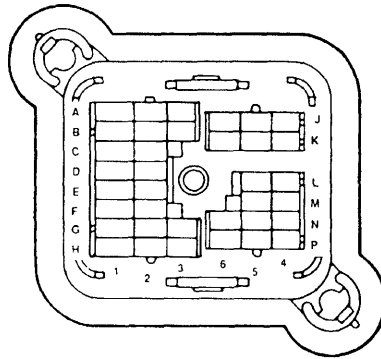


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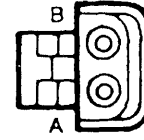
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



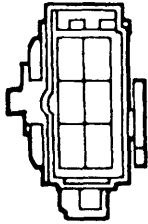
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12015792



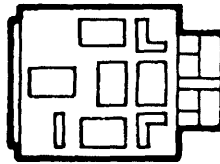
**BLACK**  
Weather Pack  
**C106A**  
Engine to Fuel Pump

12020099



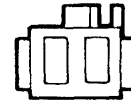
**C101**  
Bulkhead – Rear Lamps

12034003



**BLACK**  
Metri-Pack 630  
**C291**  
Daytime Running Lamps Relay

12033701



**C224**  
Auxiliary Lighting to  
Convenience Center

12059236



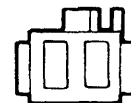
**C228A**  
Auxiliary Battery Convenience  
Center Tap

12059236



**C257**  
Power Windows and Locks  
Convenience Center Tap

12033701



**C284**  
Roof Marker Lamps Convenience  
Center Tap



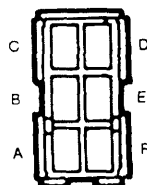
# 8A-14-16 GROUND DISTRIBUTION

12059236



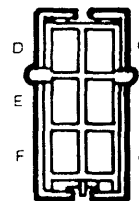
**C257**  
Power Seat Convenience Center  
Tap

12034481



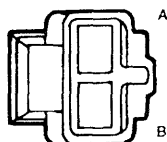
**GRAY**  
Metri-Pack 280  
**C230**  
I/P to HVAC

12034482



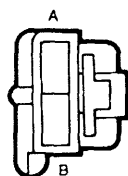
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Metri-Pack 280  
**C230**  
HVAC to I/P

12064750



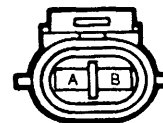
**BLACK**  
Metri-Pack 480  
**C387**  
Convenience Center to Power  
Seat

12064749



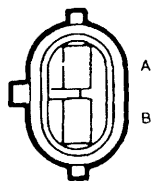
**BLACK**  
Metri-Pack 480  
**C387**  
Power Seat to Convenience  
Center

12052641



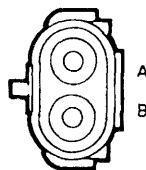
**BLACK**  
Metri-Pack 150  
**C401**  
Rear Lamps to License Lamps

12052647



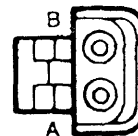
**BLACK**  
Metri-Pack  
**C401**  
License Lamps to Rear Lamps

12010973



**BLACK**  
Weather Pack  
**C403**  
Rear Lamps to Endgate

12015792



**BLACK**  
Weather Pack  
**C403**  
Endgate to Rear Lamps

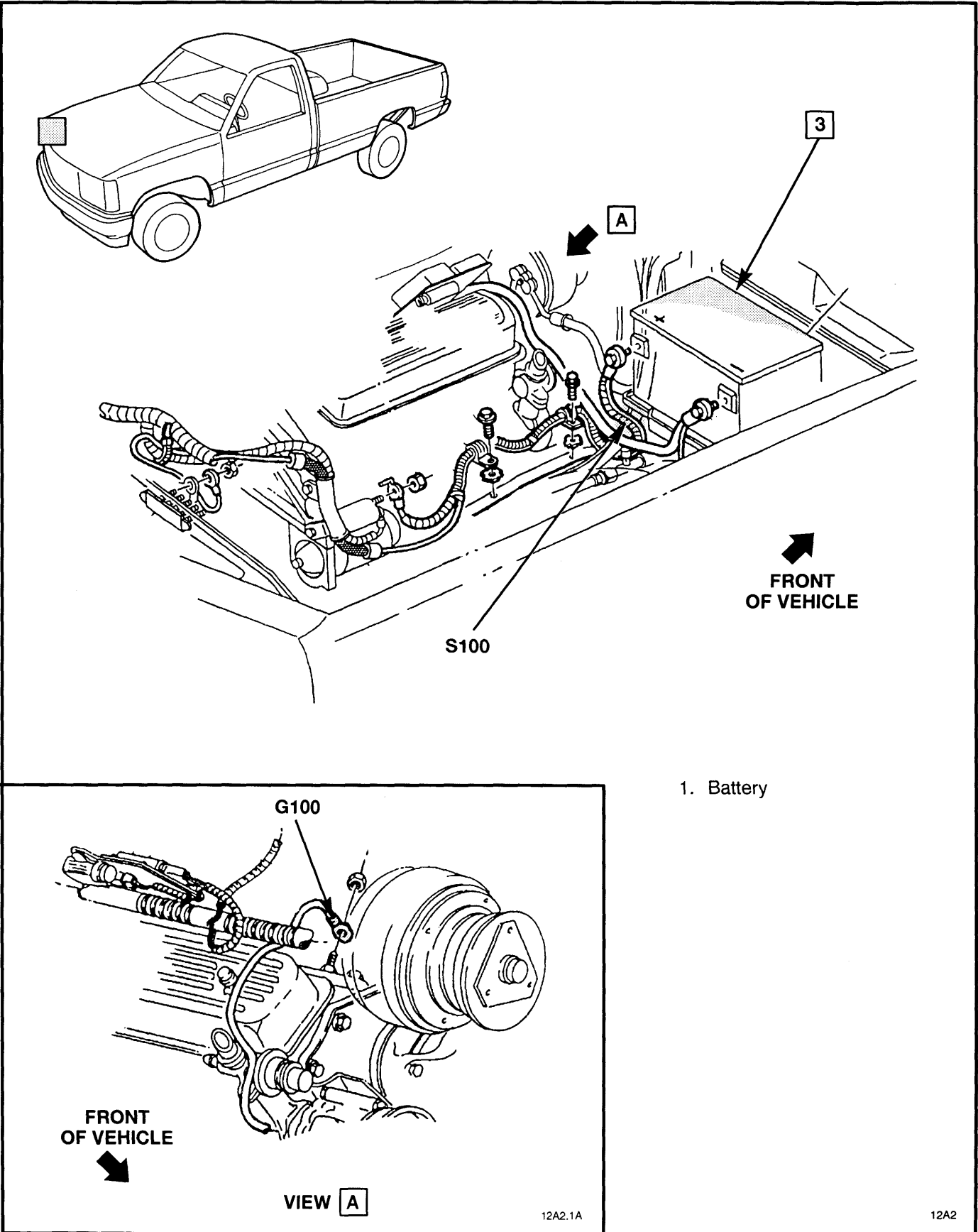
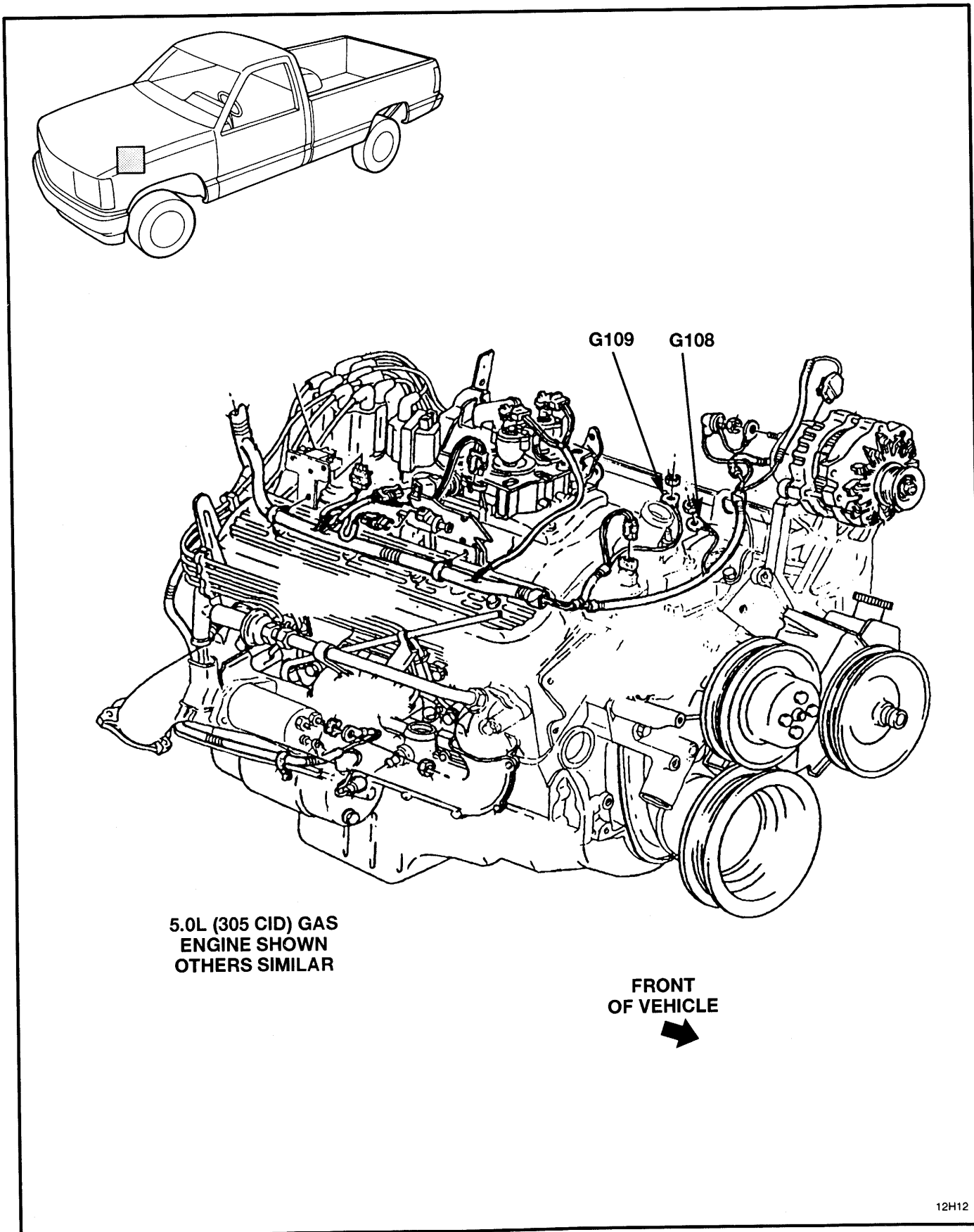


Figure 1 — Battery Wiring — Gasoline Engines

## 8A-14-18 GROUND DISTRIBUTION



12H12

Figure 2 — RH Side of Engine, 5.0L (305 CID) V8 Engine — Gasoline

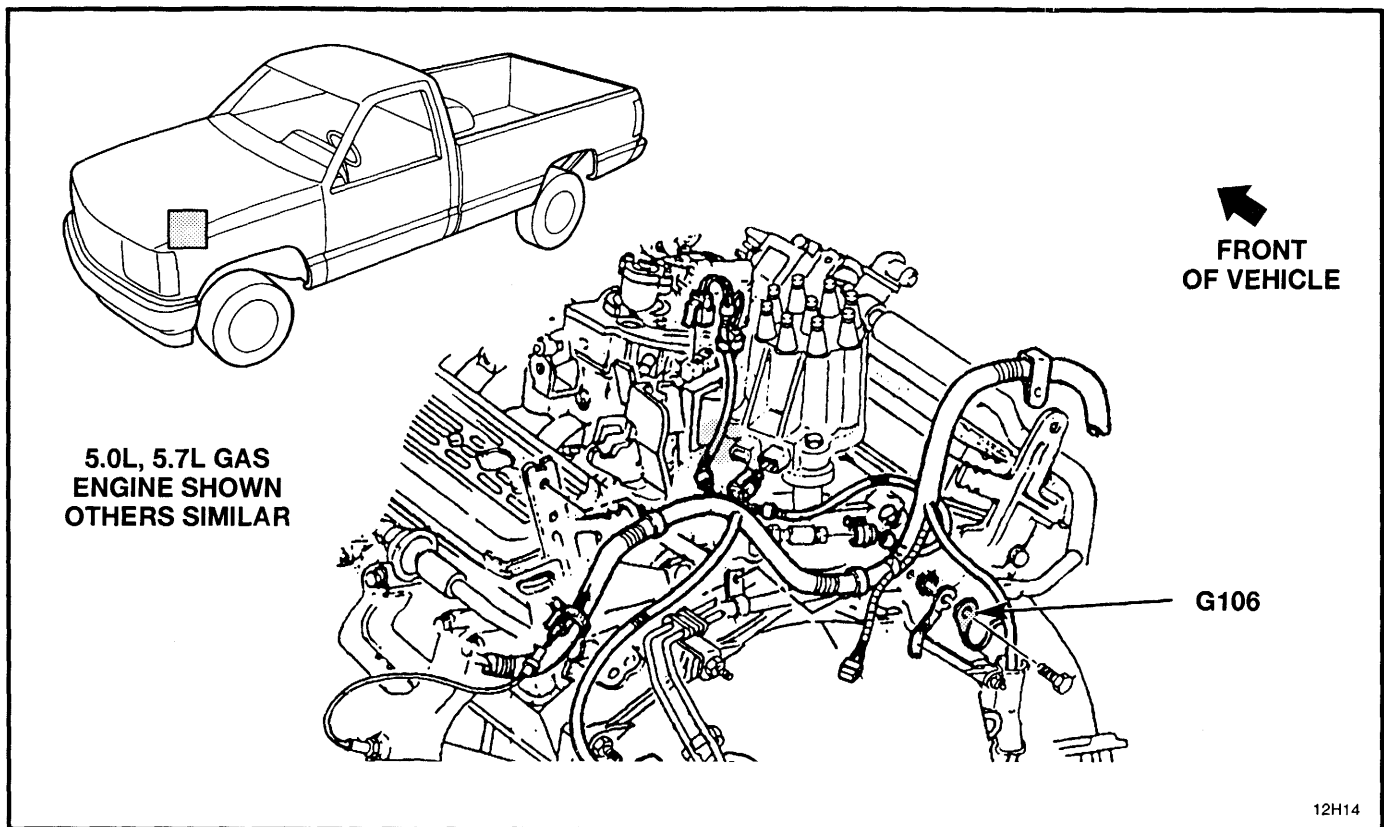


Figure 3 — LH Side of Engine, 5.0L (305 CID) 5.7L (350 CID) — Gasoline Engines

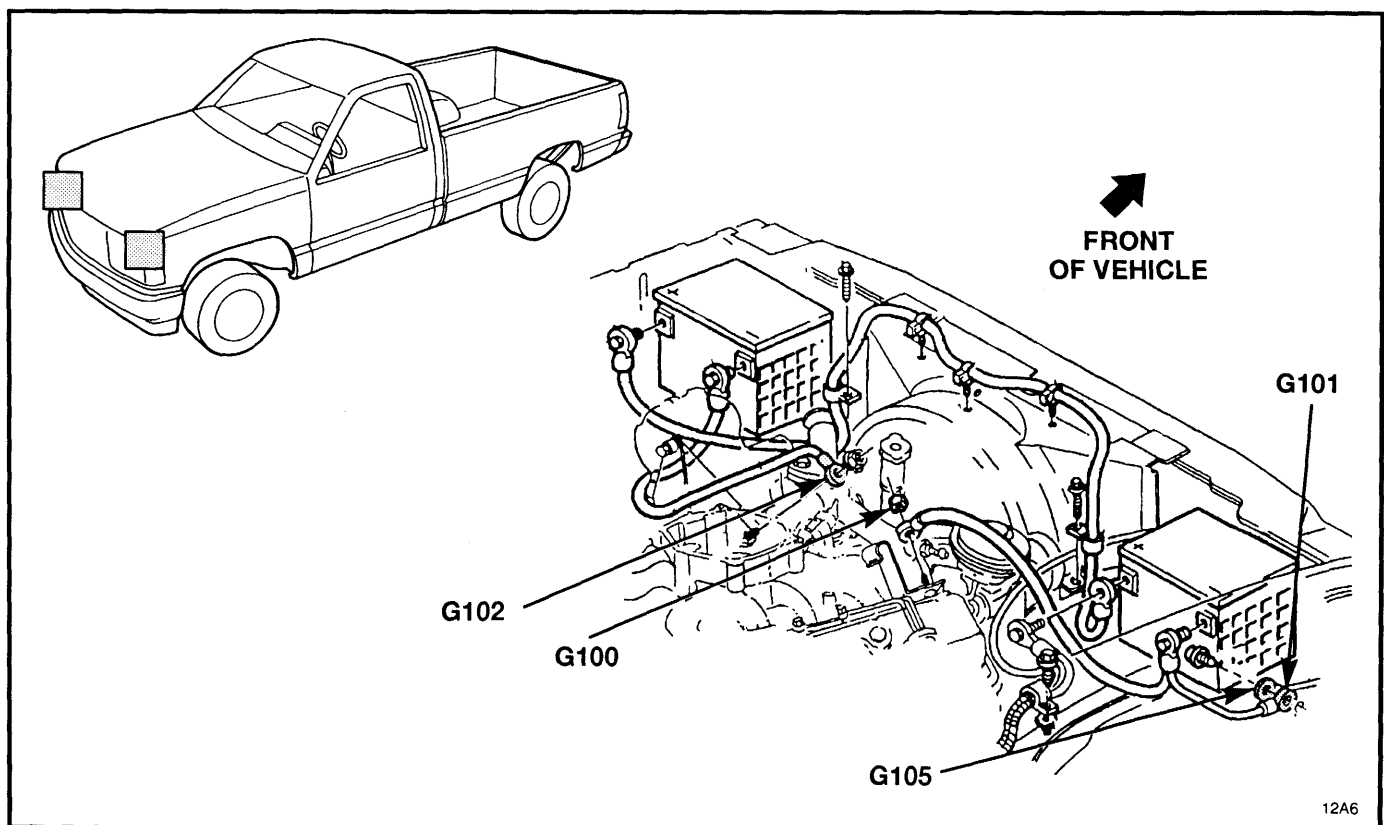


Figure 4 — Battery Cables — Diesel Engines

## 8A-14-20 GROUND DISTRIBUTION

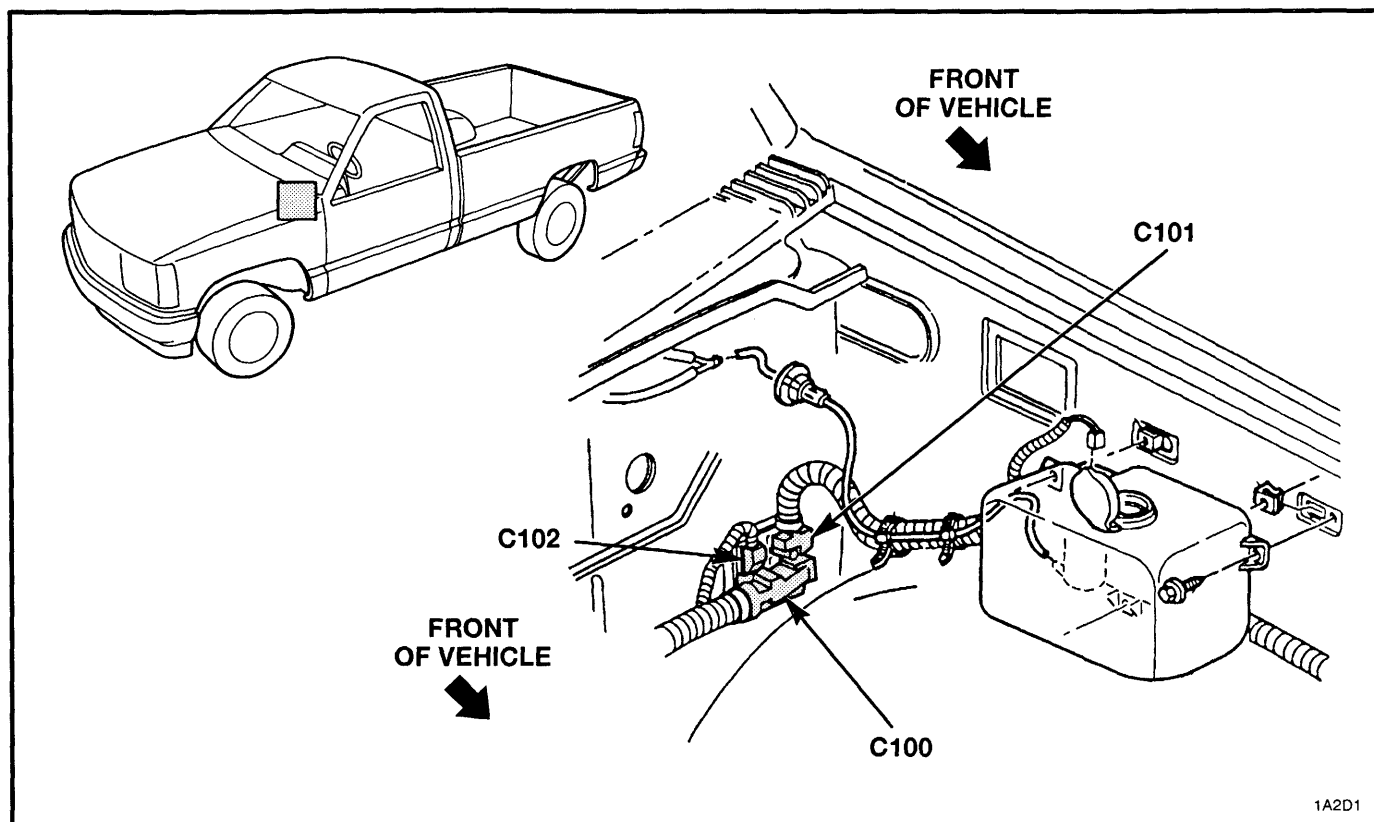


Figure 5 — Fender Wiring, Left

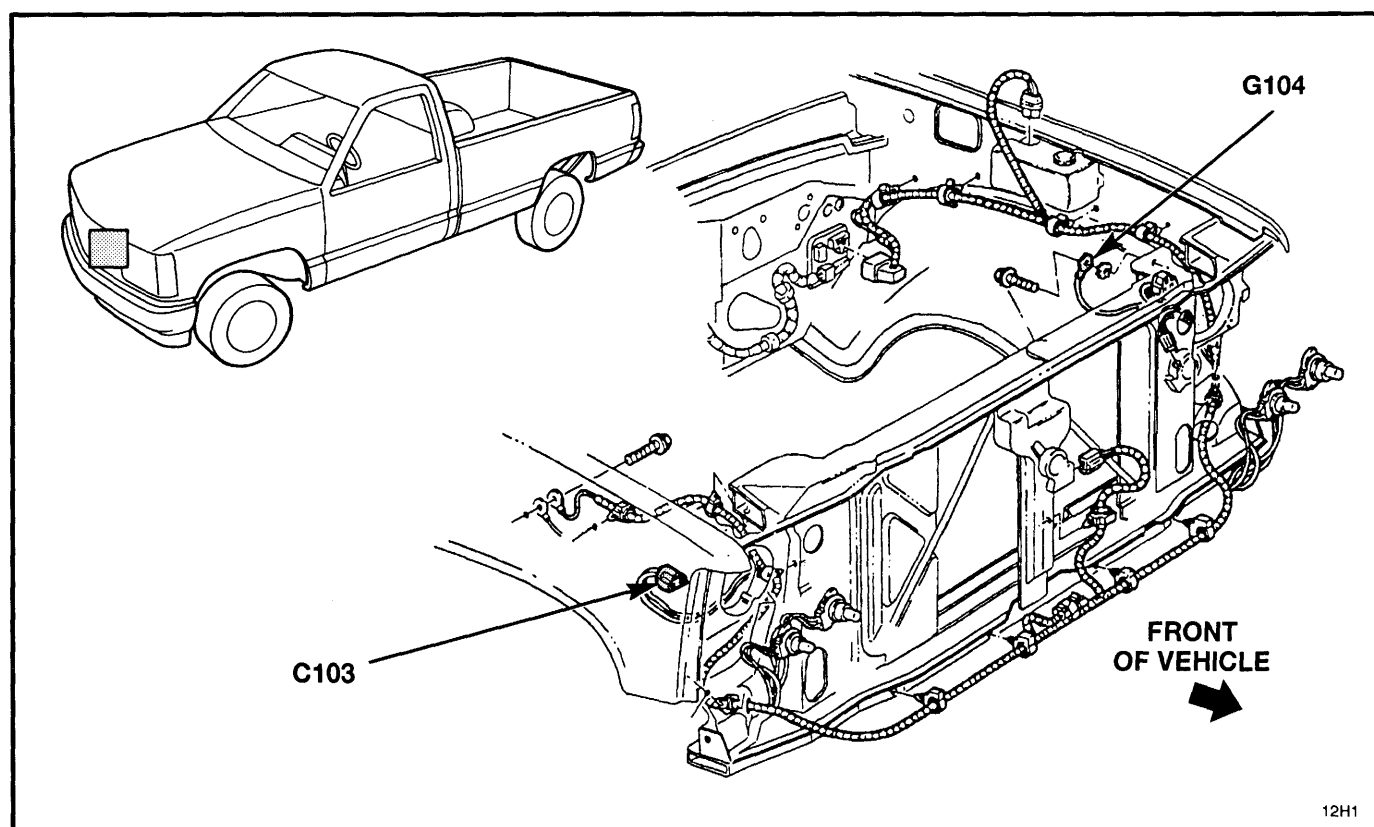


Figure 6 — Forward Lamp Harness, Dual Headlamps — 2-Door Pickup

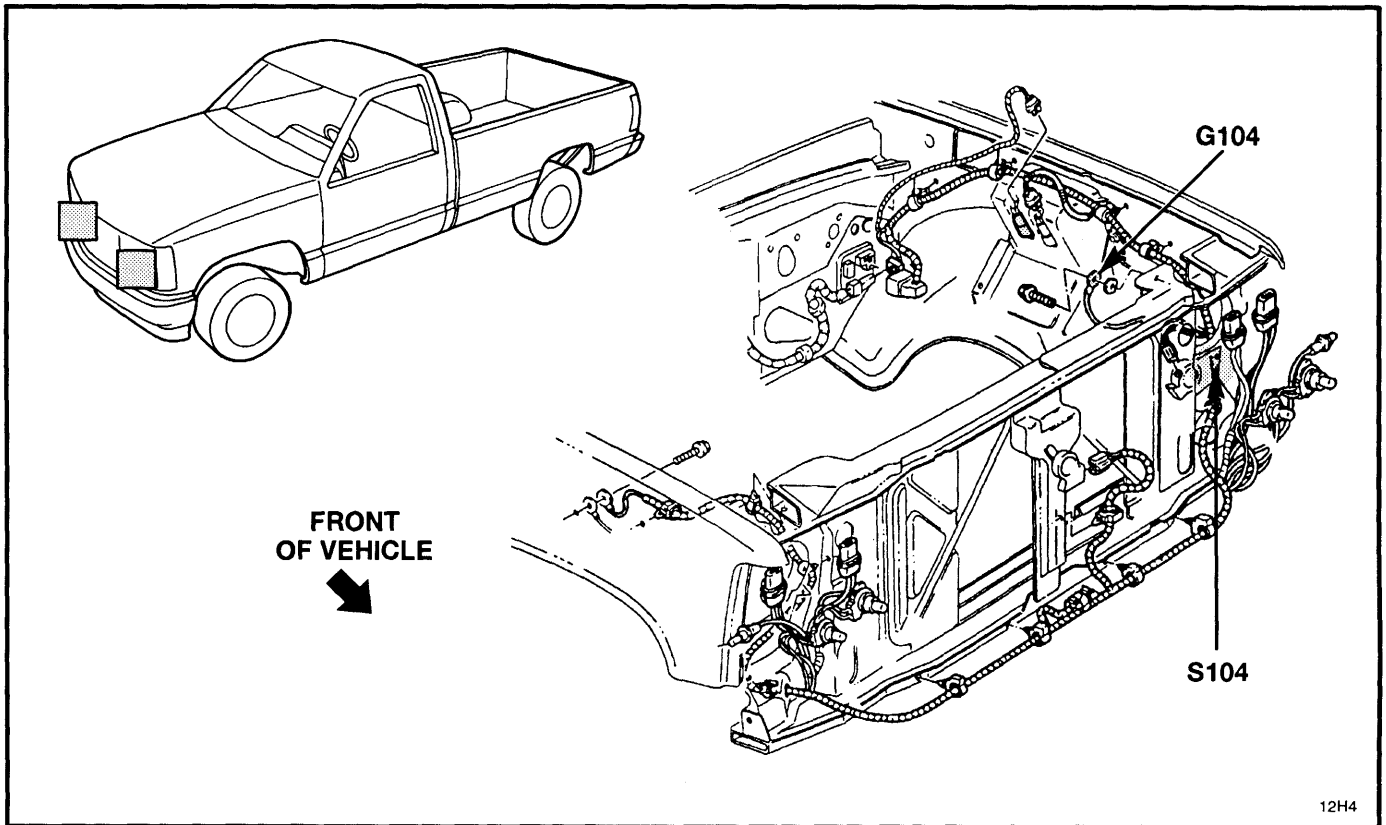


Figure 7 — Forward Lamp Harness, Quad Headlamps

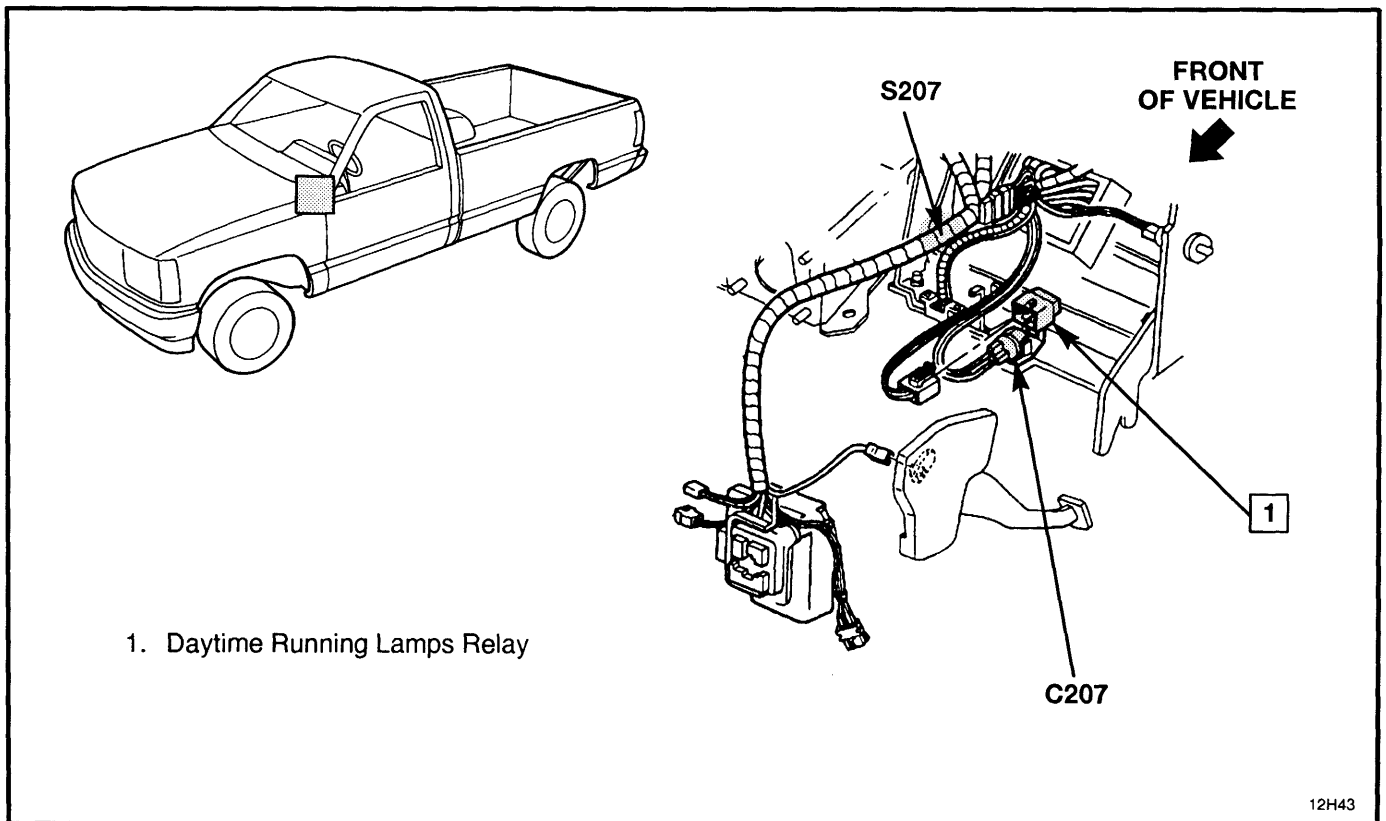


Figure 8 — Instrument Panel, LH Side

## 8A-14-22 GROUND DISTRIBUTION

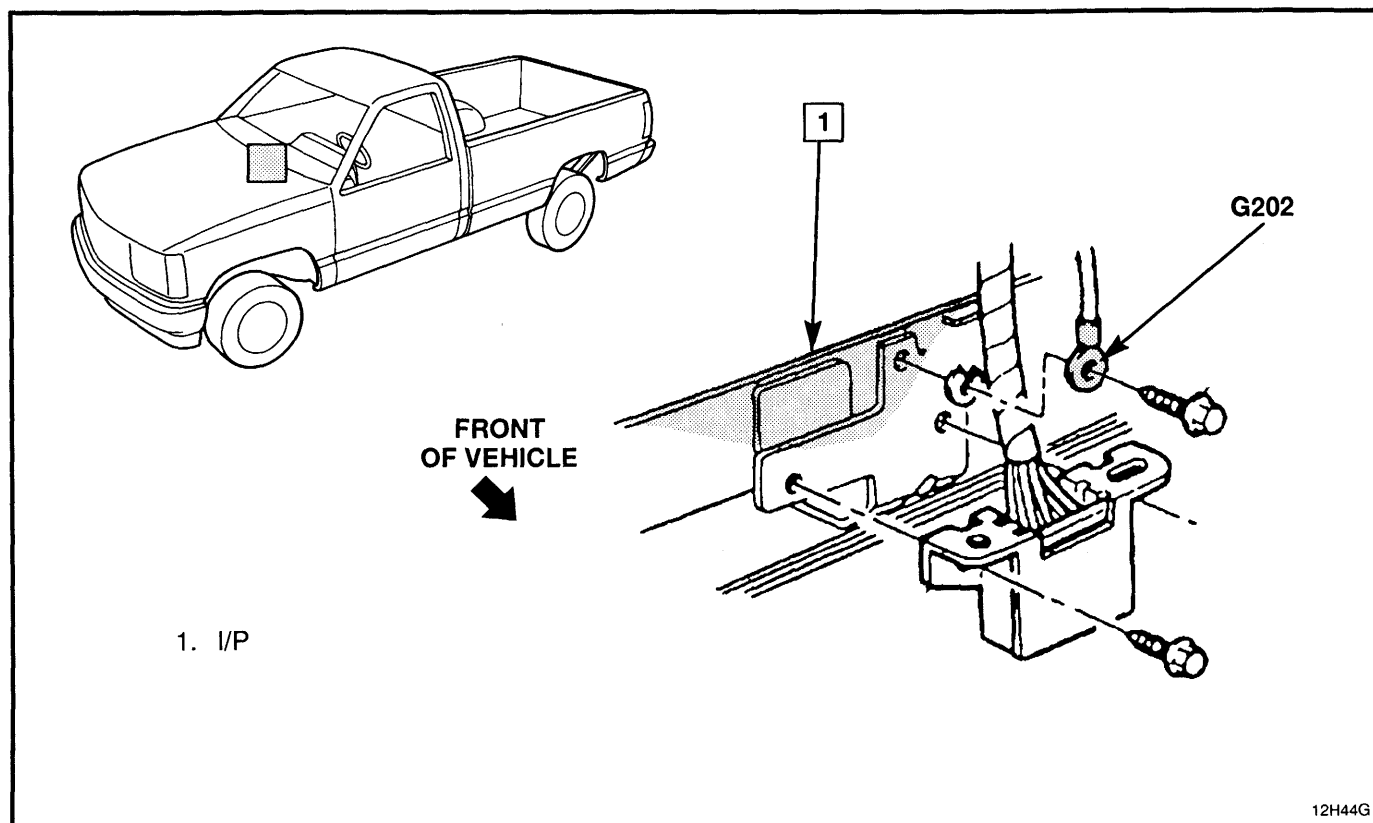


Figure 9 — I/P Ground Wiring

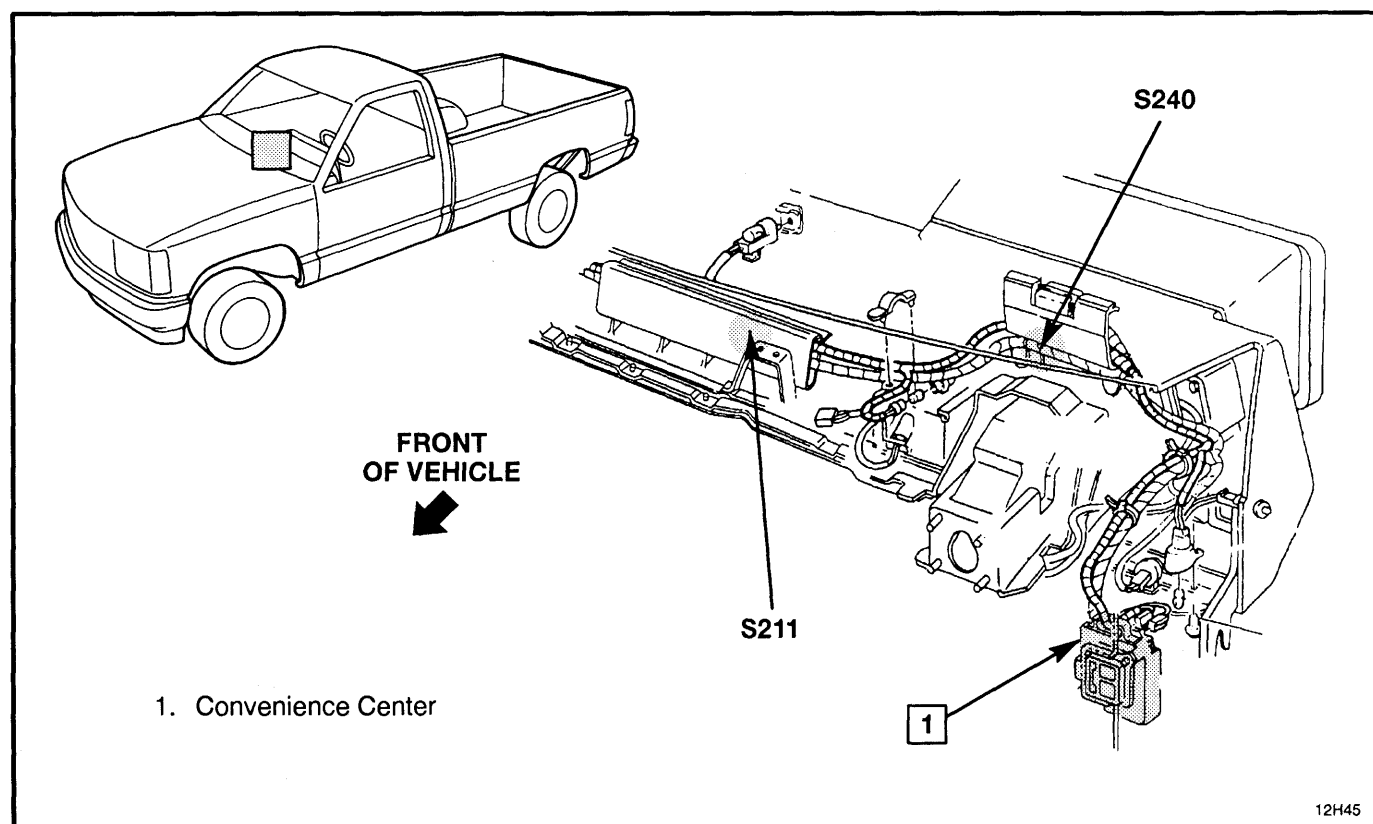


Figure 10 — I/P Wiring

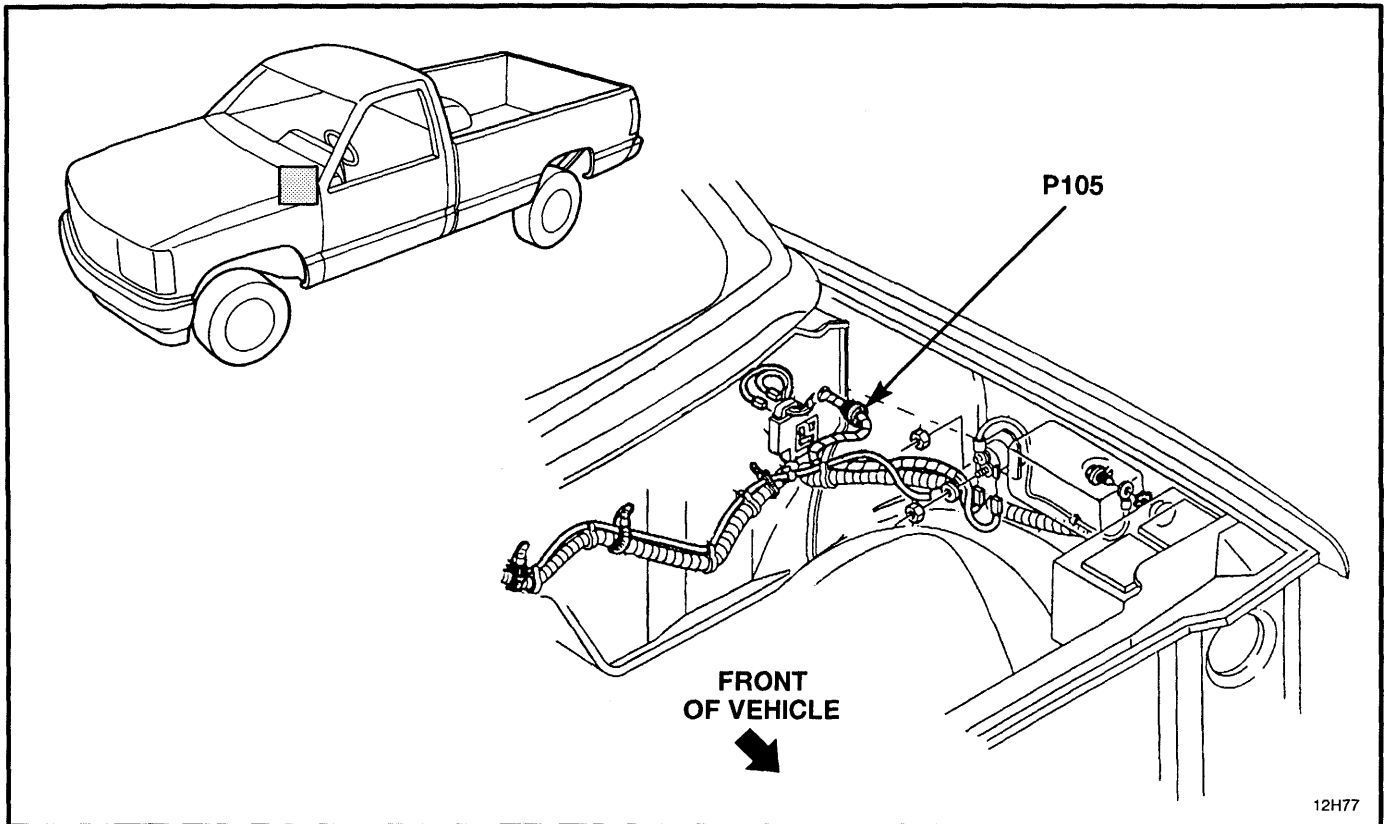


Figure 11 — Auxiliary Battery Wiring

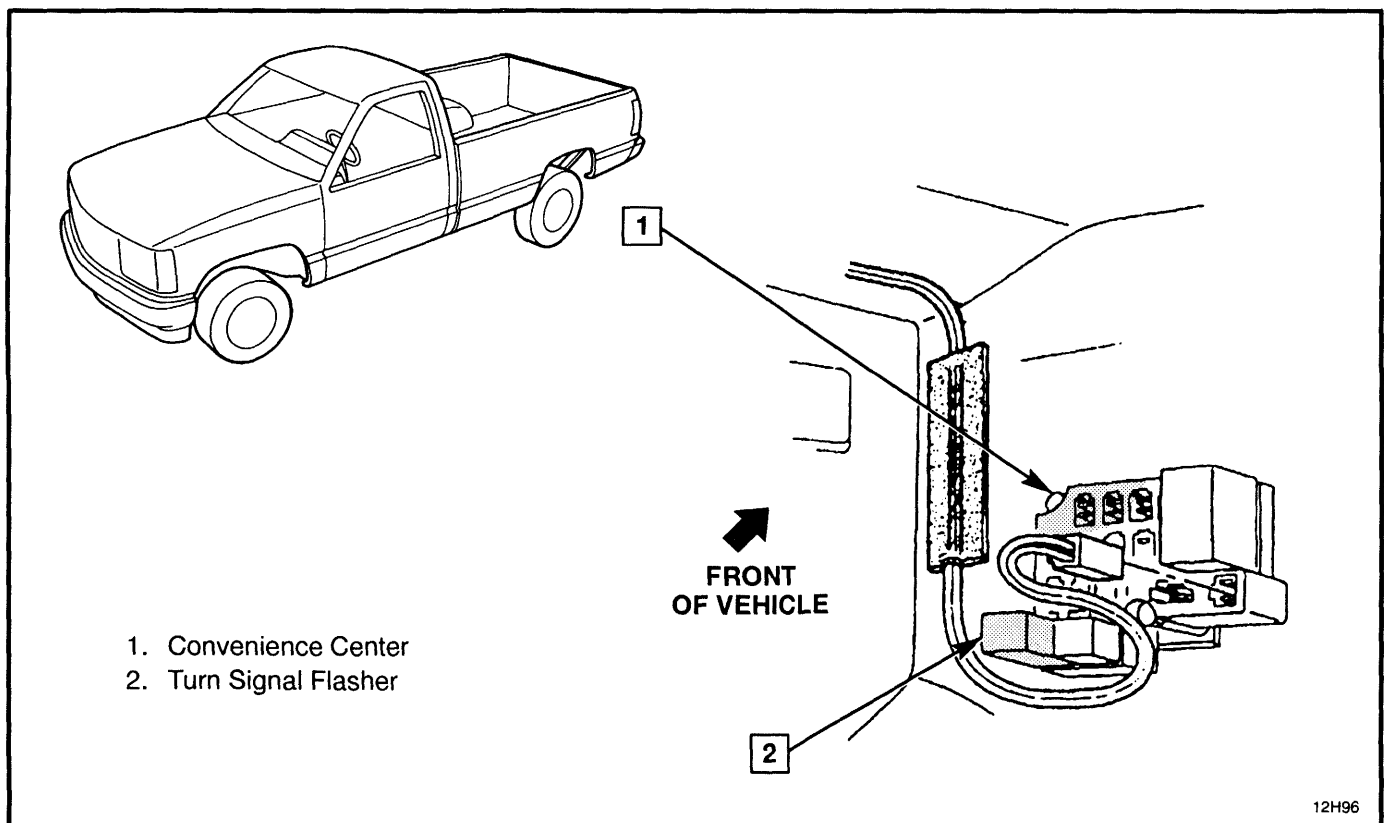
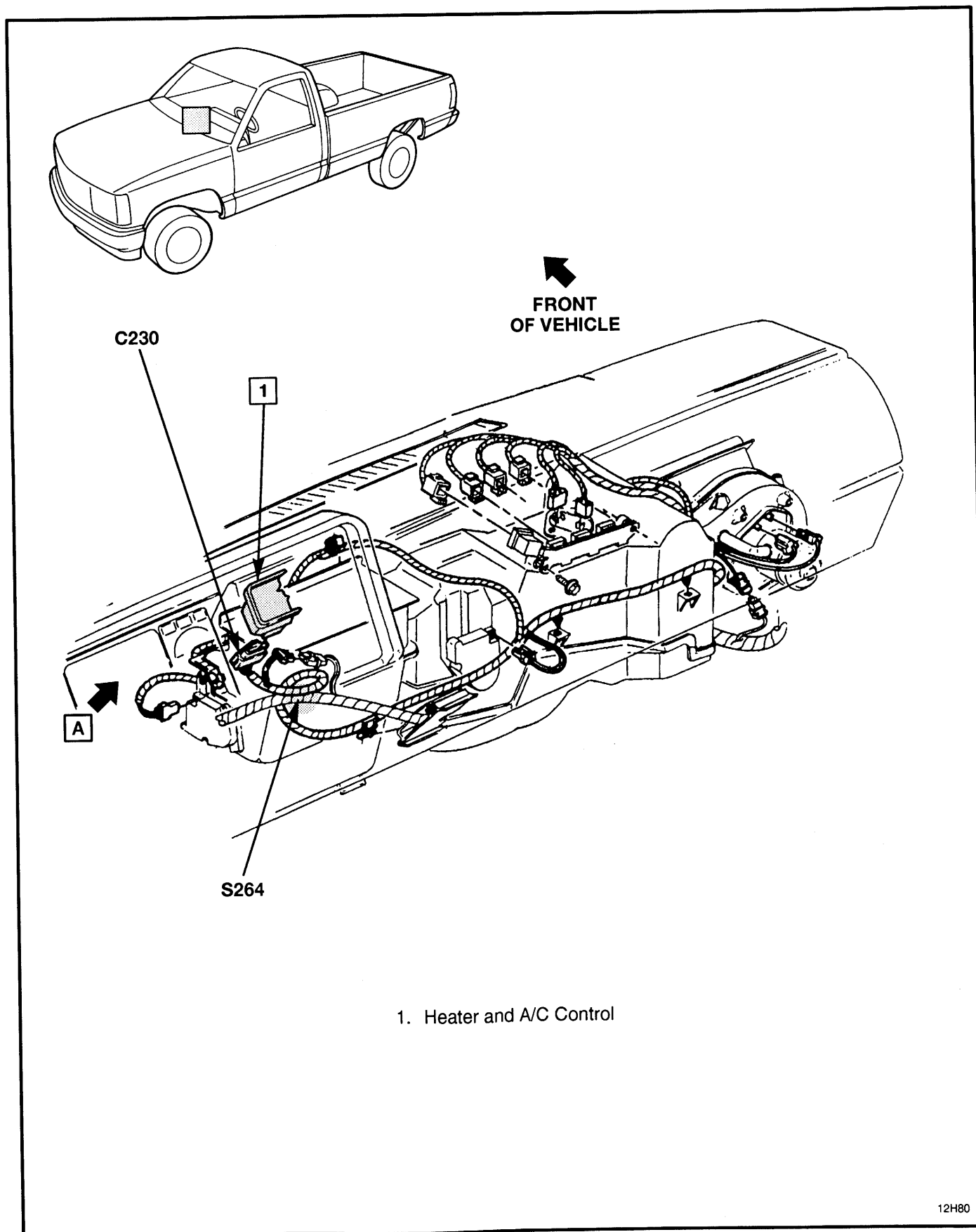


Figure 12 — Turn Signal Flasher



## 8A-14-24 GROUND DISTRIBUTION



12H80

Figure 13 — Heater and A/C Harness Wiring

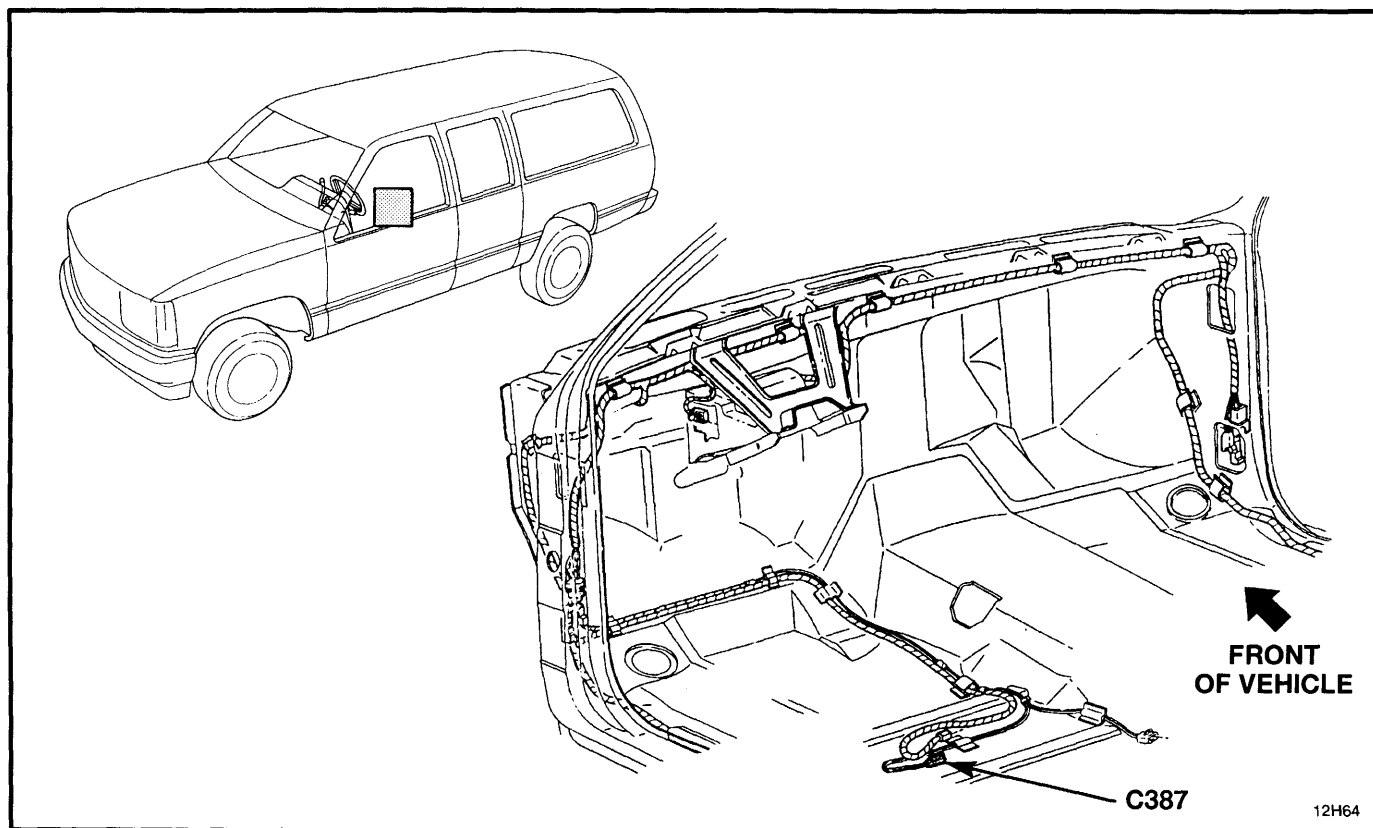


Figure 14 — Crossbody Wiring

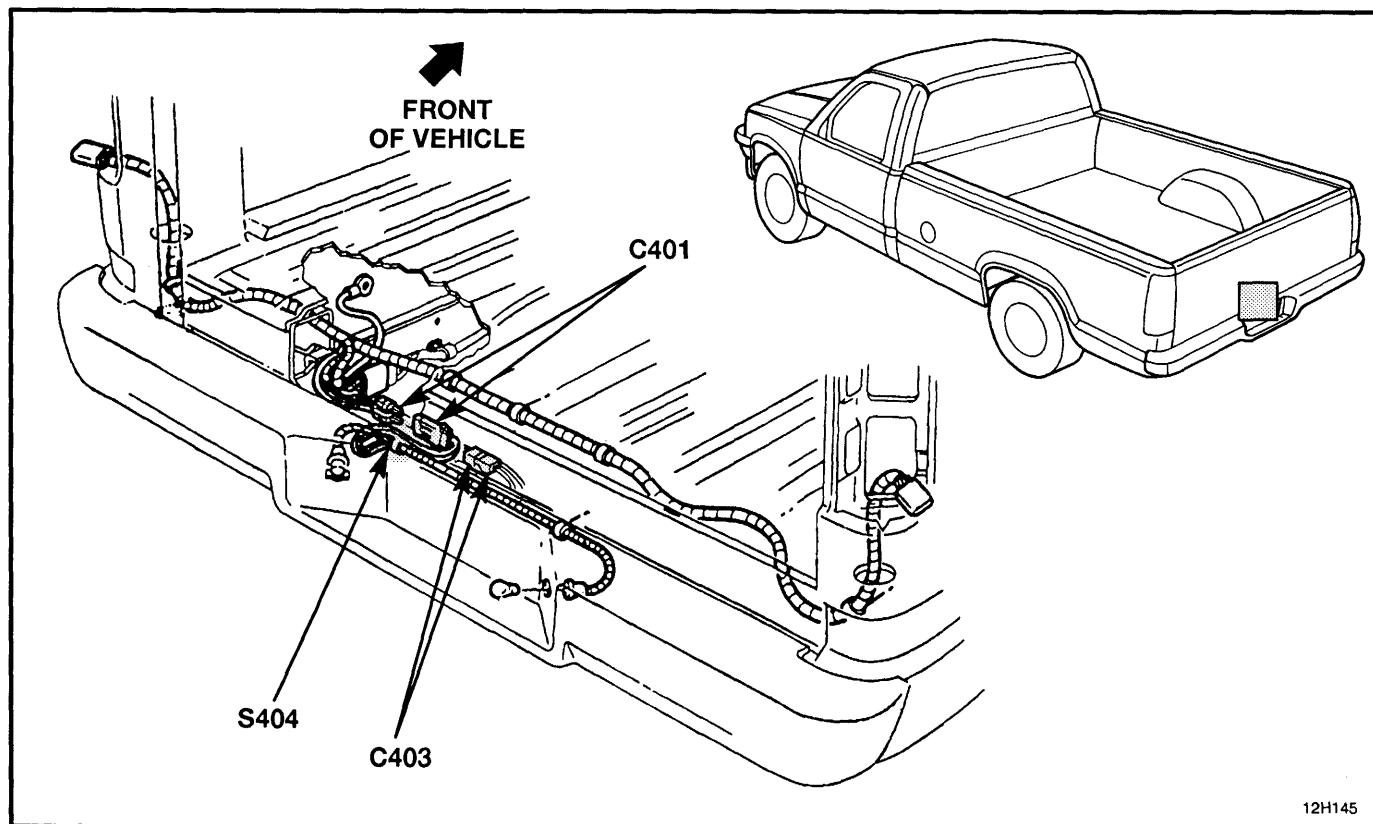


Figure 15 — Tail and Stoplamp Harness Wiring

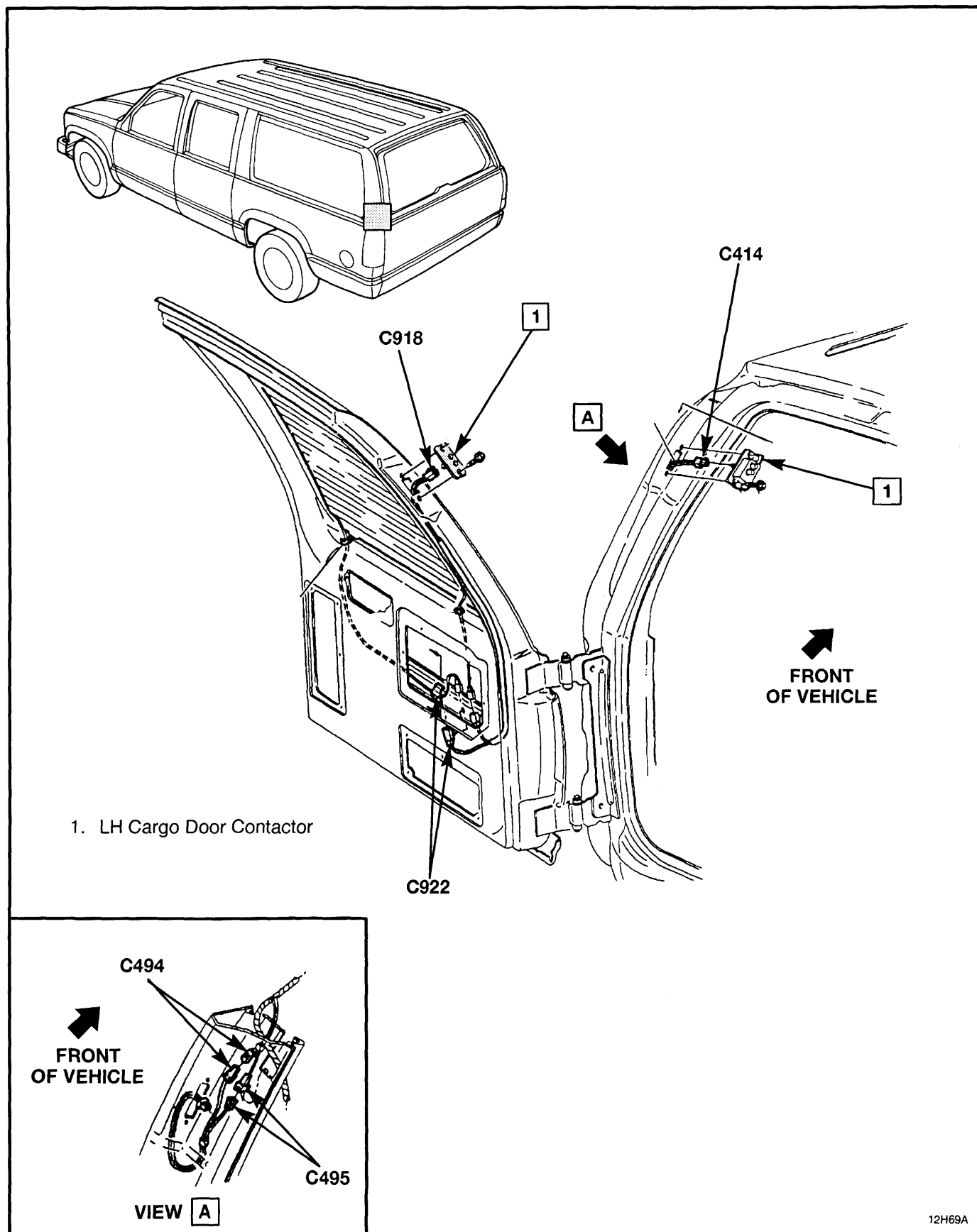


Figure 16 — Rear Door Contact Assembly

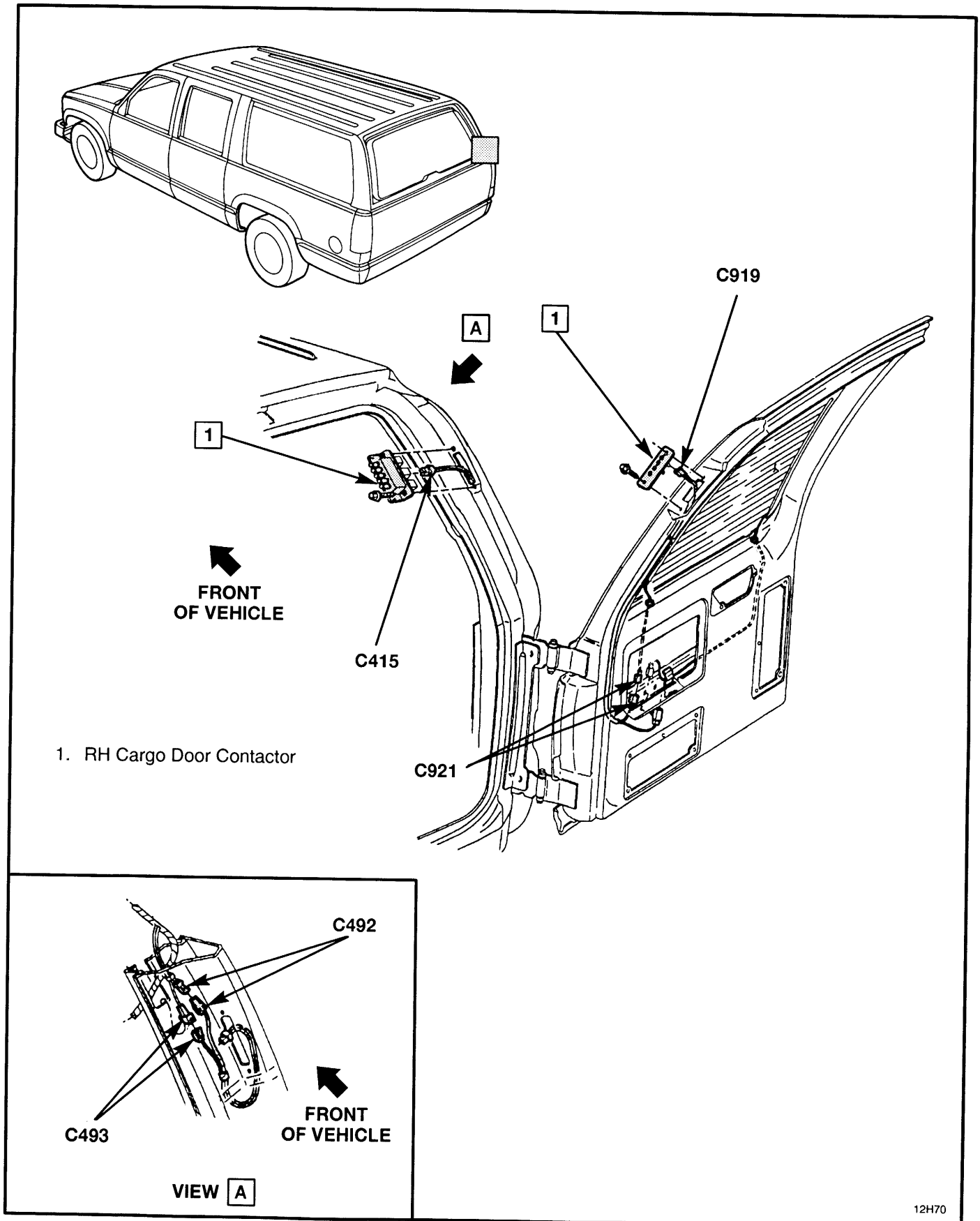


Figure 17 — Rear Door Contact Assembly

## 8A-14-28 GROUND DISTRIBUTION

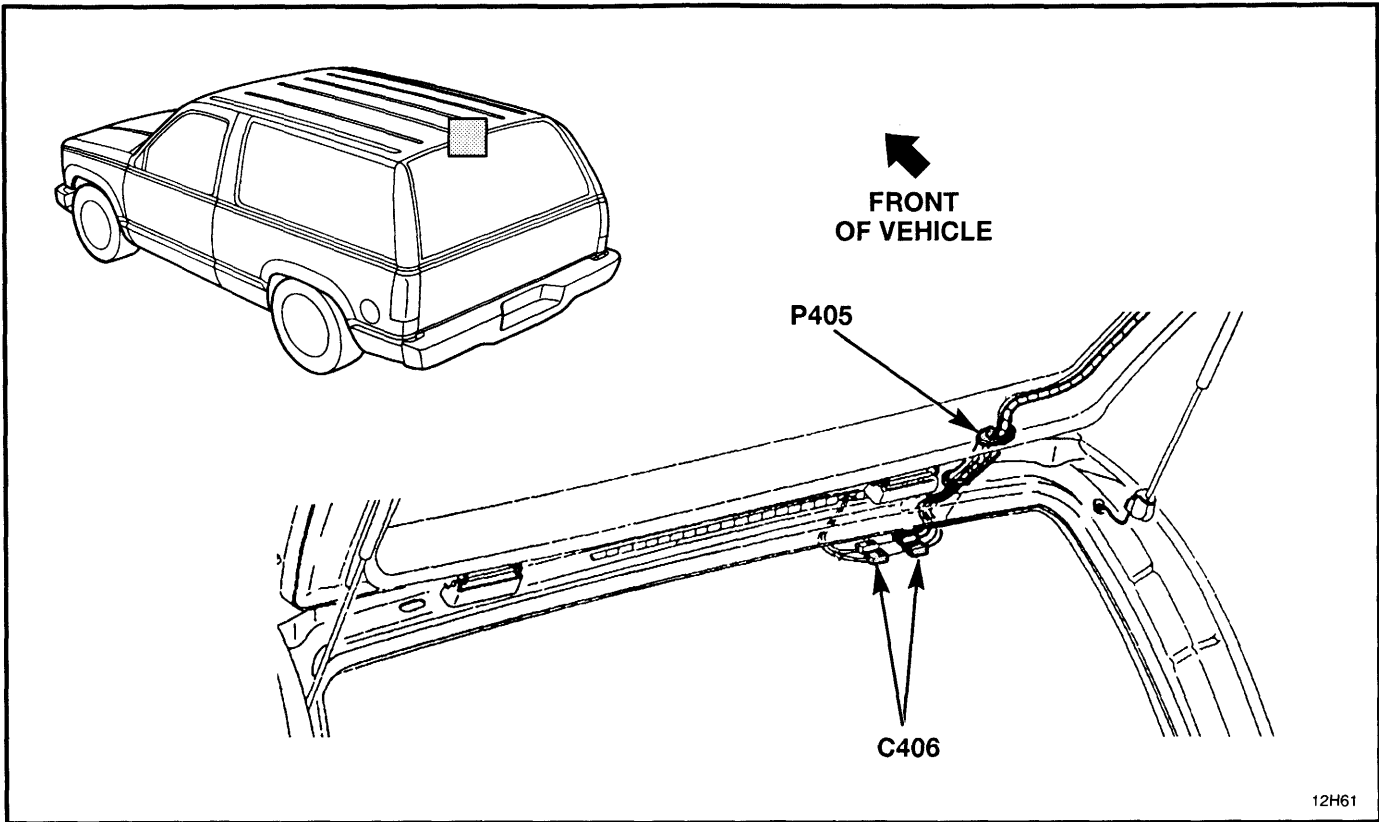


Figure 18 — Rear Window Wiper and Washer Rear Wiring — Utility and Suburban

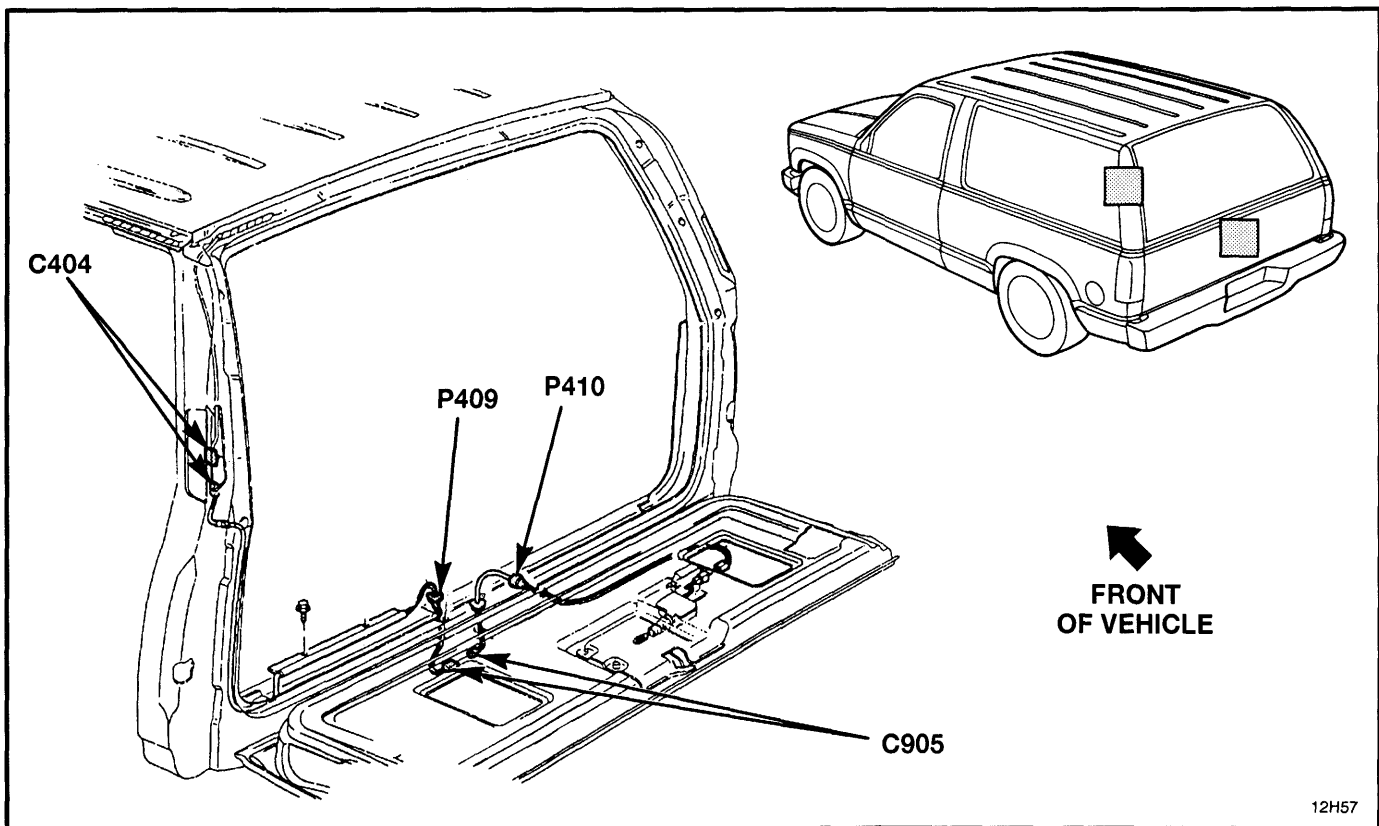


Figure 19 — Rear Window Release Rear Wiring — Utility and Suburban W/Endgate

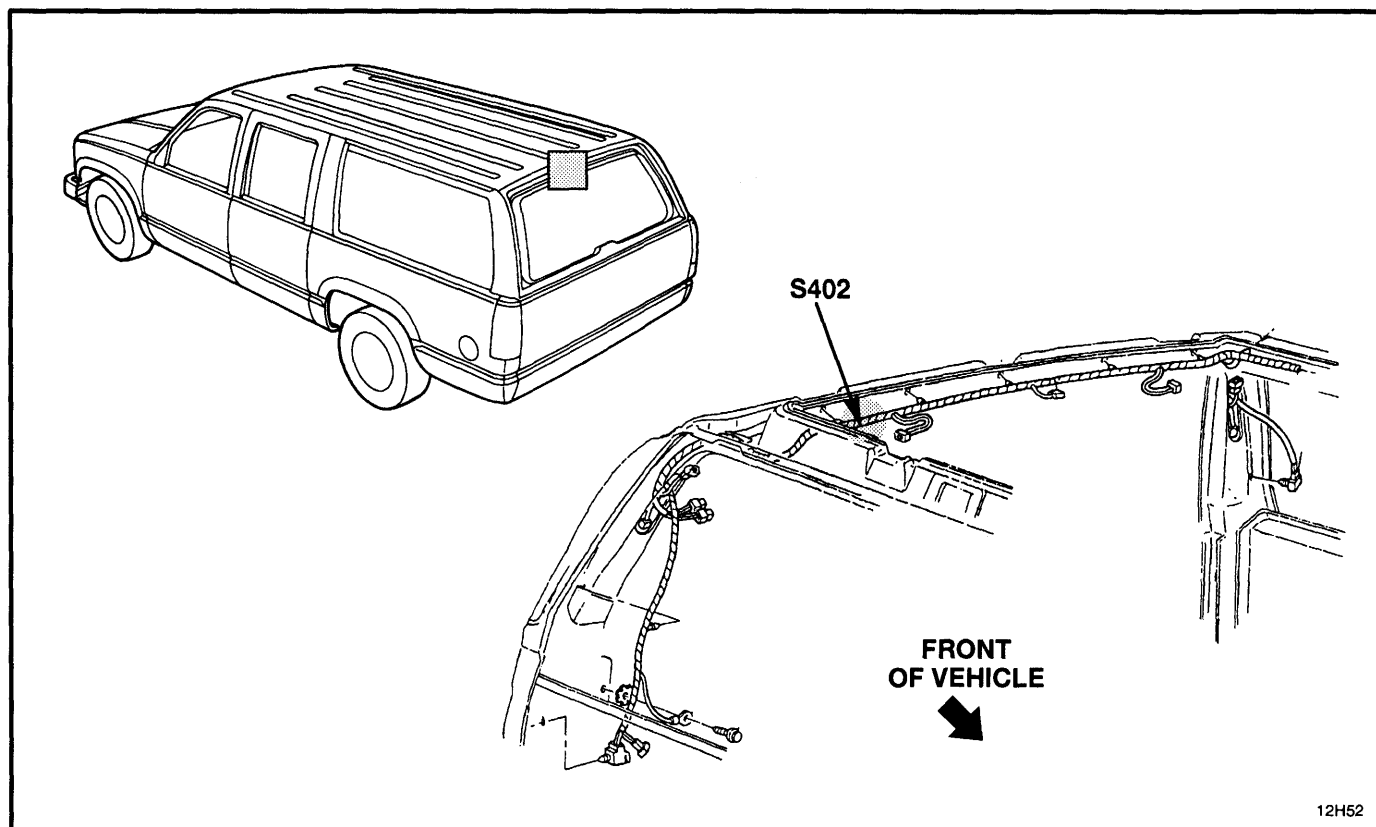


Figure 20 — Body Wiring, Rear — Suburban

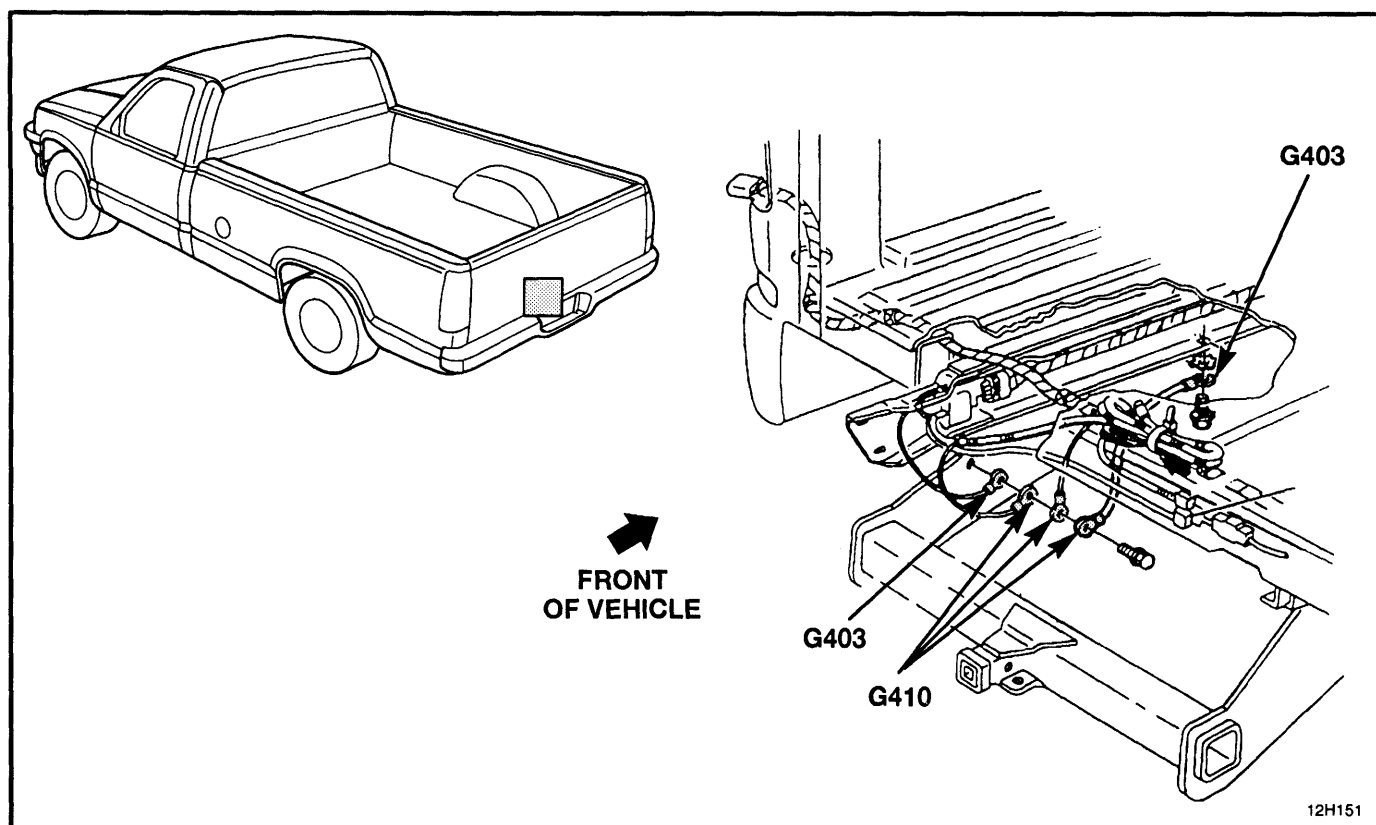
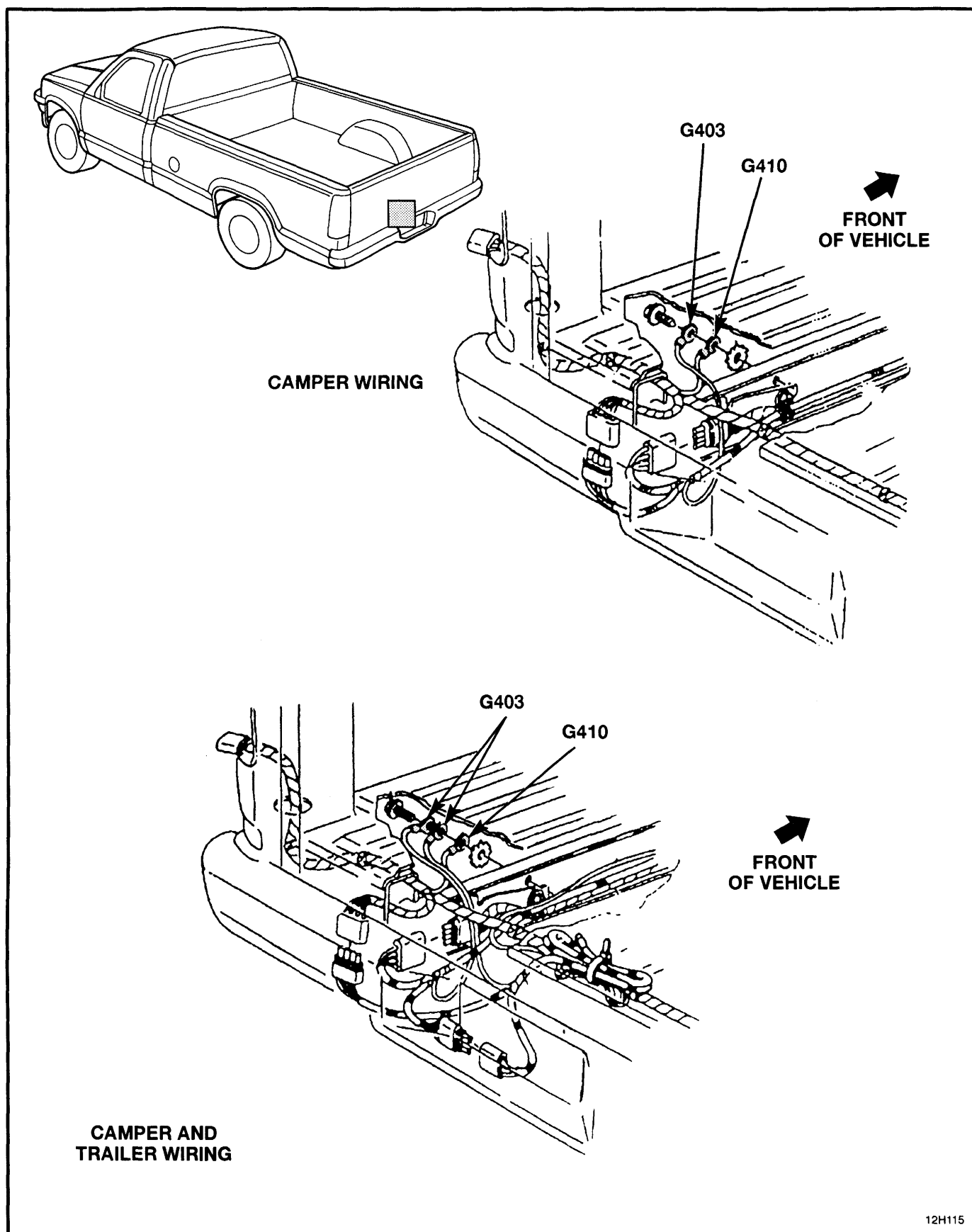
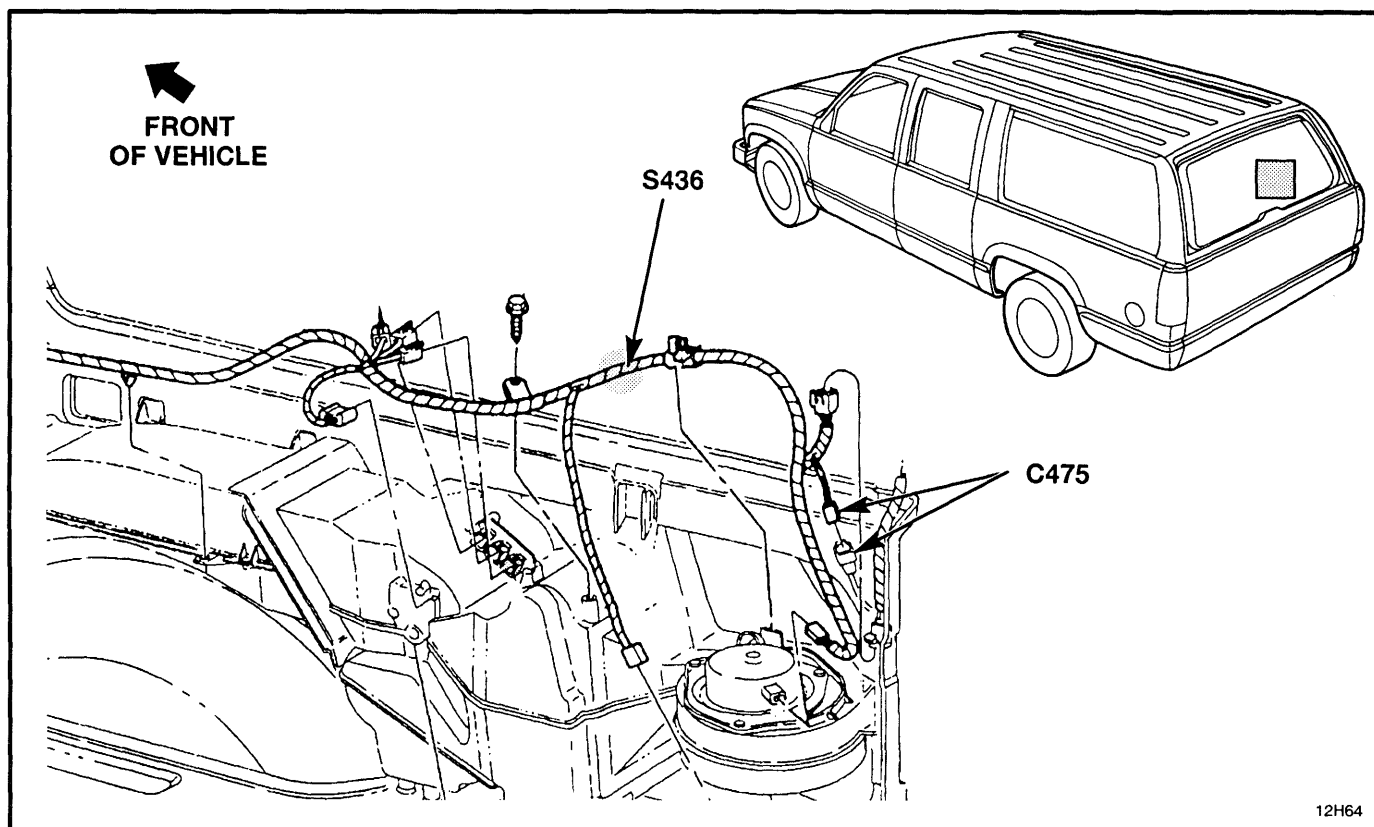


Figure 21 — Trailer Wiring W/Platform Hitch, 2 Door and Extended Cab Pickup



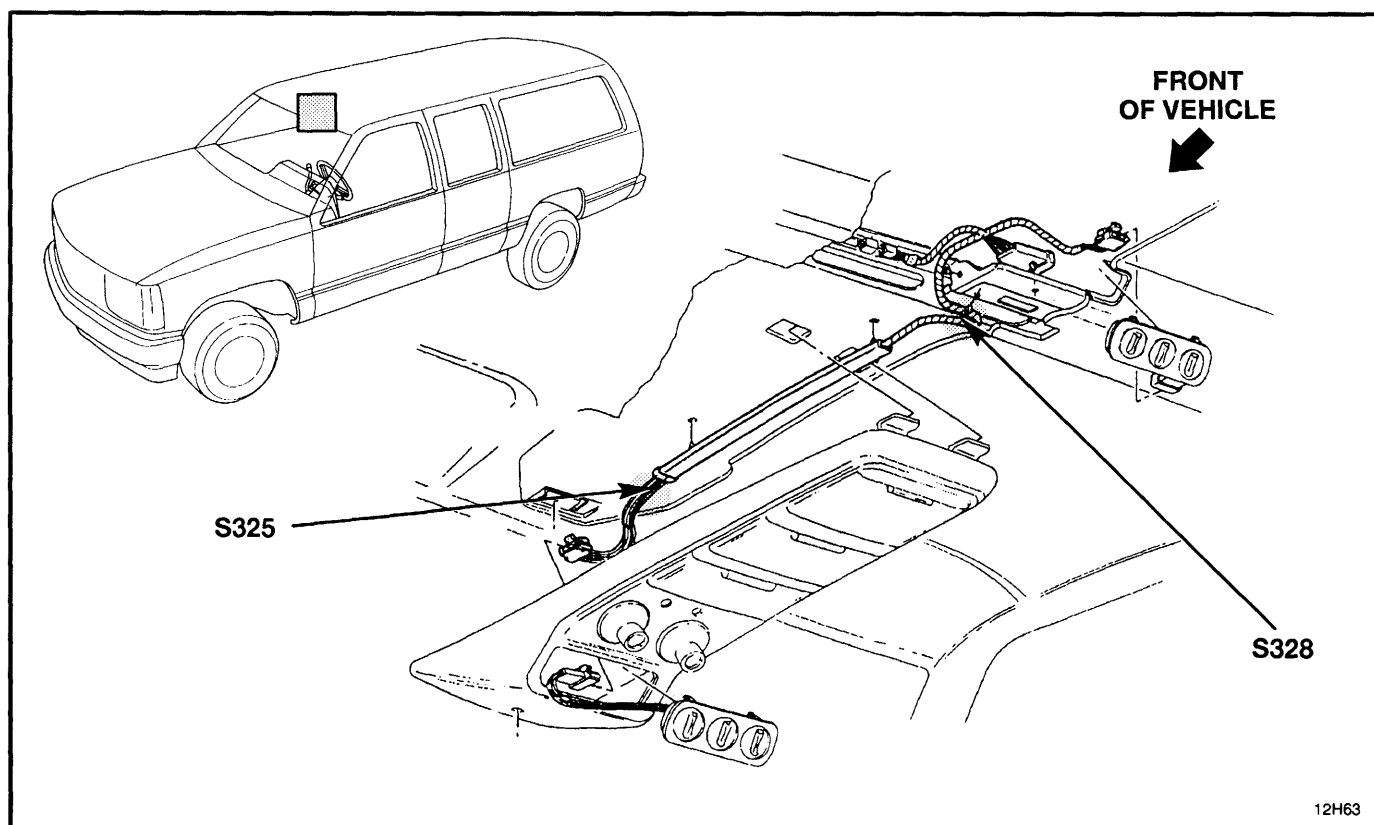
12H115

Figure 22 — Heavy Duty Trailer and Camper Rear Lamp Wiring, 2 Door Pickup



12H64

Figure 23 — Auxiliary Heater and A/C Wiring



12H63

Figure 24 — Auxiliary Heater and A/C Controls



**BLANK**

## COMPONENT LOCATION

Page — Figure

|                               |                                           |      |   |
|-------------------------------|-------------------------------------------|------|---|
| Auxiliary Battery .....       | LH front of engine compartment .....      | 17-4 | 1 |
| Auxiliary Battery Relay ..... | LH side of engine compartment .....       | 17-4 | 1 |
| Battery Junction Block .....  | RH rear engine compartment, at cowl ..... | 17-4 | 1 |
| Convenience Center .....      | Under LH side of I/P .....                | 17-4 | 1 |
| Fuse Block .....              | Lower LH side of I/P .....                | 17-6 | 4 |
| Main Battery .....            | RH front of engine compartment .....      | 17-5 | 2 |

## CONNECTORS:

|             |                             |      |   |
|-------------|-----------------------------|------|---|
| C228A ..... | At convenience center ..... | 17-4 | 1 |
| C234A ..... | At convenience center ..... | 17-4 | 1 |

## GROMMETS:

|            |                                                                         |      |   |
|------------|-------------------------------------------------------------------------|------|---|
| P105 ..... | LH rear engine compartment, at cowl left<br>of bulkhead connector ..... | 17-4 | 1 |
|------------|-------------------------------------------------------------------------|------|---|

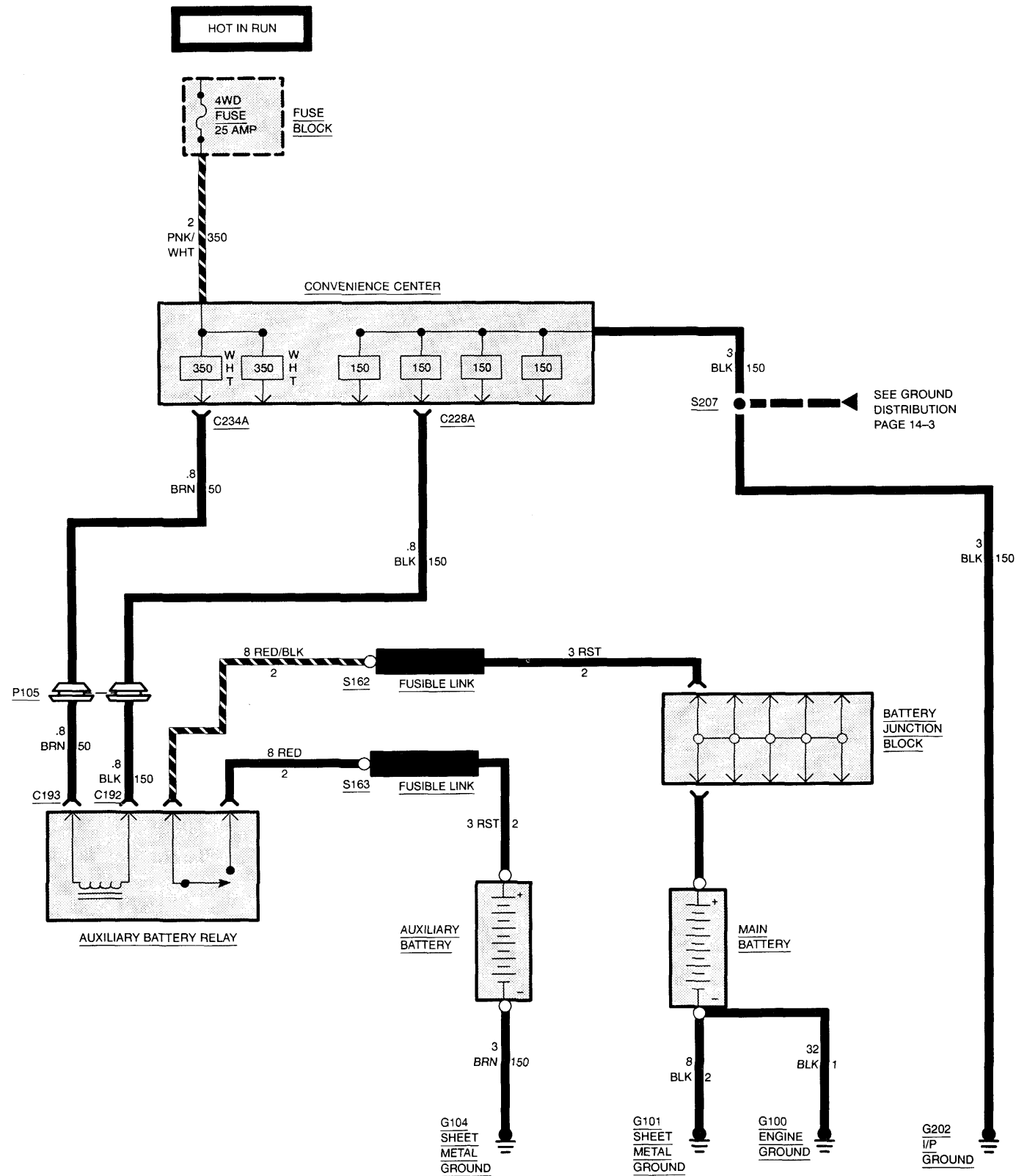
## GROUNDINGS:

|            |                                         |           |   |
|------------|-----------------------------------------|-----------|---|
| G100 ..... | RH front of engine .....                | 17-5      | 2 |
| G101 ..... | RH inner fender, near battery .....     | 17-4      | 1 |
| G104 ..... | On sheet metal, above LH headlamp ..... | Not Shown |   |
| G202 ..... | At DLC connector .....                  | 17-6      | 3 |

## SPLICES:

|            |                                                            |      |   |
|------------|------------------------------------------------------------|------|---|
| S162 ..... | Auxiliary battery wire, near battery junction block .....  | 17-4 | 1 |
| S163 ..... | Auxiliary battery wire, near auxiliary battery relay ..... | 17-4 | 1 |
| S207 ..... | Under LH side of I/P .....                                 | 17-6 | 4 |

8A-17-2 AUXILIARY BATTERY



# AUXILIARY BATTERY 8A-17-3

06288704



**NATURAL**  
56 Series

**C192**  
Convenience Center to Auxiliary  
Battery Relay at Relay

06288704



**NATURAL**  
56 Series

**C193**  
Convenience Center to Auxiliary  
Battery Relay at Relay

12059236



**C228A**  
Auxiliary Battery Relay to  
Convenience Center

12033713



**C234A**  
Auxiliary Battery Relay to  
Convenience Center

## 8A-17-4 AUXILIARY BATTERY

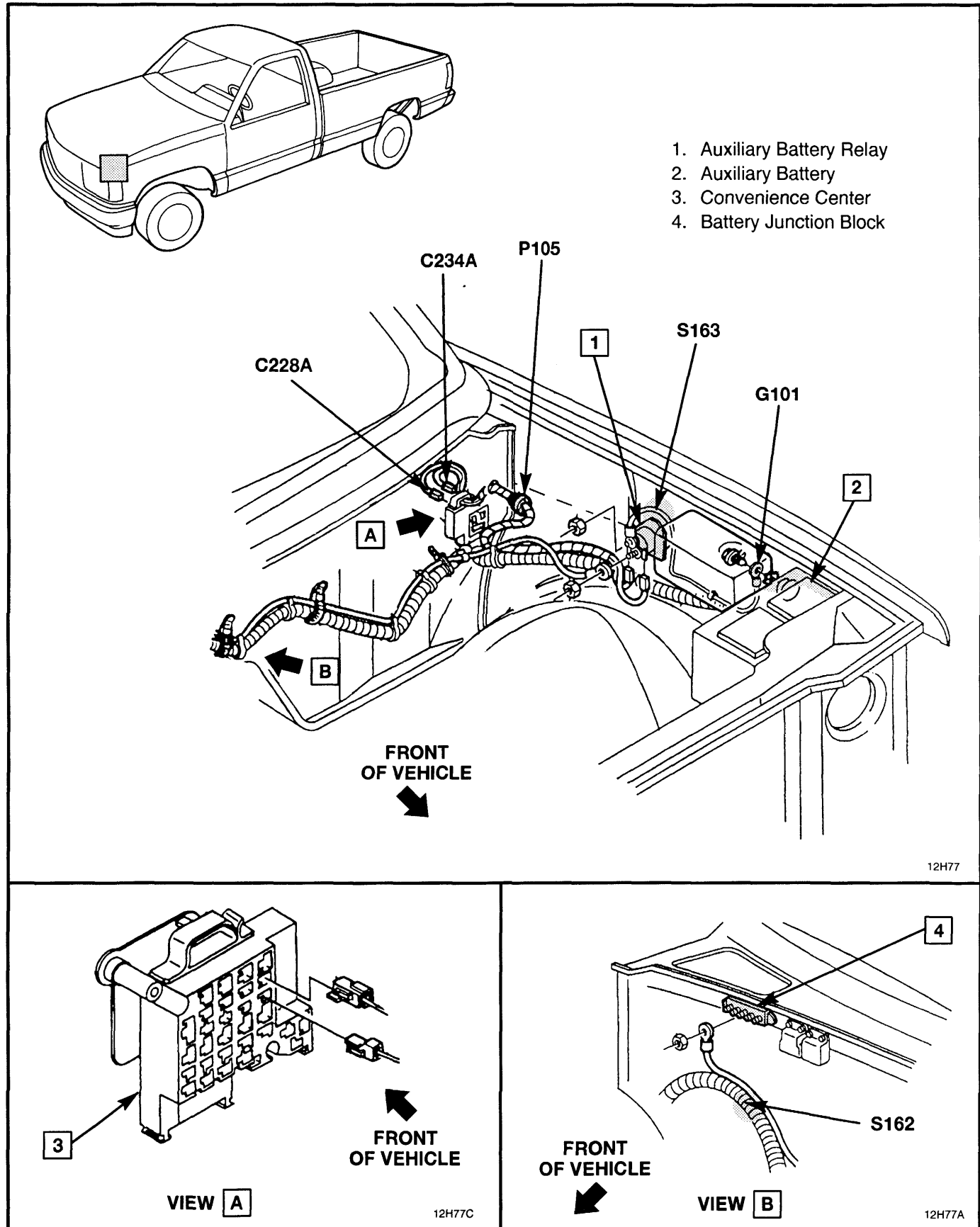


Figure 1 — Auxiliary Battery/Relay Wiring, W/TP2

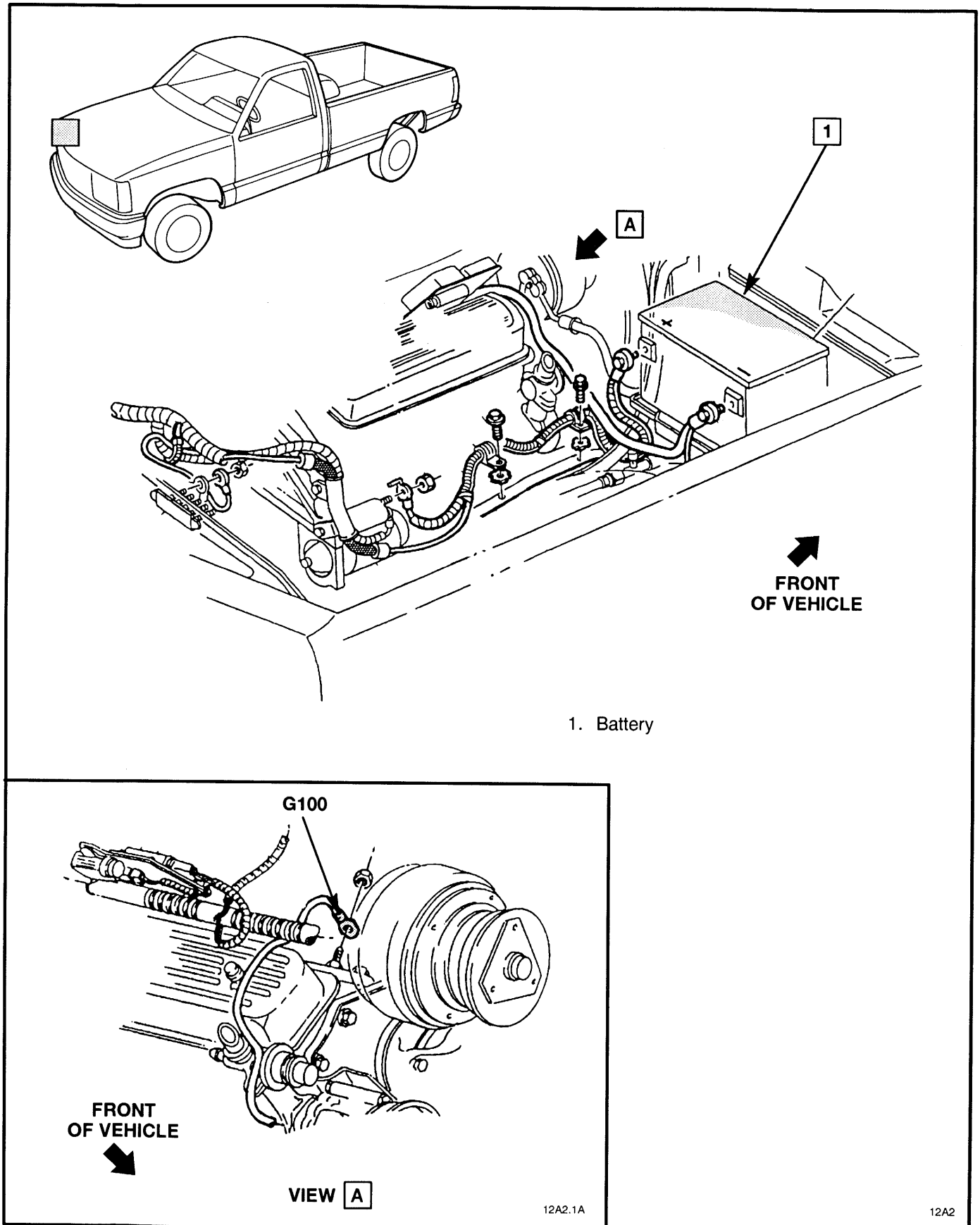


Figure 2 — Battery Wiring, Gasoline Engines

## 8A-17-6 AUXILIARY BATTERY

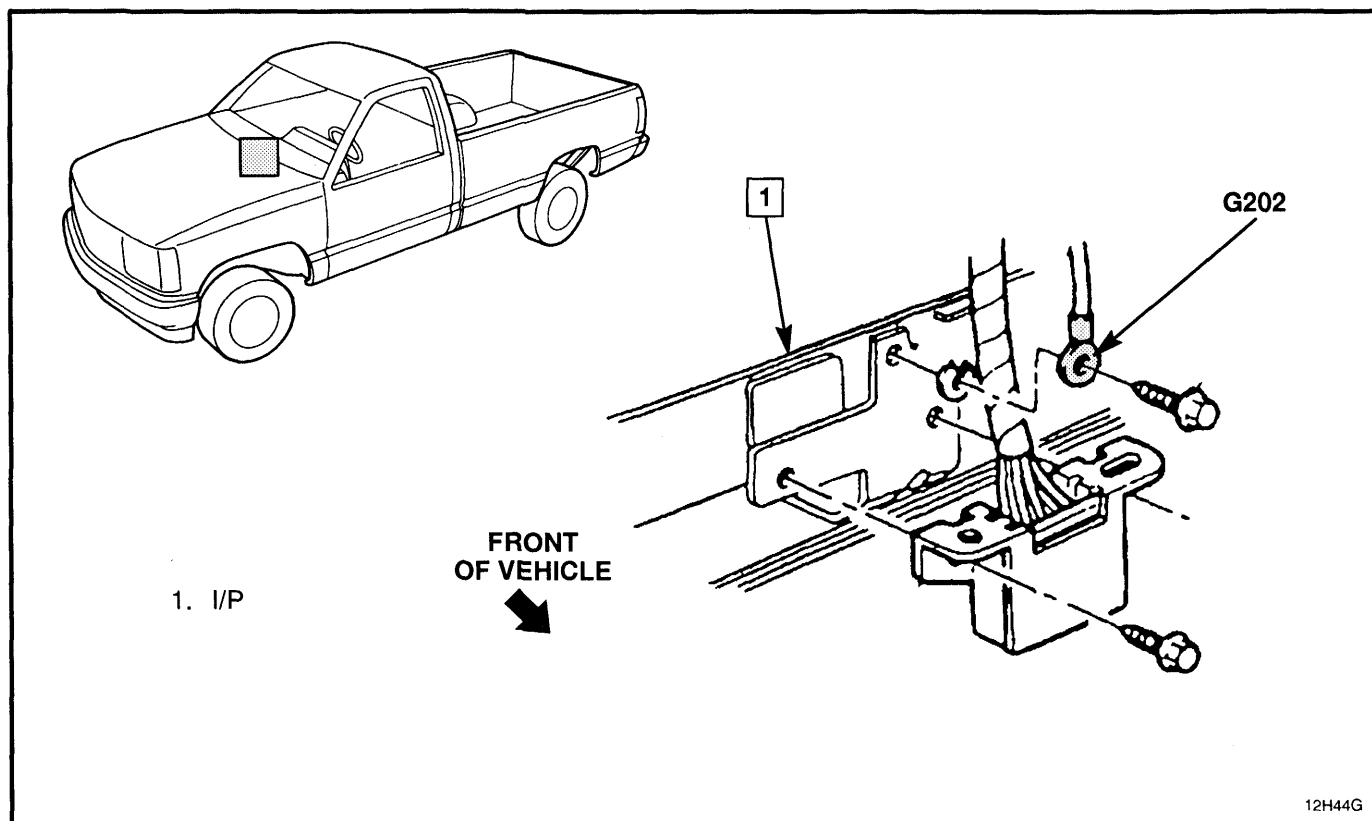


Figure 3 — Cruise Control Wiring

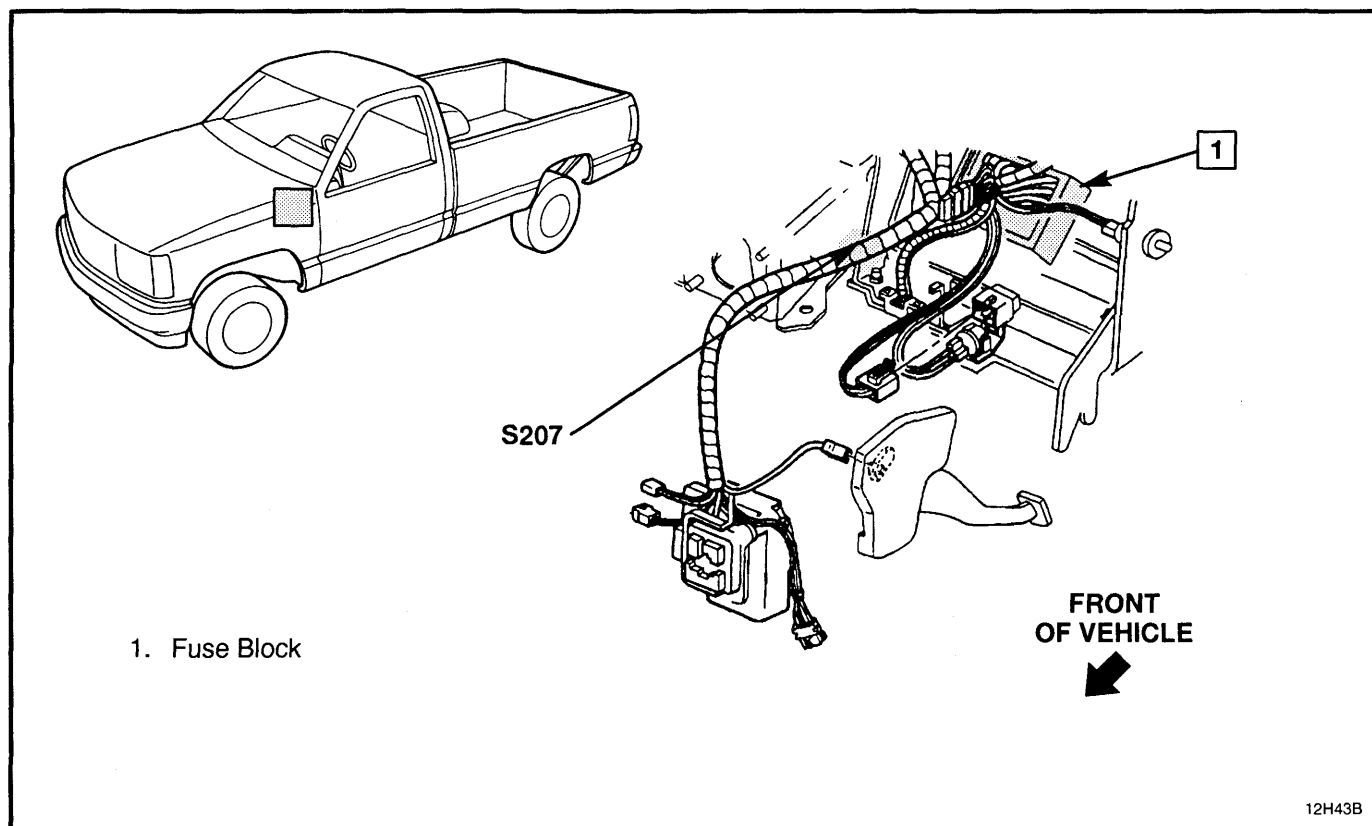


Figure 4 — Instrument Panel Wiring

## COMPONENT LOCATION

## Page — Figure

|                                     |                                                      |           |   |
|-------------------------------------|------------------------------------------------------|-----------|---|
| Battery Junction Block              | RH rear engine compartment, at cowl                  | 20-22     | 8 |
| Distributor Ignition Control Module | Center rear of engine                                | 20-23     | 9 |
| DLC                                 | Below LH side of I/P                                 | 20-18     | 2 |
| EGR Electronic Vacuum Regulator     |                                                      |           |   |
| Solenoid Valve                      | Top of engine RH side                                | 20-17     | 1 |
| EGR Solenoid Valve                  | LH rear top of engine                                | Not Shown |   |
| Engine Coolant Temperature          |                                                      |           |   |
| Sensor                              | RH top front of engine                               | 20-17     | 1 |
| Evaporative Canister Purge          |                                                      |           |   |
| Control Solenoid                    | RH side of engine                                    | 20-17     | 1 |
| Fuel Pump and Sender                | Inside fuel tank                                     | Not Shown |   |
| Fuel Pump Oil Pressure Switch       |                                                      |           |   |
| and Sender                          | LH rear of engine, near exhaust manifold             | 20-23     | 9 |
| Fuel Pump Relay                     | RH rear of engine compartment, near battery junction | 20-22     | 8 |
| Fuse Block                          | Lower LH side of I/P                                 | 20-18     | 2 |
| Heated Oxygen Sensor                | At Y connection of exhaust pipe                      | 20-19     | 3 |
| Idle Air Control Motor              | RH rear of TBI unit                                  | 20-17     | 1 |
| Ignition Coil                       | Center rear of engine                                | 20-23     | 9 |
| Instrument Cluster                  | LH side of I/P                                       | 20-18     | 2 |
| Knock Sensor                        | RH side of engine, below exhaust manifold            | 20-23     | 9 |
| Knock Sensor                        | Rear of engine near distributor                      | 20-17     | 1 |
| MAP Sensor                          | RH rear top of engine                                | 20-17     | 1 |
| PCM                                 | Under RH end of I/P                                  | 20-20     | 5 |
| TCC Stoplamp Switch                 | Top of brake pedal                                   | 20-20     | 4 |
| Throttle Body Fuel Injector #1      | Top of throttle body unit                            | 20-17     | 1 |
| Throttle Body Fuel Injector #2      | Top of throttle body unit                            | 20-17     | 1 |
| TP Sensor                           | RH side of TBI                                       | Not Shown |   |
| Transmission Input Speed Sensor     | LH side of transmission                              | 20-21     | 7 |

## CONNECTORS:

|       |                                                    |           |   |
|-------|----------------------------------------------------|-----------|---|
| C100  | At bulkhead connector                              | 20-18     | 2 |
| C101  | At bulkhead connector C100                         | 20-21     | 6 |
| C106A | Near LH lower cowl (engine compartment)            | Not Shown |   |
| C114  | Center of cowl, under battery junction block cover | 20-22     | 8 |
| C200  | Under RH side of I/P, near blower motor            | 20-20     | 5 |

## GROMMETS:

|      |                                    |           |   |
|------|------------------------------------|-----------|---|
| P101 | RH lower cowl (engine compartment) | 20-20     | 5 |
| P110 | Top of throttle body               | Not Shown |   |

## GROUND:

|      |                        |       |   |
|------|------------------------|-------|---|
| G108 | LH top front of engine | 20-17 | 1 |
| G109 | LH top front of engine | 20-17 | 1 |

## SPLICES:

|      |                                                      |           |   |
|------|------------------------------------------------------|-----------|---|
| S114 | RH rear engine compartment, near A/C accumulator     | 20-22     | 8 |
| S118 | Engine harness, near cowl LH rear engine compartment | 20-23     | 9 |
| S119 | Engine harness, near cowl LH rear engine compartment | 20-23     | 9 |
| S127 | Near P101, RH cowl                                   | 20-22     | 8 |
| S136 | Rear of engine compartment, near center              | 20-23     | 9 |
| S149 | Below battery junction block                         | Not Shown |   |
| S153 | Center of cowl, below battery junction block         | 20-22     | 8 |
| S160 | Upper rear of engine                                 | 20-23     | 9 |
| S186 | RH rear of engine                                    | 20-23     | 9 |
| S206 | Behind LH side of I/P                                | 20-18     | 2 |



## COMPONENT LOCATION

Page — Figure

### SPLICES (Continued):

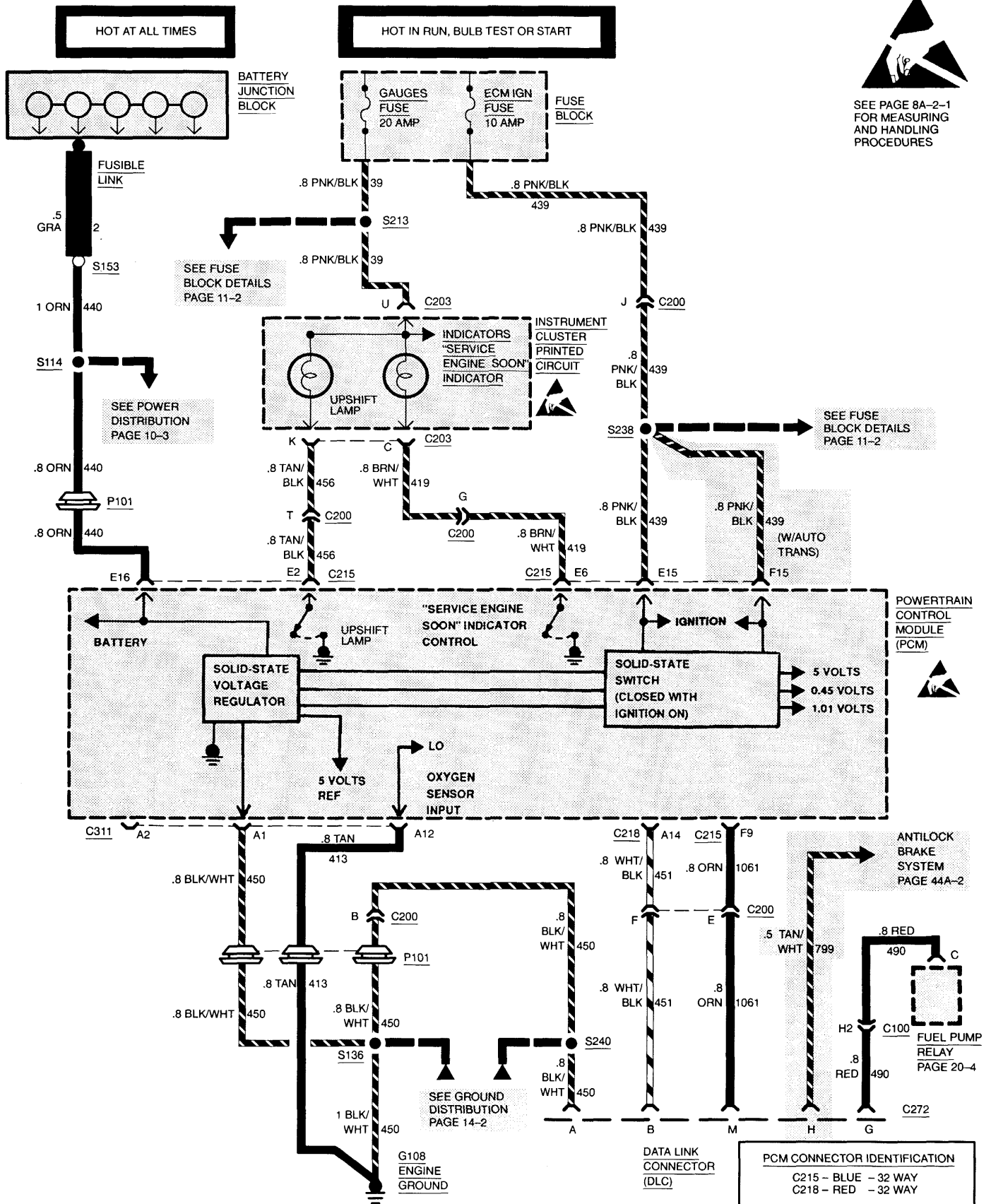
|      |                                            |       |   |
|------|--------------------------------------------|-------|---|
| S213 | ..... Under LH side of I/P .....           | 20-18 | 2 |
| S218 | ..... Near PCM, under RH side of I/P ..... | 20-20 | 5 |
| S222 | ..... Near PCM, under RH side of I/P ..... | 20-20 | 5 |
| S238 | ..... Engine harness, near PCM .....       | 20-20 | 5 |
| S240 | ..... Engine LH side of I/P .....          | 20-20 | 5 |
| S243 | ..... Engine harness, near P101 .....      | 20-20 | 5 |
| S244 | ..... Engine harness, near P101 .....      | 20-20 | 5 |

# ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z 8A-20-3

## MANUAL OR AUTOMATIC TRANSMISSION

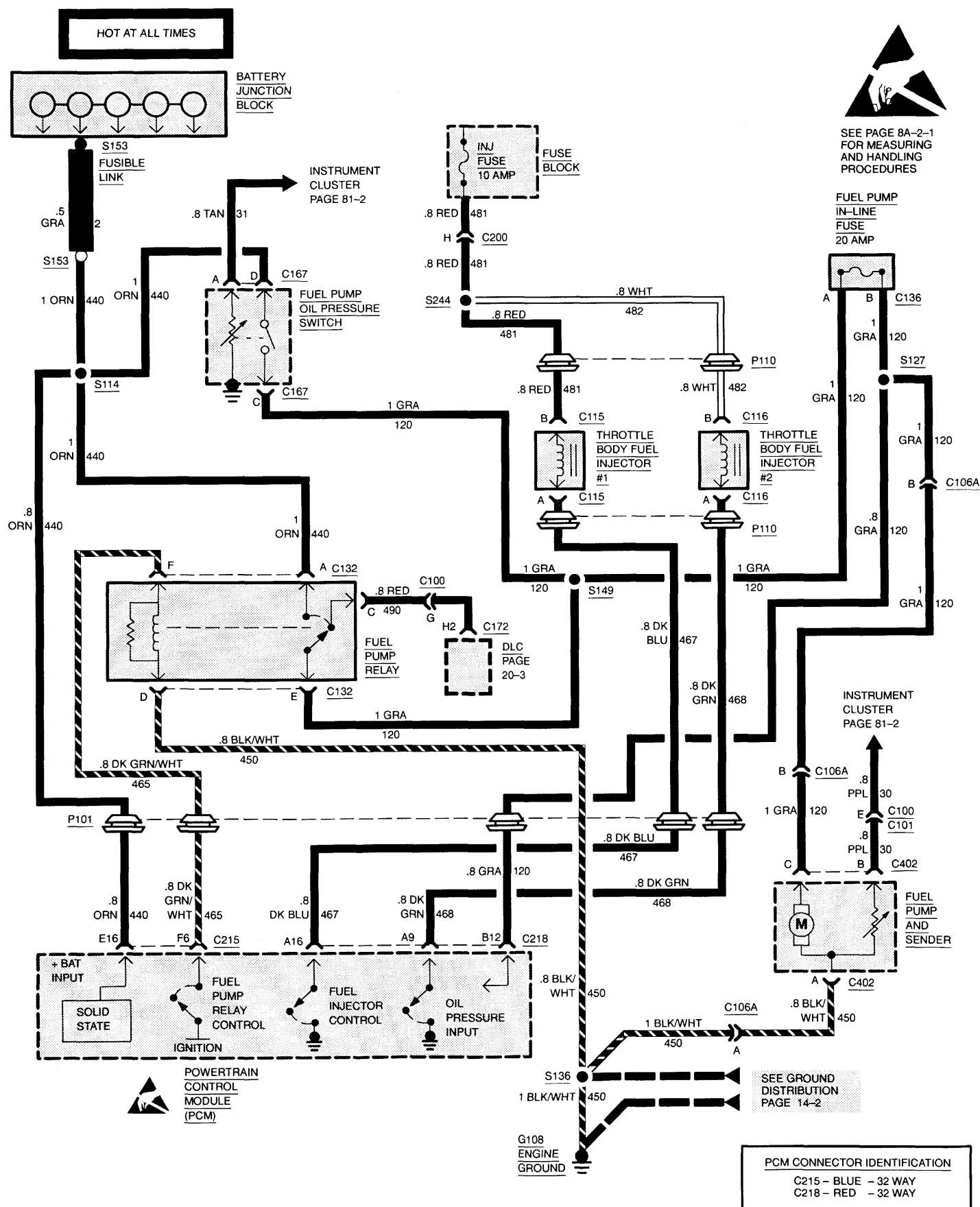


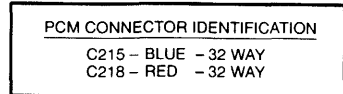
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



# 8A-20-4 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

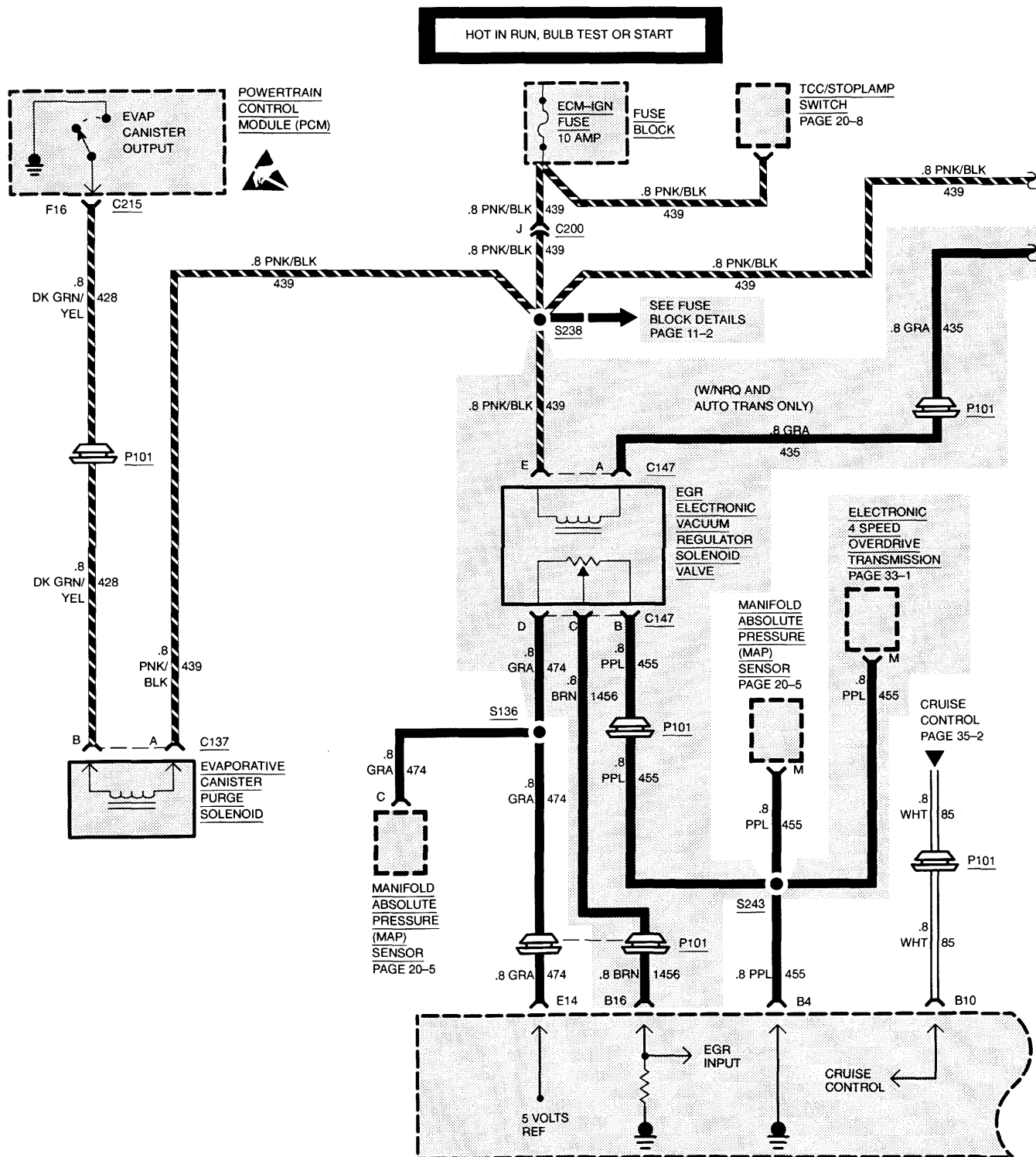
## MANUAL OR AUTOMATIC TRANSMISSION





# 8A-20-6 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

## MANUAL AND AUTOMATIC TRANSMISSION

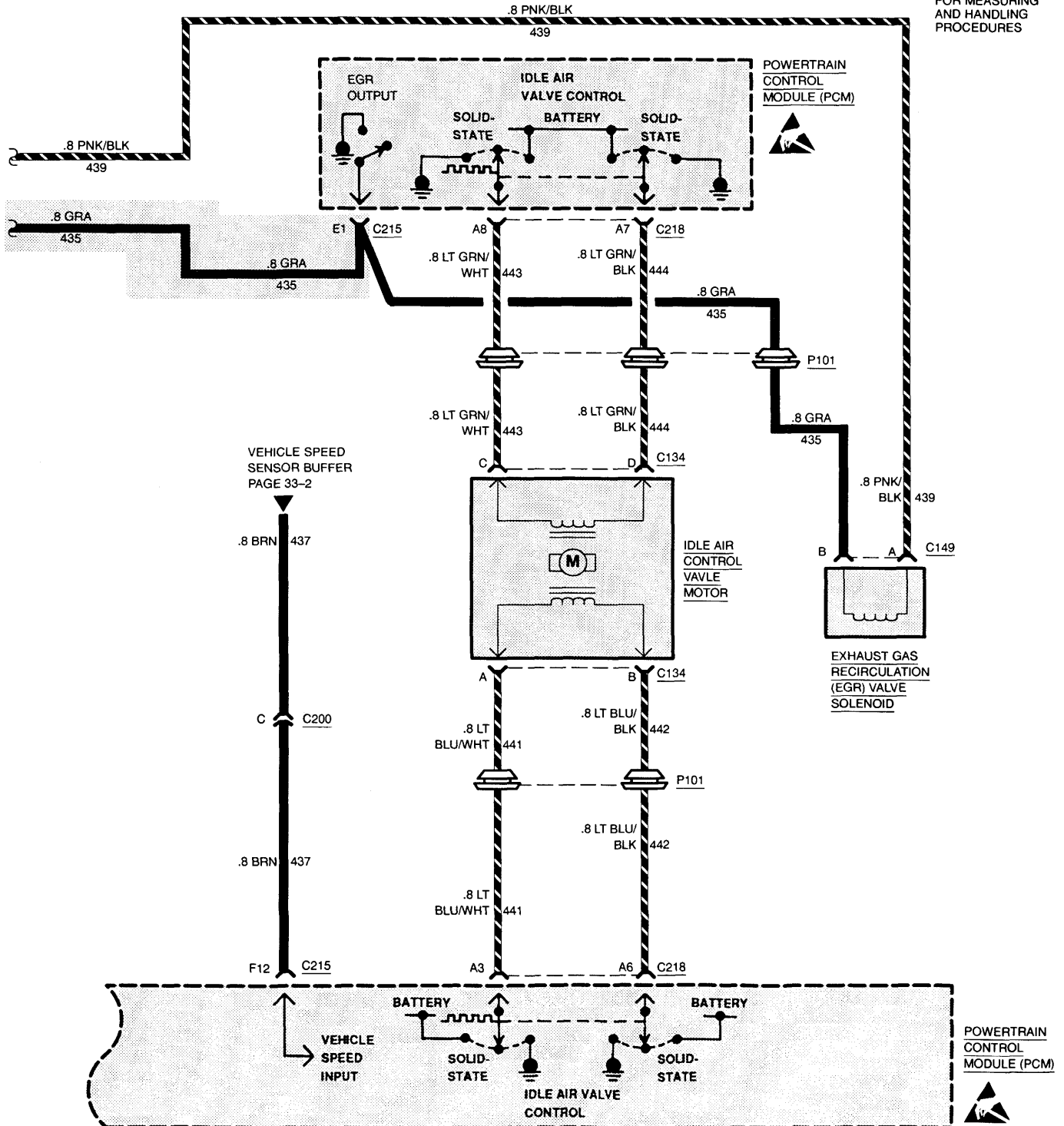


# ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z 8A-20-7

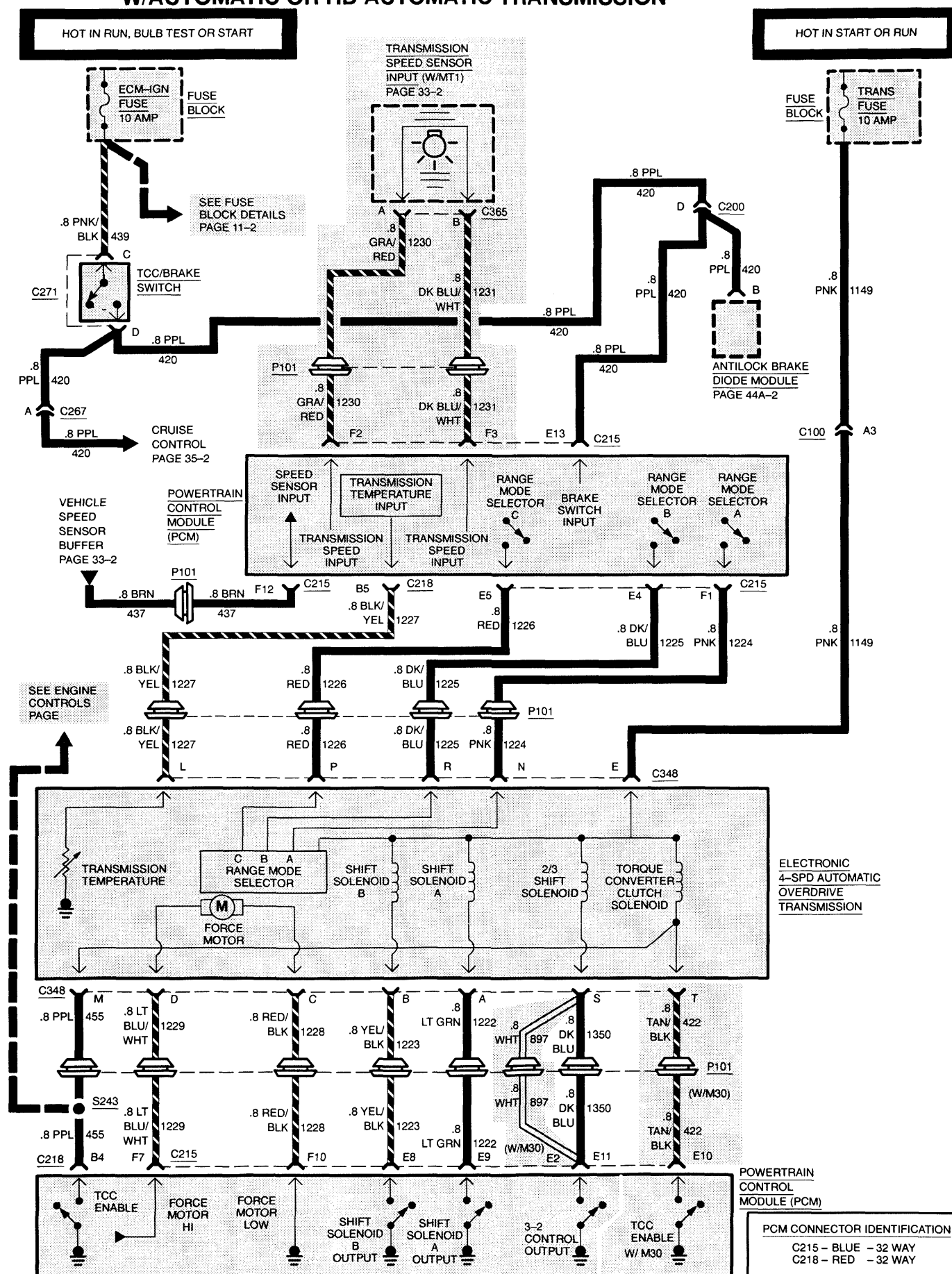
## MANUAL AND AUTOMATIC TRANSMISSION



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## W/AUTOMATIC OR HD AUTOMATIC TRANSMISSION



### W/MANUAL OR AUTOMATIC TRANSMISSION



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

SEE POWER  
DISTRIBUTION  
PAGE 11-2

**KNOCK**

**KNOCK**

TACHOMETER,  
I/P CLUSTER  
PAGE 81-2

## PCM CONNECTOR IDENTIFICATION

C215 - BLUE - 32 WAY  
C218 - RED - 32 WAY

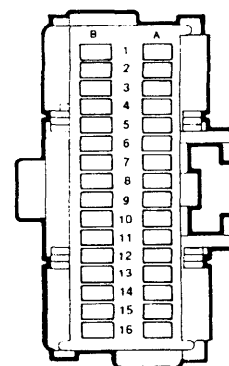


# 8A-20-10 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

## POWERTRAIN CONTROL MODULE – 4.3L (262 CID) ENGINE (32-Pin Red)

| CIRCUIT NO. | WIRE SIZE | COLOR       | CAVITY | DESCRIPTION                       |
|-------------|-----------|-------------|--------|-----------------------------------|
| 450         | 1.0       | BLK/WHT     | A1     | SYSTEM GROUND                     |
| 551         | 1.0       | TAN/WHT     | A2     | SYSTEM GROUND                     |
| 441         | .8        | LT BLU/WHT  | A3     | STEPPER COIL A HIGH               |
| 430         | .8        | PPL/WHT     | A4     | DISTRIBUTOR REF HIGH              |
| 453         | .8        | BLK/RED     | A5     | DISTRIBUTOR REF LOW               |
| 442         | .8        | LT BLU/BLK  | A6     | STEPPER COIL A LOW                |
| 444         | .8        | LT GRN/ BLK | A7     | STEPPER COIL B LOW                |
| 443         | .8        | LT GRN/WHT  | A8     | STEPPER COIL B HIGH               |
| 468         | .8        | DK GRN      | A9     | LOW SIDE INJ B                    |
| 412         | .8        | PPL         | A10    | OXYGEN SENSOR HIGH                |
|             |           |             | A11    | NOT USED                          |
| 413         | .8        | TAN         | A12    | OXYGEN SENSOR LOW                 |
|             |           |             | A13    | NOT USED                          |
| 451         | .8        | WHT/BLK     | A14    | DLC                               |
| 417         | .8        | DK BLU      | A15    | TRHOTTLE POSITION SENSOR          |
| 467         | .8        | DK BLU      | A16    | LOW SIDE INJ A                    |
| 424         | .8        | TAN/BLK     | B1     | NOT USED                          |
| 452         | .8        | BLK         | B2     | IGNITION BYPASS                   |
| 455         | .8        | PPL         | B3     | 5V RETURN B                       |
| 1227        | .8        | BLK/YEL     | B4     | 5V SYSTEM RETURN A                |
|             |           |             | B5     | PCM TO TRANS TEMP SENSOR          |
|             |           |             | B6     | NOT USED                          |
|             |           |             | B7     | NOT USED                          |
| 410         | .8        | YEL         | B8     | ENGINE COOLANT TEMPERATURE SENSOR |
|             |           |             | B9     | NOT USED                          |
| 85          | .8        | WHT         | B10    | CRUS IND REG CNTRLD GRD           |
|             |           |             | B11    | NOT USED                          |
| 120         | 1.0       | GRA         | B12    | ELEC FUEL PUMP – INPUT            |
| 432         | .8        | LT GRN      | B13    | MANIFOLD ABSOLUTE PRESSURE SENSOR |
|             |           |             | B14    | NOT USED                          |
| 496         | .8        | DK BLU      | B15    | KNOCK SENSOR                      |
|             |           |             | B16    | NOT USED                          |

**C218  
RED**

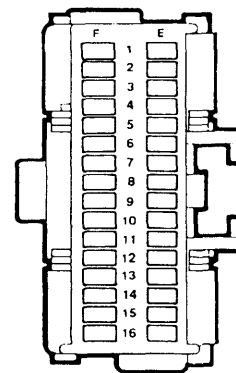


# ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z 8A-20-11

## POWERTRAIN CONTROL MODULE – 4.3L (262 CID) ENGINE (32-Pin Blue)

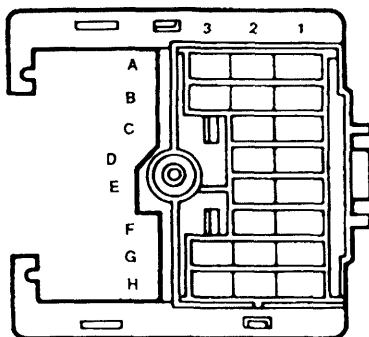
| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                       |
|-------------|-----------|------------|--------|---------------------------------------------------|
| 435         | .8        | GRA        | E1     | EGR ELECTRONIC VACUUM<br>REGULATOR SOLENOID VALVE |
| 897         | .8        | WHT        | E2     | TRANS SHIFT 2/3 SOL                               |
|             |           |            | E3     | NOT USED                                          |
| 1225        | .8        | DK BLU     | E4     | PCM TRANS RANGE MODE B                            |
| 1226        | .8        | RED        | E5     | PCM TRANS RANGE MODE C                            |
| 419         | .8        | BRN/WHT    | E6     | MALFUNCTION INDICATOR LAMP                        |
|             |           |            | E7     | NOT USED                                          |
| 1223        | .8        | YEL/BLK    | E8     | PCM TRANS SHIFT SOL B                             |
| 1222        | .8        | LT GRN     | E9     | PCM TRANS SHIFT SOL A                             |
| 422         | .8        | TAN/BLK    | E10    | TORQUE CONVERTER CLUTCH                           |
|             |           |            | E11    | NOT USED                                          |
| 59          | .8        | DK GRN     | E12    | AIR CONDITIONING                                  |
| 420         | .8        | PPL        | E13    | BRAKE SW TO PCM                                   |
| 474         | .8        | GRA        | E14    | 5V REF VOLTAGE                                    |
| 439         | .8        | PNK/BLK    | E15    | 12V IGNITION FUSED                                |
| 440         | 1.0       | ORN        | E16    | 12 BATTERY FUSED                                  |
| 1224        | .8        | PNK        | F1     | PCM TRANS RANGE MODE A                            |
| 1230        | .8        | GRA/RED    | F2     | TRANSMISSION SPEED SENSOR<br>INPUT                |
| 1231        | .8        | DK BLU/WHT | F3     | TRANSMISSION SPEED SENSOR<br>INPUT                |
|             |           |            | F4     | NOT USED                                          |
|             |           |            | F5     | NOT USED                                          |
| 465         | .8        | DK GRN/WHT | F6     | FUEL PUMP RELAY DRIVE                             |
| 1229        | .8        | LT BLU/WHT | F7     | PCM TRANS FORCE MTR LOW                           |
|             |           |            | F8     | NOT USED                                          |
| 1061        | .8        | ORN/BLK    | F9     | DLC SERIAL DATA                                   |
| 1228        | .8        | RED/BLK    | F10    | PCM TRANS FORCE MOTOR<br>HIGH                     |
| 423         | .8        | WHT        | F11    | IGNITION CONTROL (IC)                             |
| 1697        | .8        | BRN/WHT    | F12    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL             |
| 437         | .8        | BRN        | F13    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL             |
| 416         | .8        | GRA        | F14    | 5V SENSOR REF                                     |
|             |           |            | F15    | NOT USED                                          |
|             |           |            | F16    | NOT USED                                          |

**C215  
BLUE**



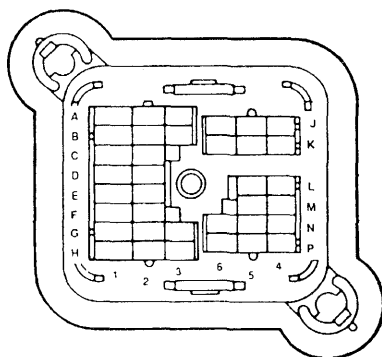
# 8A-20-12 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

12020183



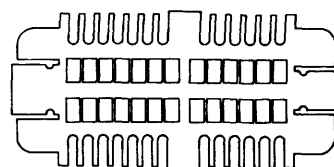
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



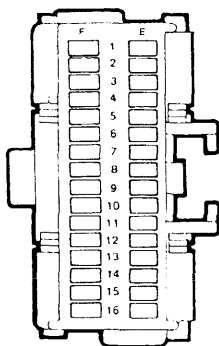
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



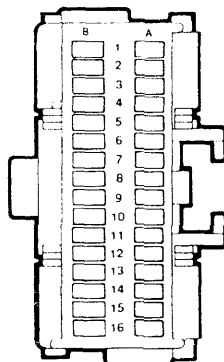
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12110115



**BLUE**  
Metri-Pack 280  
**C215**  
PCM

12110113



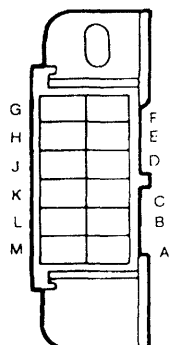
**RED**  
Metri-Pack 280  
**C218**  
PCM

12020403



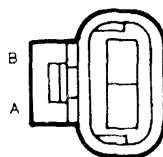
**BLACK**  
**C100A**  
MAP Sensor

12020043



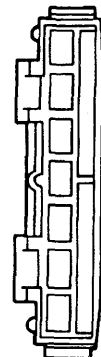
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

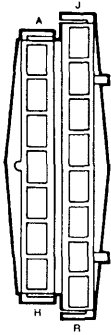
12041254



**C200**  
I/P to Bulkhead

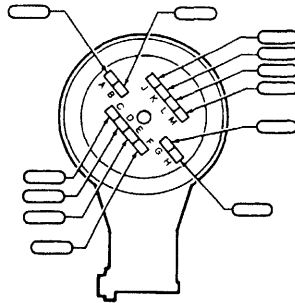
# ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z 8A-20-13

12020213



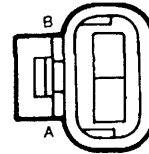
**C200**  
Bulkhead to I/P

12084690



**C348**  
Transmission

12078084



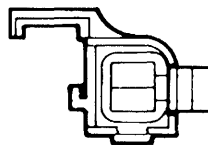
**BLACK**  
Metri-Pack 150  
**C143**  
Engine Coolant Temperature  
Sensor

12052643



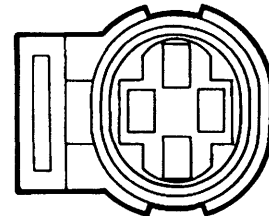
**RED**  
Metri-Pack 150  
**C137**  
Evaporative Cansiter Purge  
Solenoid

12040705



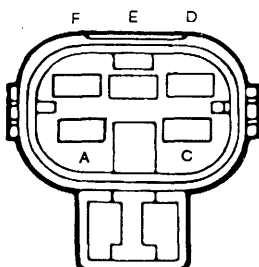
**GRAY**  
Metri-Pack 280  
**C111**  
Ignition Coil

12065401



**GRAY**  
Metri-Pack 150  
**C167**  
Fuel Pump oil Pressure Switch

12052287



**BLACK**  
Metri-Pack  
**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack  
**C106A**  
Fuse to Fuel Pump and Sender

12015791



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

# 8A-20-14 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12015791



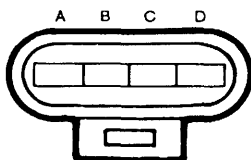
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



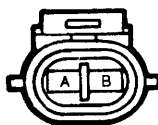
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



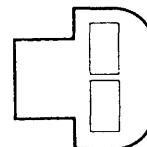
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12052641



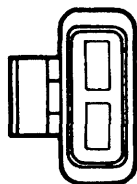
**BLACK**  
Metri-Pack 150  
**C149**  
EGR Solenoid

12103584



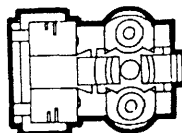
**BROWN**  
**C118**  
Air Switch Solenoid

12066681



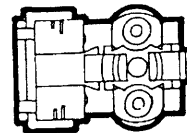
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

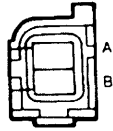
12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

# ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z 8A-20-15

12040706



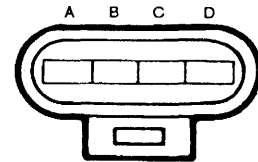
**C145**  
Ignition Coil

12015375



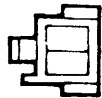
GRAY  
**C144**  
Knock Sensor

12040754



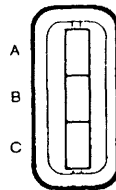
**BLACK**  
Metri-Pack 150  
**C113**  
Distributor

12033709



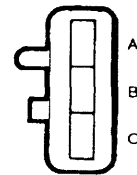
**BLACK**  
Metri-Pack 280  
**C271**  
TCC/Brake Switch

12047782



**BLACK**  
Metri-Pack 150  
**C267**  
TCC/Brake Switch to Cruise  
Control Module

12047781



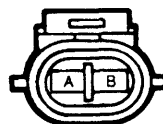
**BLACK**  
Metri-Pack 150  
**C267**  
Cruise Control to TCC/Brake  
Switch

02984528



**BLACK**  
56 Series  
**C104A**  
Tachometer Test Lead

12052641



**BLACK**  
Metri-Pack 150  
**C147**  
EGR Electronic Vacuum  
Regulator Solenoid Valve

12020600



**BLACK**  
Metri-Pack 280  
**C365**  
Vehicle Speed Sensor

# 8A-20-16 ENGINE CONTROLS 4.3L (262 CID) V6 VIN Z

12015375



GRAY

C199A  
Knock Sensor

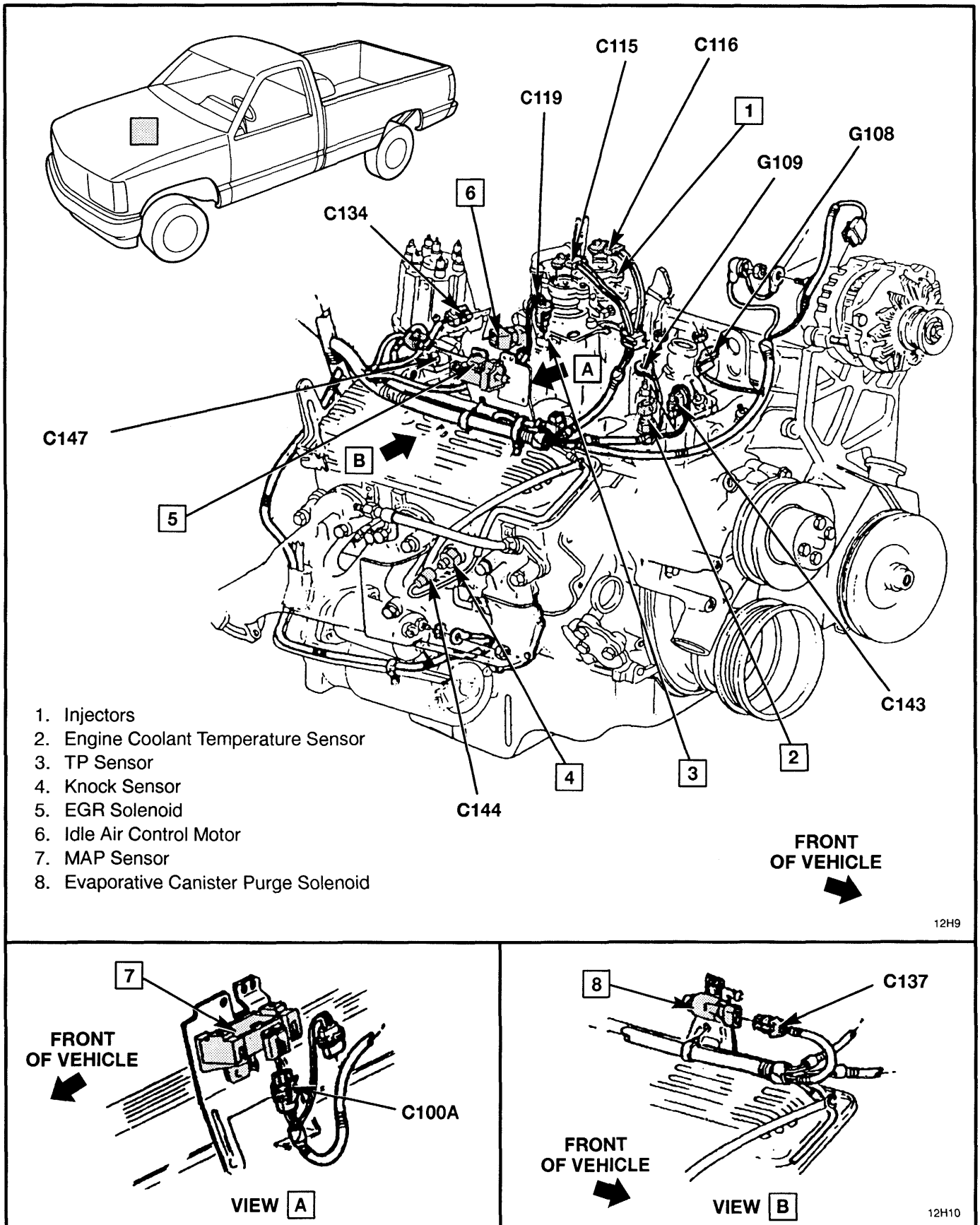


Figure 1 — 4.3L Engine Wiring, RH Side



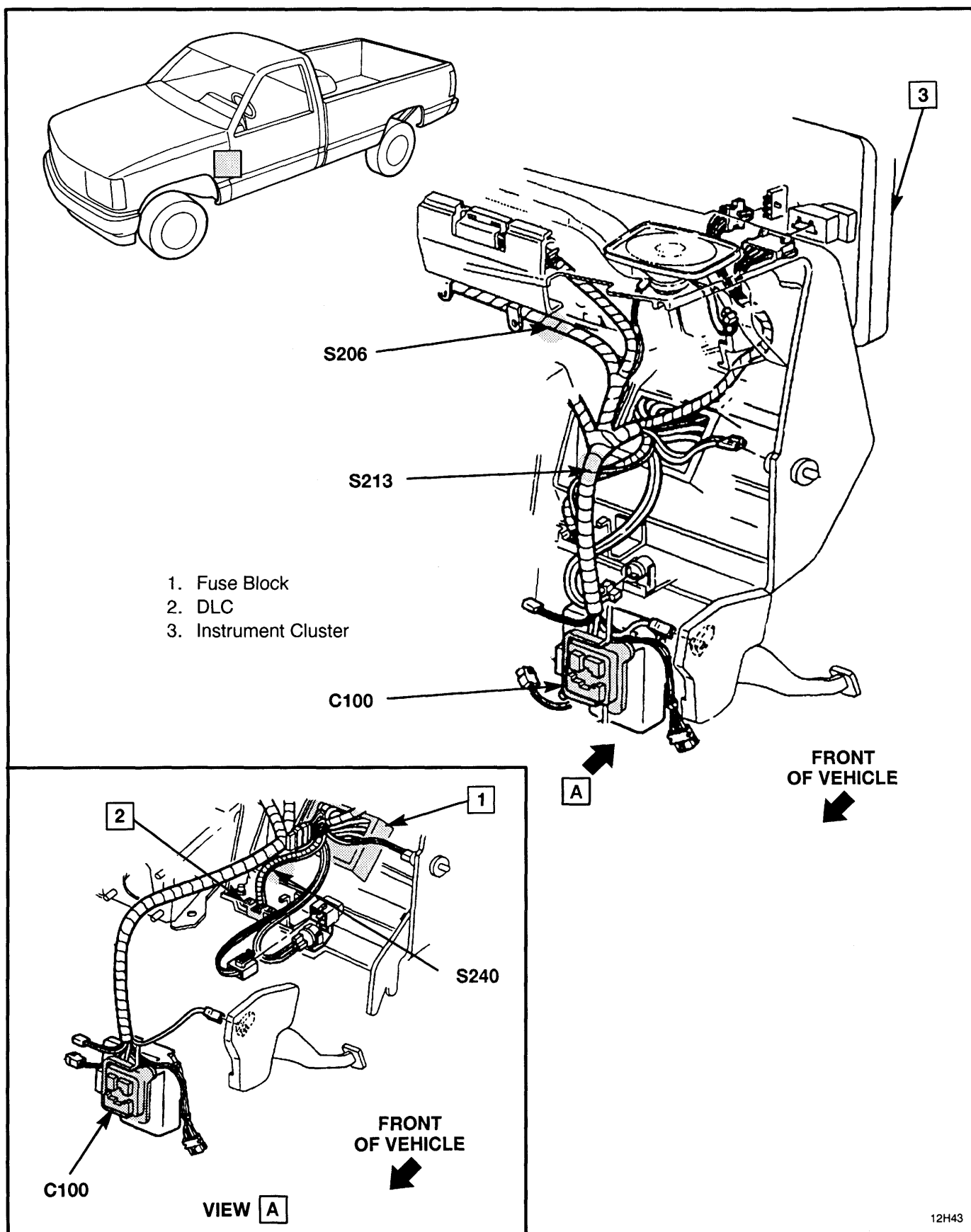


Figure 2 — Instrument Panel, LH Side

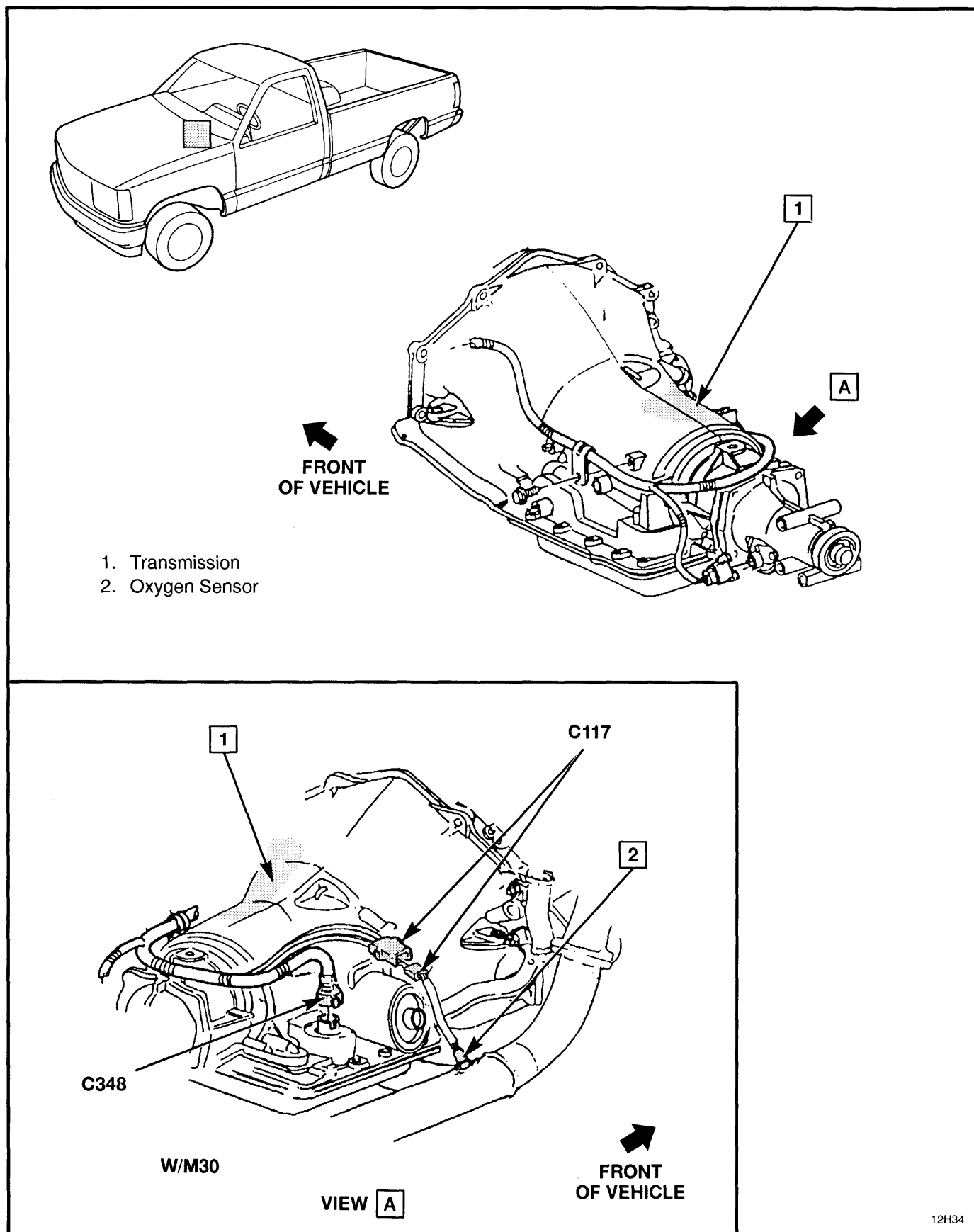


Figure 3 — Transmission Wiring

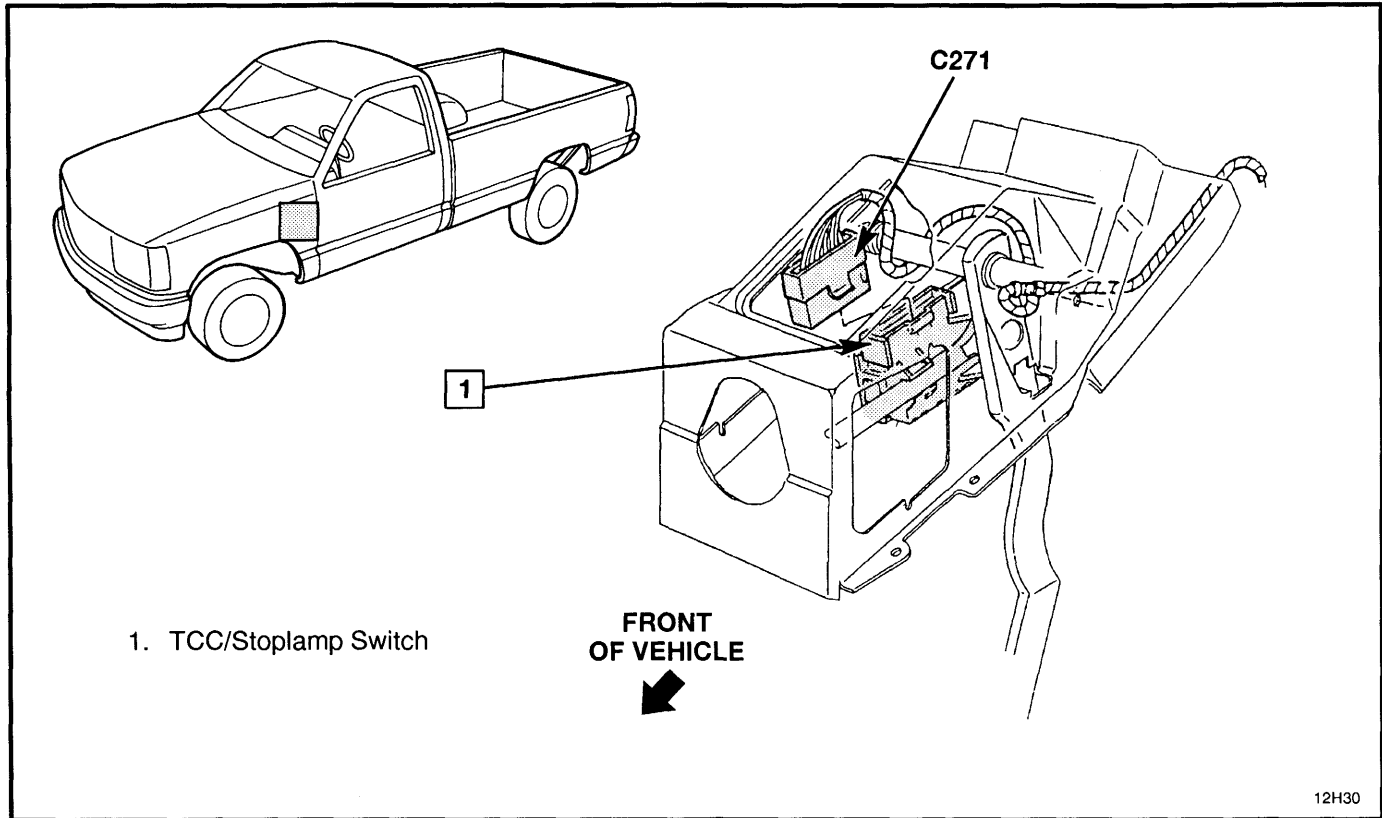


Figure 4 — TCC/Stoplamp Switch

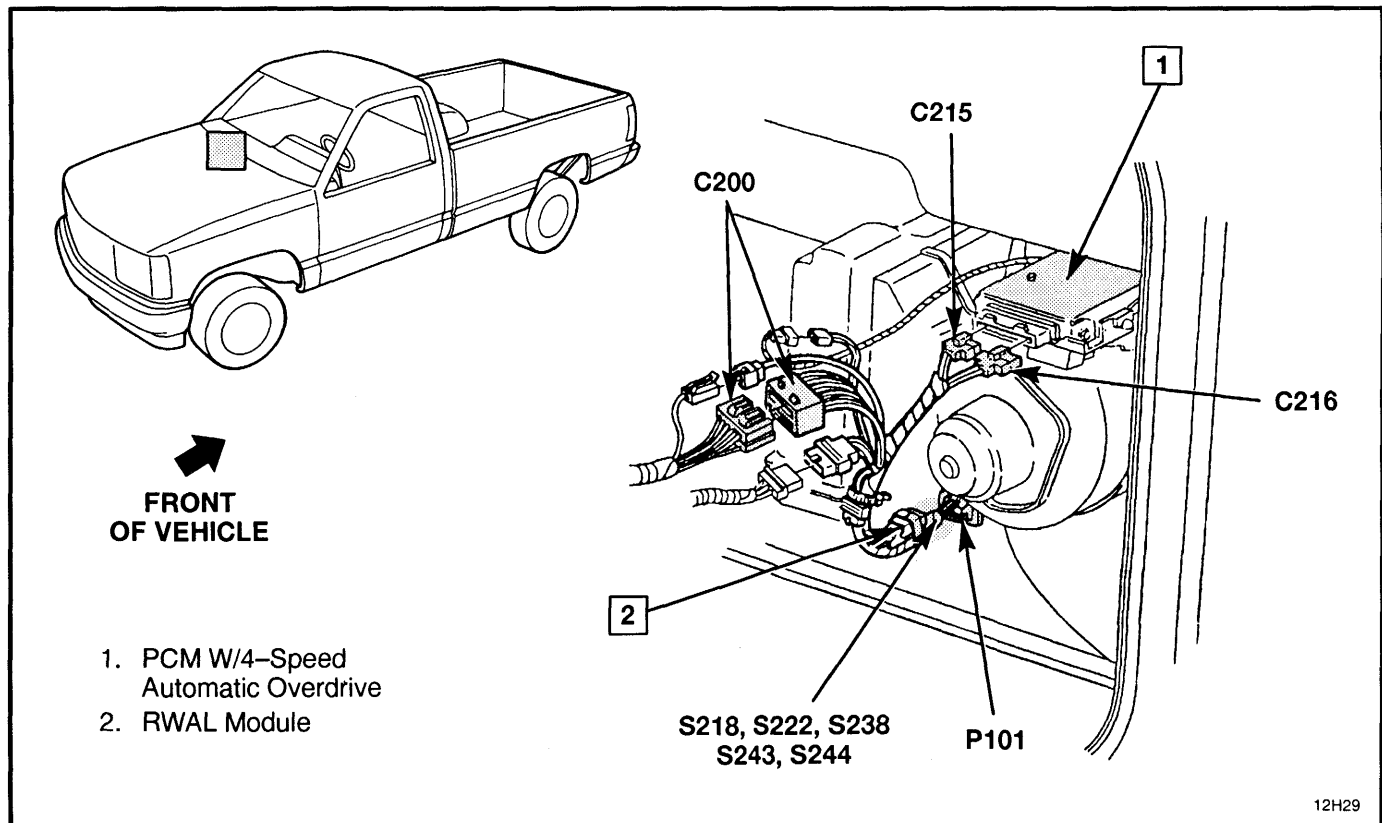


Figure 5 — ECM/PCM Wiring

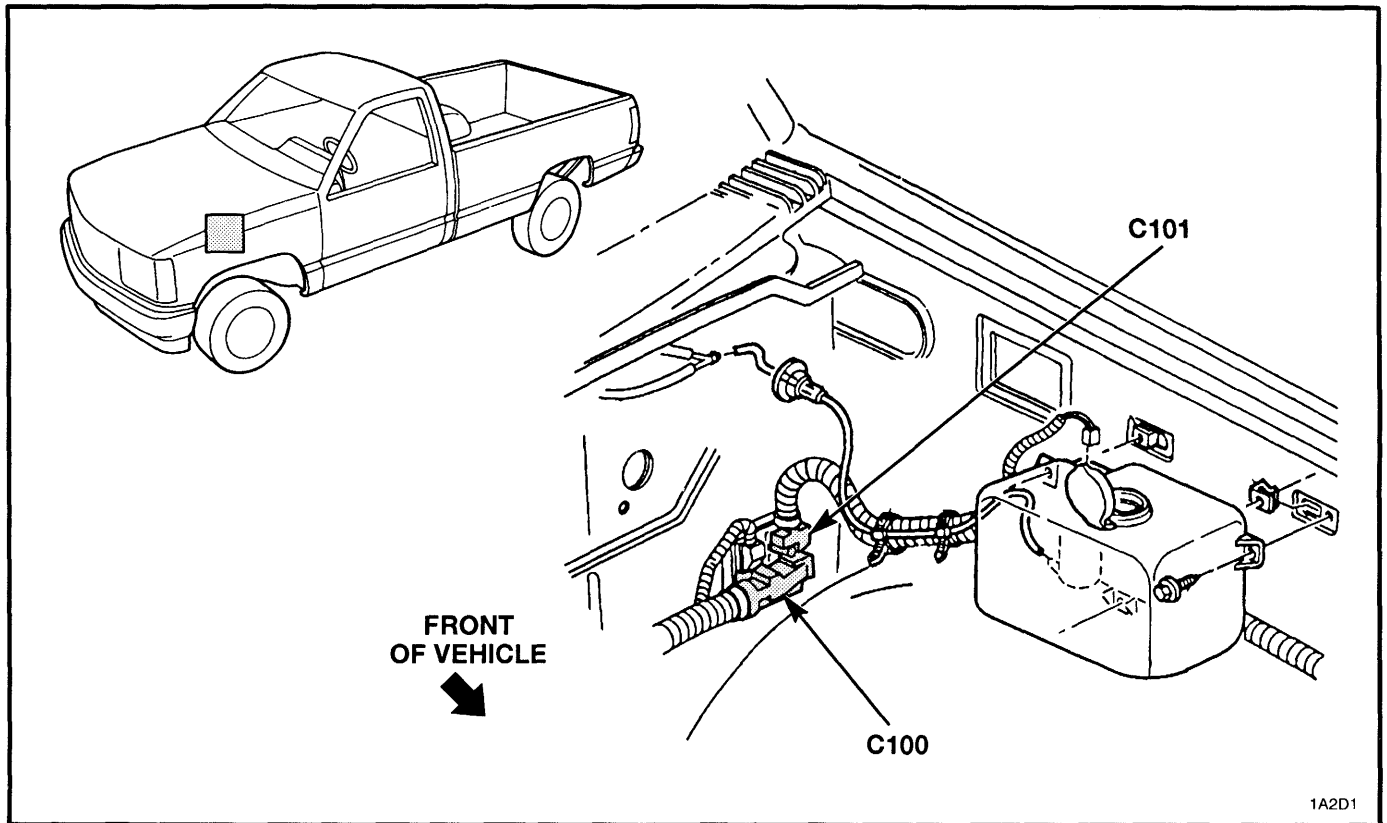


Figure 6 — LH Cowl Wiring

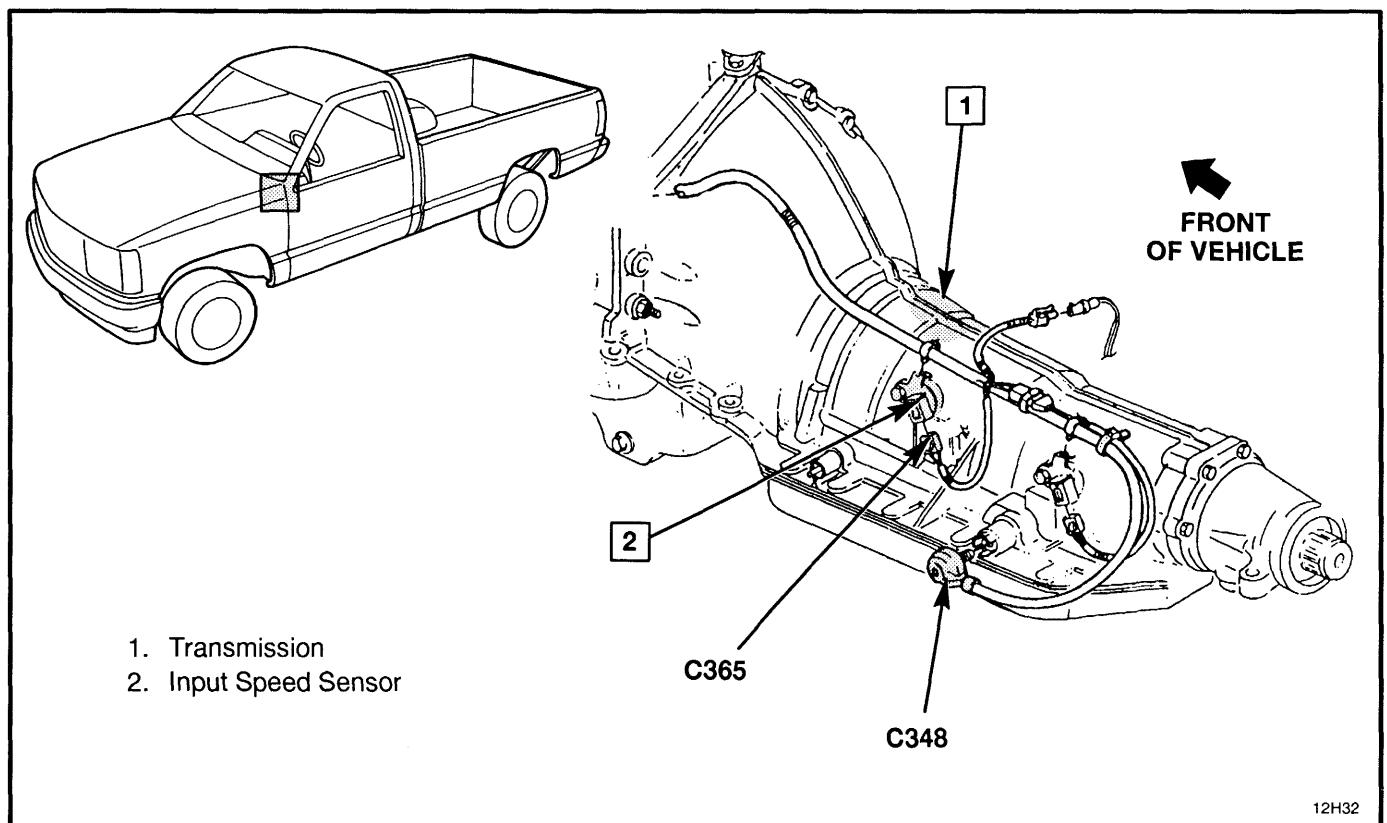


Figure 7 — HD Transmission Wiring

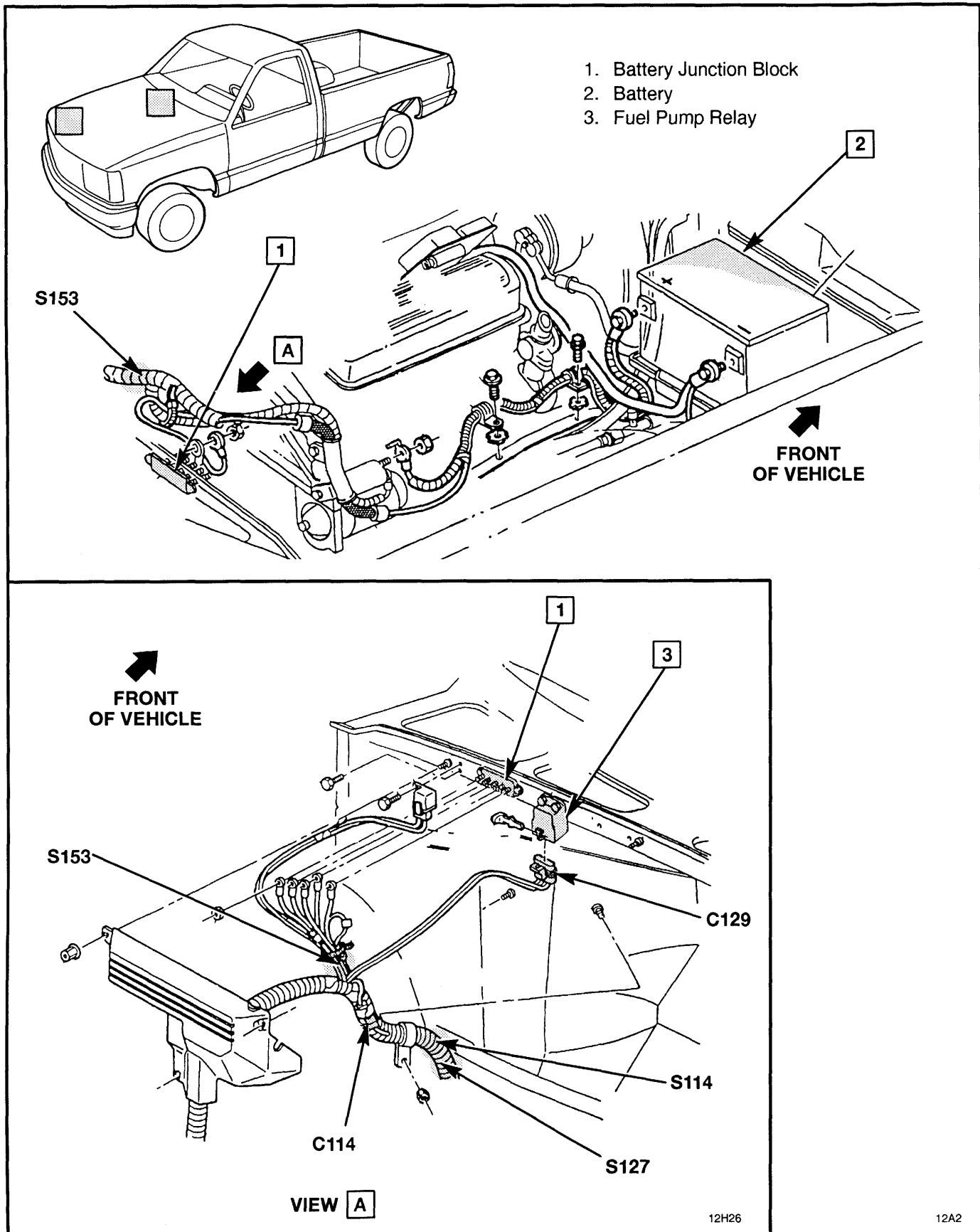
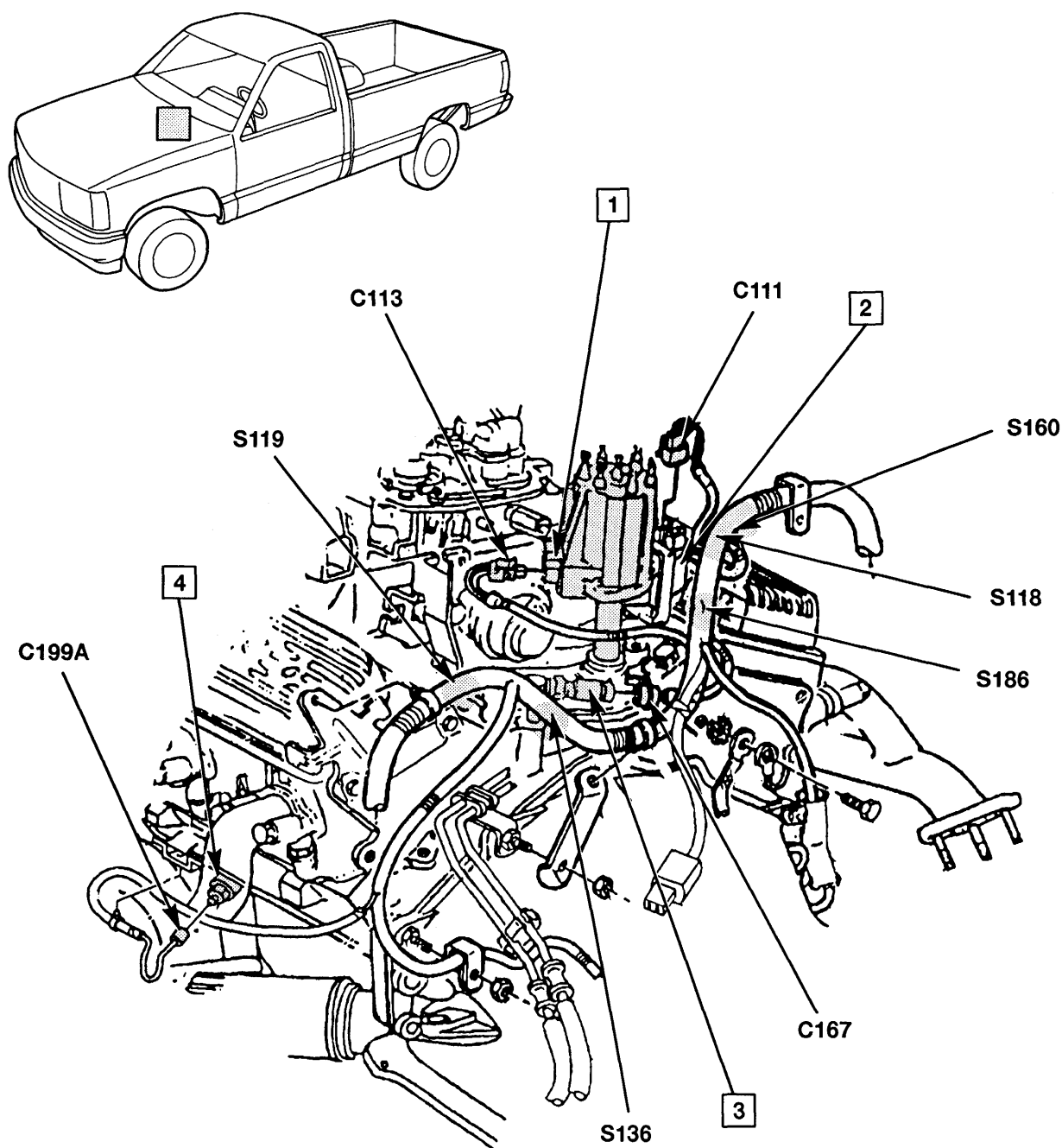


Figure 8 — Battery Wiring, Fuel Pump Relay and Battery Junction Block



1. Ignition Control Module and Distributor
2. Ignition Coil
3. Fuel Pump Oil Pressure Switch and Sender
4. Knock Sensor

  
**FRONT  
OF VEHICLE**

Figure 9 — 4.3L (262 CID) Engine, LH Side

**BLANK**

## ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21A-1

### COMPONENT LOCATION

### Page — Figure

|                                          |                                                            |           |   |
|------------------------------------------|------------------------------------------------------------|-----------|---|
| Air Switch Solenoid                      | RH front of engine                                         | 21A-14    | 2 |
| Battery Junction Block                   | RH rear engine compartment, at cowl                        | 21A-15    | 3 |
| Distributor Ignition Control Module      | Center rear of engine                                      | 21A-13    | 1 |
| EGR Solenoid Valve                       | LH rear top of engine                                      | 21A-15    | 3 |
| Engine Coolant Temperature Sensor        | RH top front of engine                                     | 21A-14    | 2 |
| Fuel Pump and Sender                     | Inside fuel tank                                           | Not Shown |   |
| Fuel Pump Oil Pressure Switch and Sender | LH rear of engine, near exhaust manifold                   | 21A-13    | 1 |
| Fuel Pump Relay                          | RH rear of engine compartment, near battery junction block | 21A-15    | 3 |
| Fuse Block                               | Lower LH side of I/P                                       | 21A-19    | 8 |
| Idle Air Control Motor                   | RH rear of TBI unit                                        | 21A-14    | 2 |
| Ignition Coil                            | Center rear of engine                                      | 21A-13    | 1 |
| Instrument Cluster                       | LH side of I/P                                             | Not Shown |   |
| Knock Sensor                             | RH side of engine, below exhaust manifold                  | 21A-14    | 2 |
| Knock Sensor Module                      | Above RH rocker cover                                      | 21A-15    | 3 |
| MAP Sensor                               | RH rear top of engine                                      | 21A-14    | 2 |
| Oxygen Sensor                            | In LH exhaust manifold                                     | 21A-13    | 1 |
| ECM                                      | Under RH end of I/P                                        | 21A-17    | 5 |
| Throttle Body Fuel Injector #1           | Top of throttle body unit                                  | 21A-14    | 2 |
| Throttle Body Fuel Injector #2           | Top of throttle body unit                                  | 21A-14    | 2 |
| TP Sensor                                | RH side of TBI                                             | 21A-14    | 2 |

### CONNECTORS:

|       |                                                    |           |   |
|-------|----------------------------------------------------|-----------|---|
| C100  | At bulkhead connector                              | 21A-17    | 6 |
| C101  | At bulkhead connector C100                         | 21A-17    | 6 |
| C106A | Near LH lower cowl (engine compartment)            | Not Shown |   |
| C114  | Center of cowl, under battery junction block cover | 21A-18    | 7 |
| C200  | Under RH side of I/P, near blower motor            | 21A-17    | 5 |

### GROMMETS:

|      |                                    |        |   |
|------|------------------------------------|--------|---|
| P101 | RH lower cowl (engine compartment) | 21A-17 | 5 |
|------|------------------------------------|--------|---|

### GROUND:

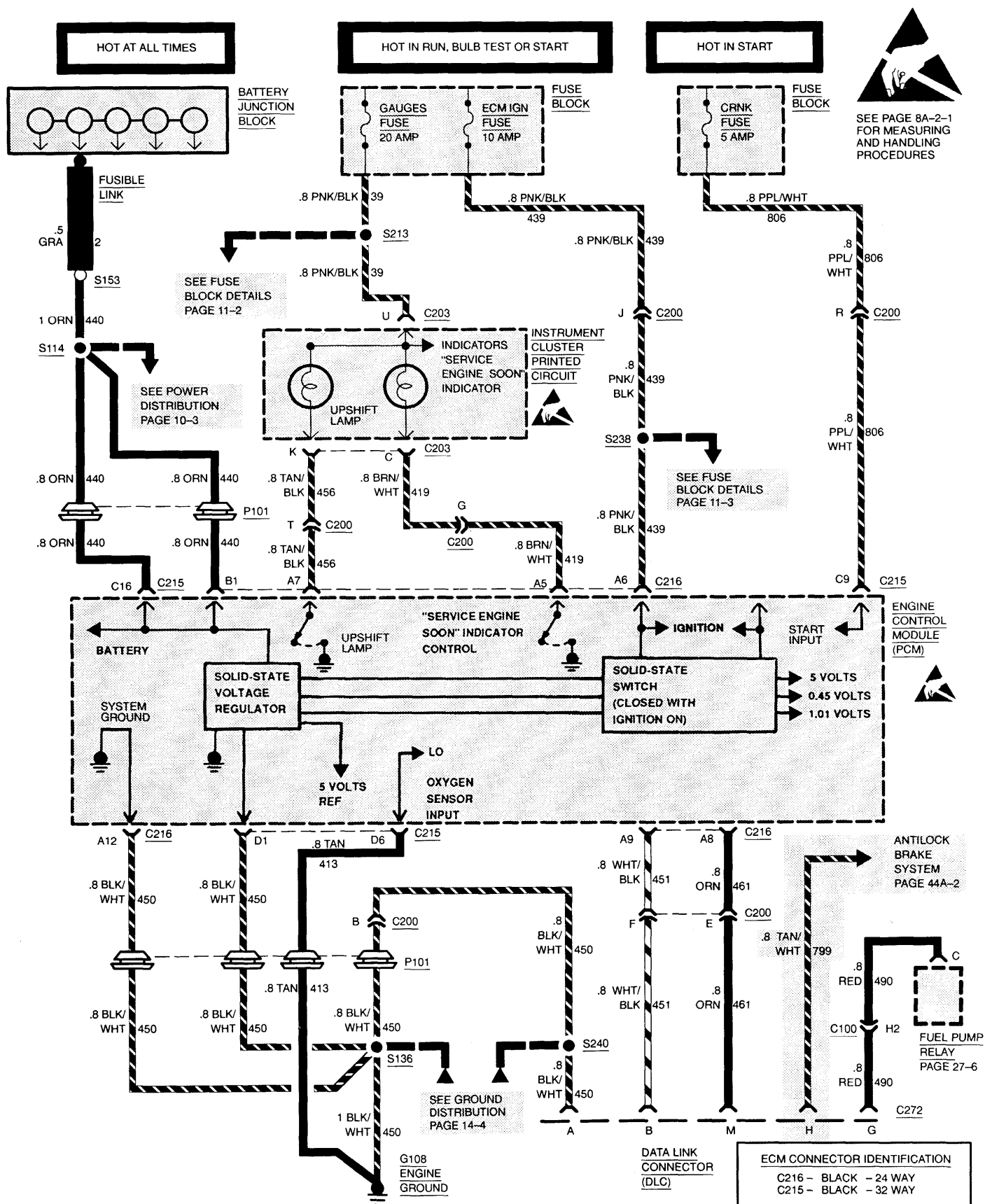
|      |                            |        |   |
|------|----------------------------|--------|---|
| G108 | LH top front of engine     | 21A-14 | 2 |
| G109 | Top front of center engine | 21A-14 | 2 |

### SPLICES:

|      |                                                  |        |   |
|------|--------------------------------------------------|--------|---|
| S114 | RH rear engine compartment, near A/C accumulator | 21A-18 | 7 |
| S127 | Near P101, RH cowl                               | 21A-18 | 7 |
| S136 | Rear of engine compartment, near center          | 21A-13 | 1 |
| S149 | RH rear of engine                                | 21A-18 | 7 |
| S153 | Center of cowl, below battery junction block     | 21A-15 | 3 |
| S160 | Upper rear of engine                             | 21A-13 | 1 |
| S206 | Behind LH side of I/P                            | 21A-19 | 8 |
| S213 | Under LH side of I/P                             | 21A-19 | 8 |
| S218 | Near ECM, under RH side of I/P                   | 21A-17 | 5 |
| S222 | Near PCM, under RH side of I/P                   | 21A-17 | 5 |
| S223 | Near PCM, under RH side of I/P                   | 21A-17 | 5 |
| S238 | Engine harness, near ECM                         | 21A-17 | 5 |
| S240 | LH side of I/P                                   | 21A-19 | 8 |
| S244 | Near PCM, under RH side of I/P                   | 21A-17 | 5 |



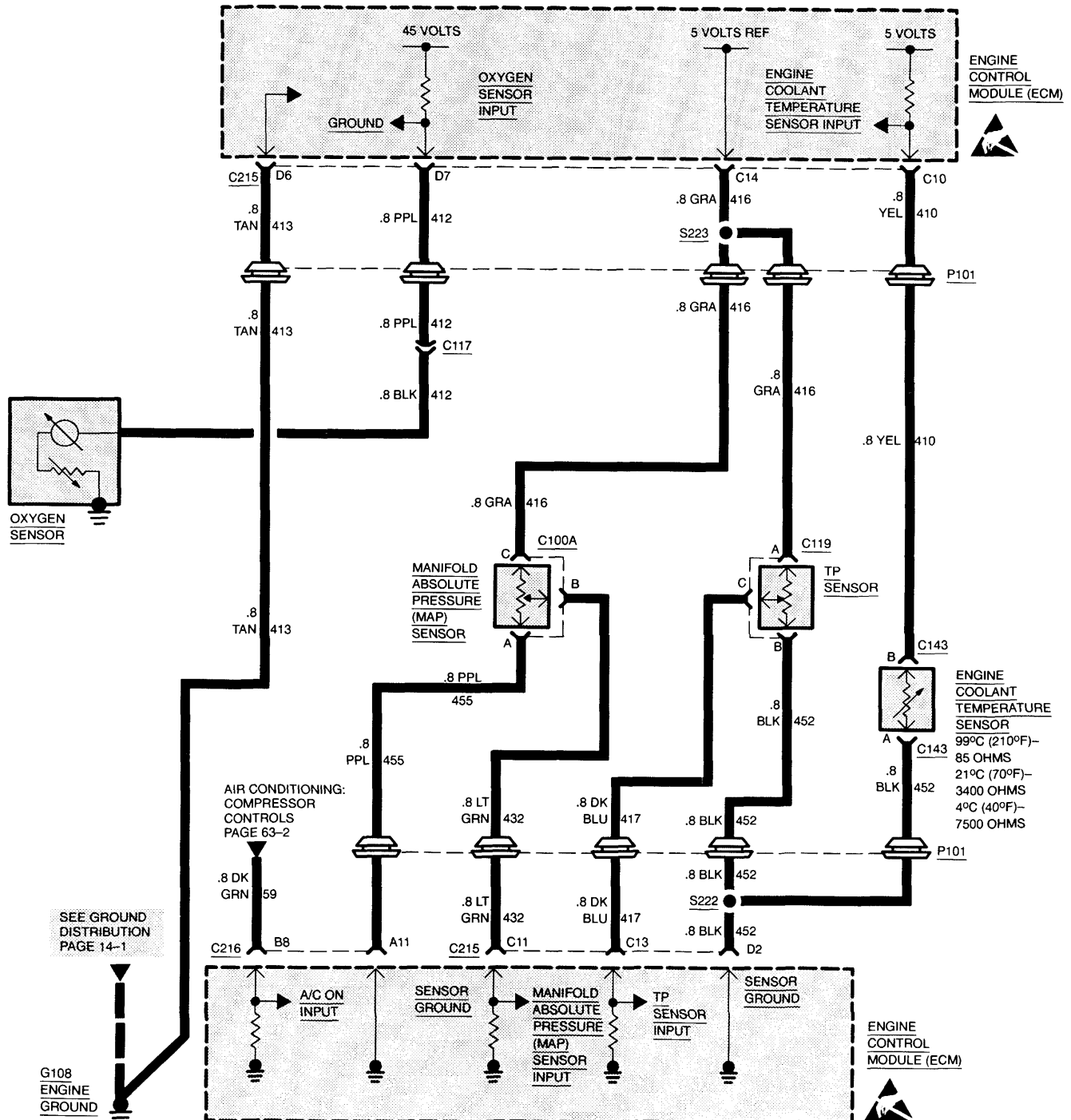
# 8A-21A-2 ENGINE CONTROLS 5.0L(305 CID) V8 VIN H W/MANUAL TRANSMISSION



# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21A-3

## W/MANUAL TRANSMISSION

SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



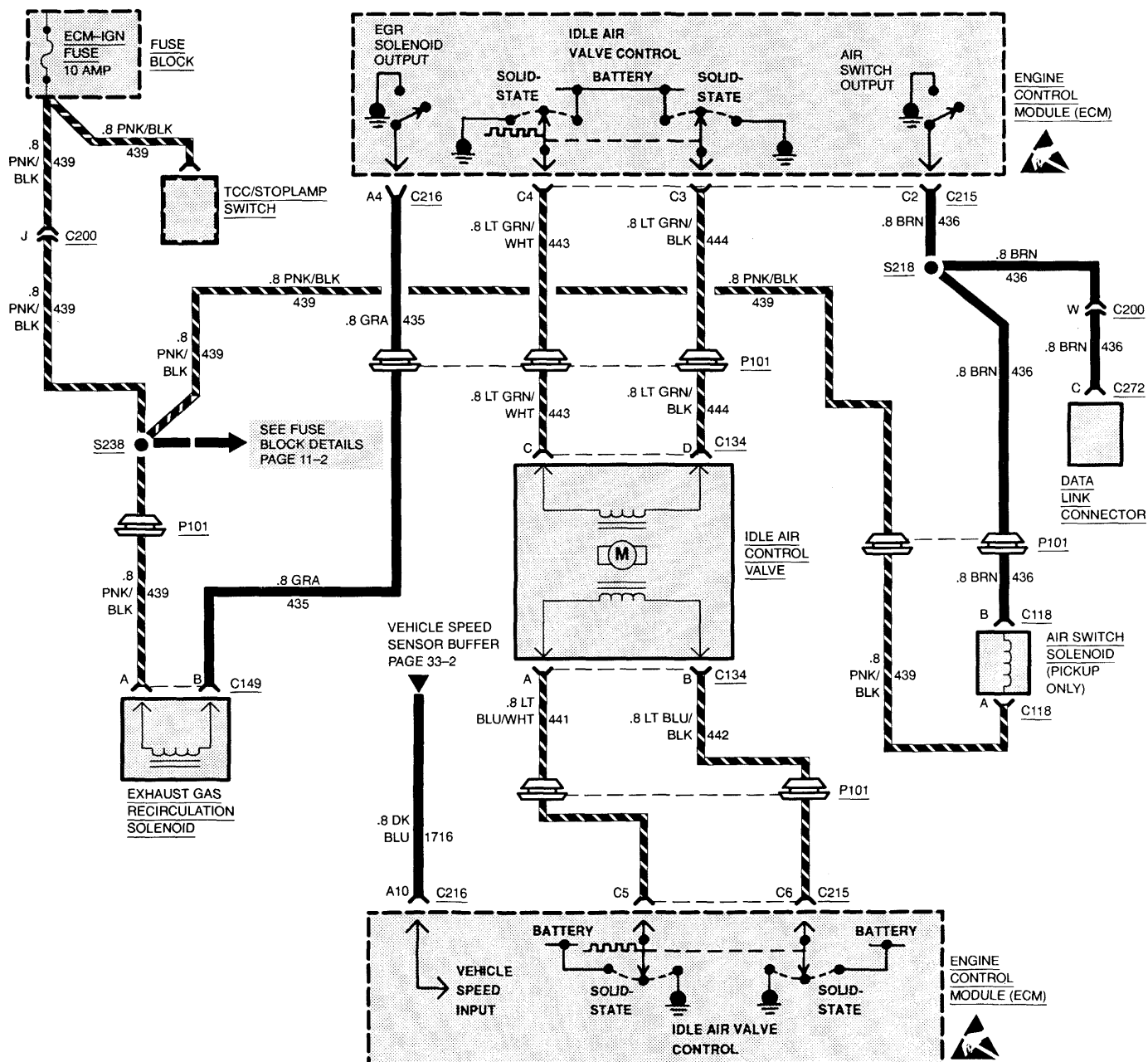
SEE GROUND  
DISTRIBUTION  
PAGE 14-1

G108  
ENGINE  
GROUND

## MANUAL TRANSMISSION



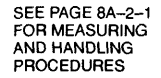
HOT IN RUN, BULB TEST OR START



## ECM CONNECTOR IDENTIFICATION

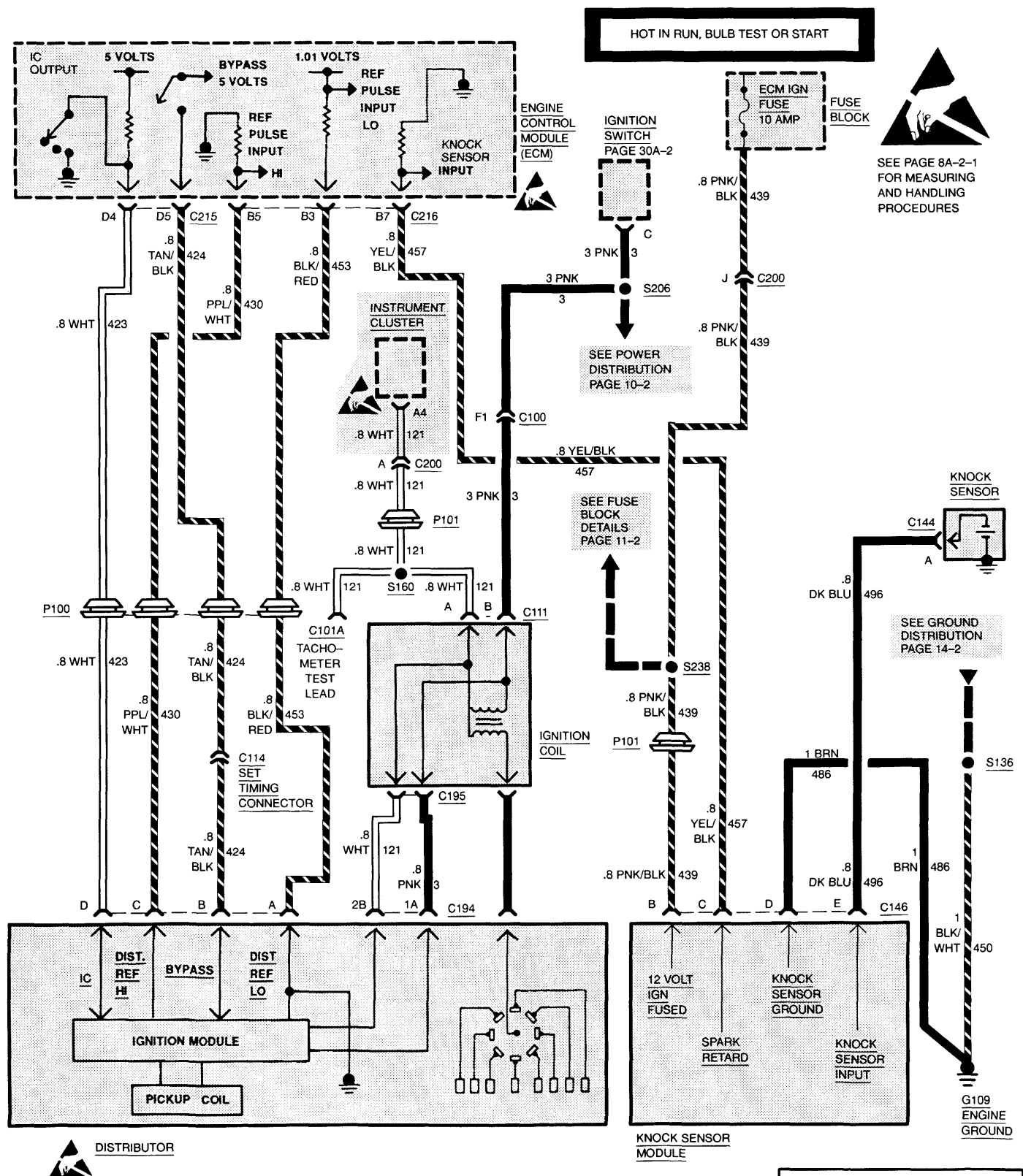
C215 - BLACK - 32 WAY  
C216 - BLACK - 24 WAY

## MANUAL TRANSMISSION



# 8A-21A-6 ENGINE CONTROLS 5.0L(305 CID) V8 VIN H

## IGNITION SYSTEM

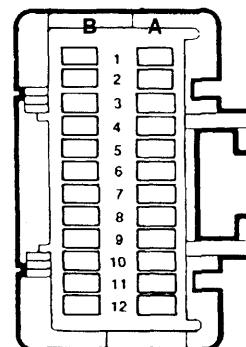


# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21A-7

## ELECTRONIC CONTROL MODULE — 5.0L (305 CID) ENGINE W/MANUAL TRANSMISSION (32-PIN)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                        |
|-------------|-----------|------------|--------|------------------------------------|
| 465         | .8        | DK GRN/WHT | A1     | FUEL PUMP RELAY DRIVE              |
| 459         | .8        | DK GRN     | A2     | NOT USED                           |
|             |           |            | A3     | NOT USED                           |
| 435         | .8        | GRA        | A4     | EGR SOLENOID                       |
| 419         | .8        | BRN/WHT    | A5     | MALFUNCTION INDICATOR LAMP CONTROL |
| 439         | .8        | PNK/BLK    | A6     | 12V IGNITION (FUSED)               |
| 456         | .8        | TAN/BLK    | A7     | UPSHIFT LAMP CONTROL               |
| 461         | .8        | ORN        | A8     | DLC SERIAL DATA                    |
| 451         | .8        | WHT/BLK    | A9     | DLC DIAGNOSTIC TEST                |
| 1716        | .8        | DK BLU     | A10    | VEHICLE SPEED SENSOR BUFFER SIGNAL |
| 455         | .8        | PPL        | A11    | MAP SENSOR 5V RETURN GROUND        |
| 450         | .8        | BLK/WHT    | A12    | SYSTEM GROUND                      |
| 440         | .8        | ORN        | B1     | 12V BATTERY (FUSED)                |
| 120         | .8        | GRA        | B2     | FUEL PUMP SIGNAL (INPUT)           |
| 453         | .8        | BLK/RED    | B3     | DISTRIBUTOR REF LOW                |
|             |           |            | B4     | NOT USED                           |
| 430         | .5        | PPL/WHT    | B5     | DISTRIBUTOR REF HIGH               |
|             |           |            | B6     | NOT USED                           |
| 457         | .8        | YEL/BLK    | B7     | SPARK RETARD SIGNAL                |
| 59          | .8        | DK GRN     | B8     | A/C REQUEST SIGNAL                 |
|             |           |            | B9     | NOT USED                           |
|             |           |            | B10    | NOT USED                           |
|             |           |            | B11    | NOT USED                           |
|             |           |            | B12    | NOT USED                           |

C216

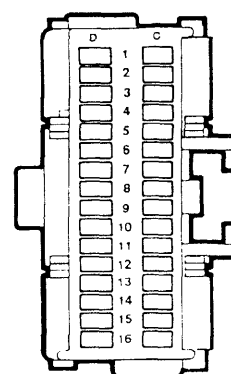


# 8A-21A-8 ENGINE CONTROLS 5.0L (305 CID) V8

## ELECTRONIC CONTROL MODULE — 5.0L (305 CID) ENGINE W/MANUAL TRANSMISSION (32-Pin)

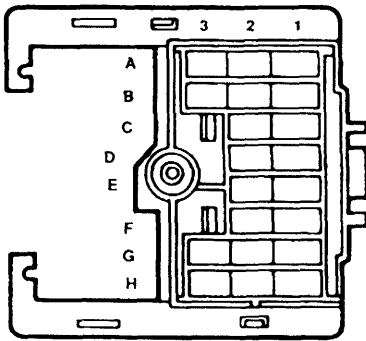
| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                                |
|-------------|-----------|------------|--------|------------------------------------------------------------|
| 436         | .8        | BRN        | C1     | NOT USED                                                   |
| 444         | .8        | LTGRN/BLK  | C2     | AIR SWITCH SOLENOID                                        |
| 443         | .8        | LT GRN/WHT | C3     | IAC COIL B LOW                                             |
| 441         | .8        | LT BLU/WHT | C4     | IAC COIL B HIGH                                            |
| 442         | .8        | LT BLU/BLK | C5     | IAC COIL A HIGH                                            |
|             |           |            | C6     | IAC COIL A LOW                                             |
|             |           |            | C7     | NOT USED                                                   |
|             |           |            | C8     | NOT USED                                                   |
| 806         | .8        | PPL/WHT    | C9     | CRANK SIGNAL                                               |
| 410         | .8        | YEL        | C10    | ENGINE COOLANT TEMPERATURE<br>SENSOR SIGNAL                |
| 432         | .8        | LT GRN     | C11    | MAP SENSOR SIGNAL                                          |
|             |           |            | C12    | NOT USED                                                   |
| 417         | .5        | DK BLU     | C13    | TP SENSOR SIGNAL                                           |
| 416         | .5        | GRA        | C14    | 5V SENSOR REFERENCE                                        |
|             |           |            | C15    | NOT USED                                                   |
| 440         | .8        | ORN        | C16    | 12V BATTERY (FUSED)                                        |
| 450         | .8        | BLK        | D1     | SYSTEM GROUND                                              |
| 452         | .8        | BLK        | D2     | TP SENSOR AND ENGINE<br>COOLANT SENSOR 5V RETURN<br>GROUND |
|             |           |            | D3     | NOT USED                                                   |
| 423         | .5        | NAT/WHT    | D4     | IGNITION CONTROL (IC)                                      |
| 424         | .8        | TAN/BLK    | D5     | IC BYPASS                                                  |
| 413         | .5        | TAN        | D6     | OXYGEN SENSOR GROUND                                       |
| 412         | .5        | PPL        | D7     | OXYGEN SENSOR SIGNAL                                       |
|             |           |            | D8     | NOT USED                                                   |
|             |           |            | D9     | NOT USED                                                   |
|             |           |            | D10    | NOT USED                                                   |
|             |           |            | D11    | NOT USED                                                   |
|             |           |            | D12    | NOT USED                                                   |
|             |           |            | D13    | NOT USED                                                   |
| 468         | .8        | DK GRN     | D14    | INJECTOR 2 DRIVER                                          |
|             |           |            | D15    | NOT USED                                                   |
| 467         | .8        | DK BLU     | D16    | INJECTOR 1 DRIVER                                          |

C215



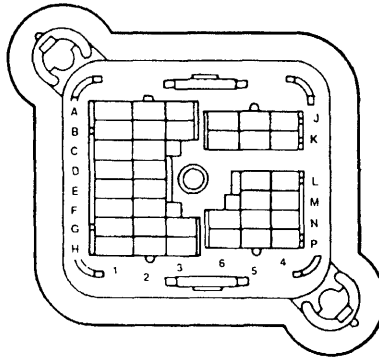
# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21A-9

12020183



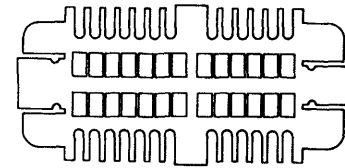
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



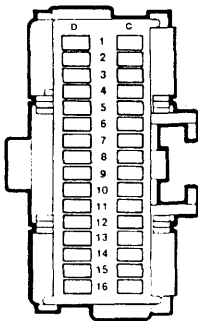
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Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



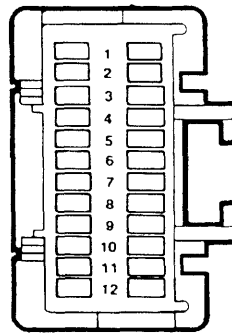
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12045575



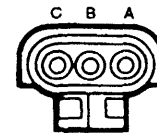
**BLACK**  
Micro-Pack 100  
**C215**  
ECM

12047946



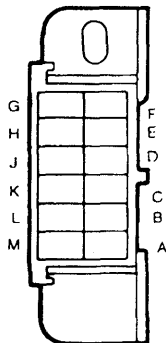
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Micro-Pack 100  
**C216**  
ECM

12020403



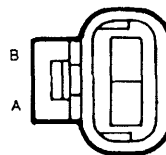
**BLACK**  
**C100A**  
MAP Sensor

12020043



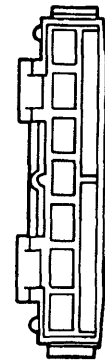
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

12041254

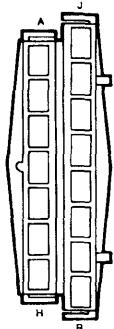


**C200**  
I/P to ECM



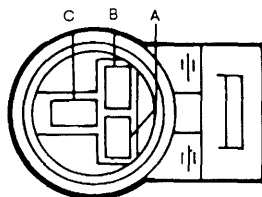
# 8A-21A-10 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

12020213



**C200**  
ECM to I/P

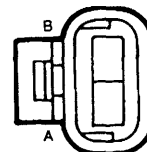
12078090



**BLACK**  
Metri-Pack 150

**C119**  
TP Sensor

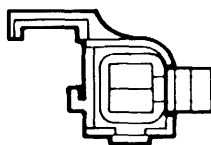
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**BLACK**  
Metri-Pack 150

**C143**  
Engine Coolant Temperature  
Sensor

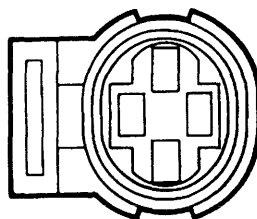
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**GRAY**  
Metri-Pack 280

**C111**  
Ignition Coil

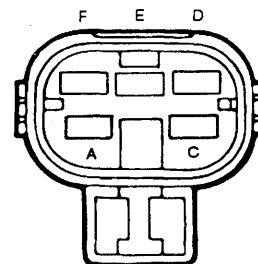
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**GRAY**  
Metri-Pack 150

**C167**  
Fuel Pump Oil Pressure Switch

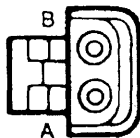
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**BLACK**  
Metri-Pack

**C132**  
Fuel Pump Relay

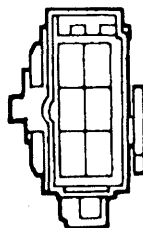
12015792



**BLACK**  
Weather Pack

**C106A**  
Fuse to Fuel Pump and Sender

12020099



**C101**  
Bulkhead - Rear Lamps

12015791



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21A-11

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12015791



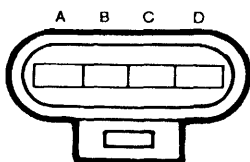
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



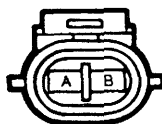
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



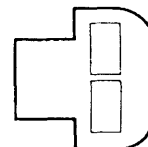
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12052641



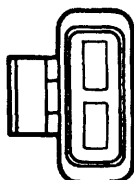
**BLACK**  
Metri-Pack 150  
**C149**  
EGR Solenoid

12103584



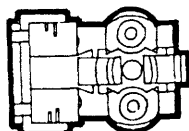
**BROWN**  
**C118**  
Air Switch Solenoid

12066681



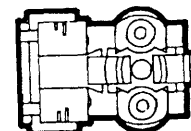
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

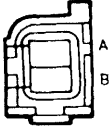
12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

**8A-21A-12 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H**

12040706



**C145**  
**Ignition Coil**

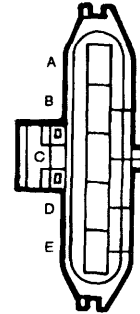
12015375



GRAY

**C144**  
**Knock Sensor**

12015982



**C146**  
**Knock Sensor Module**

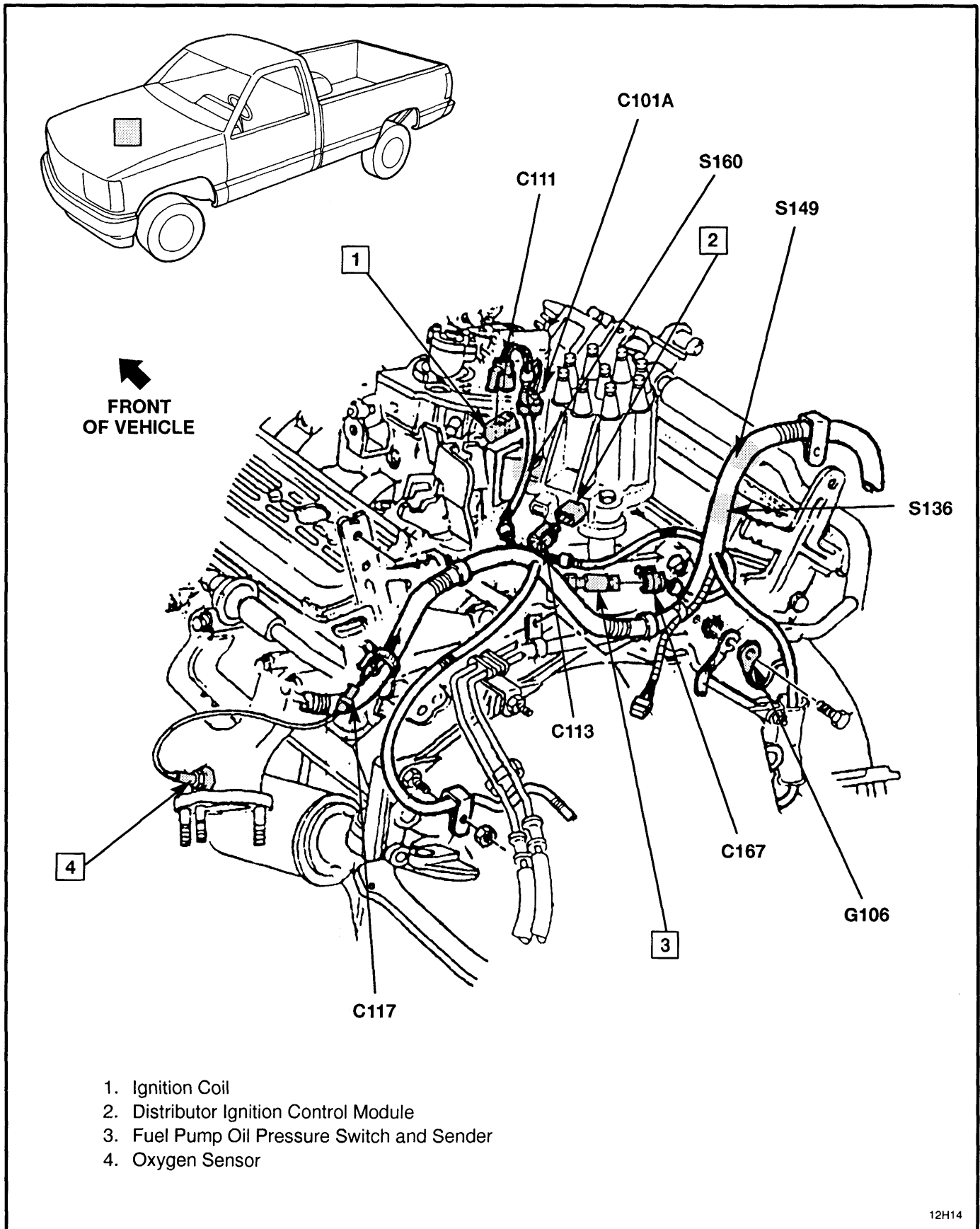


Figure 1 — 5.0L Engine Wiring Rear

## 8A-21A-14 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

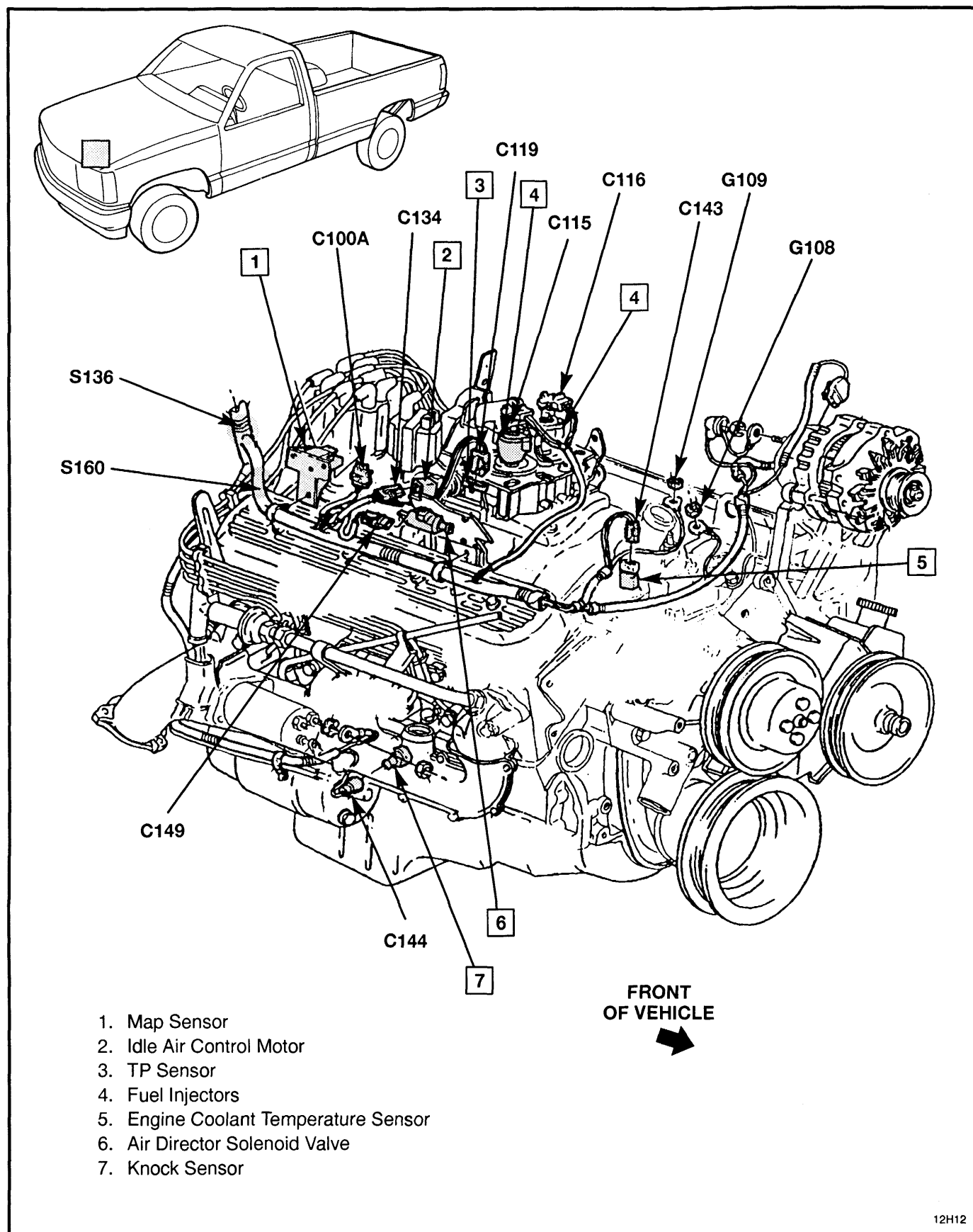


Figure 2 — RH Side of Engine, 5.0L (305 CID) Engine — Gasoline

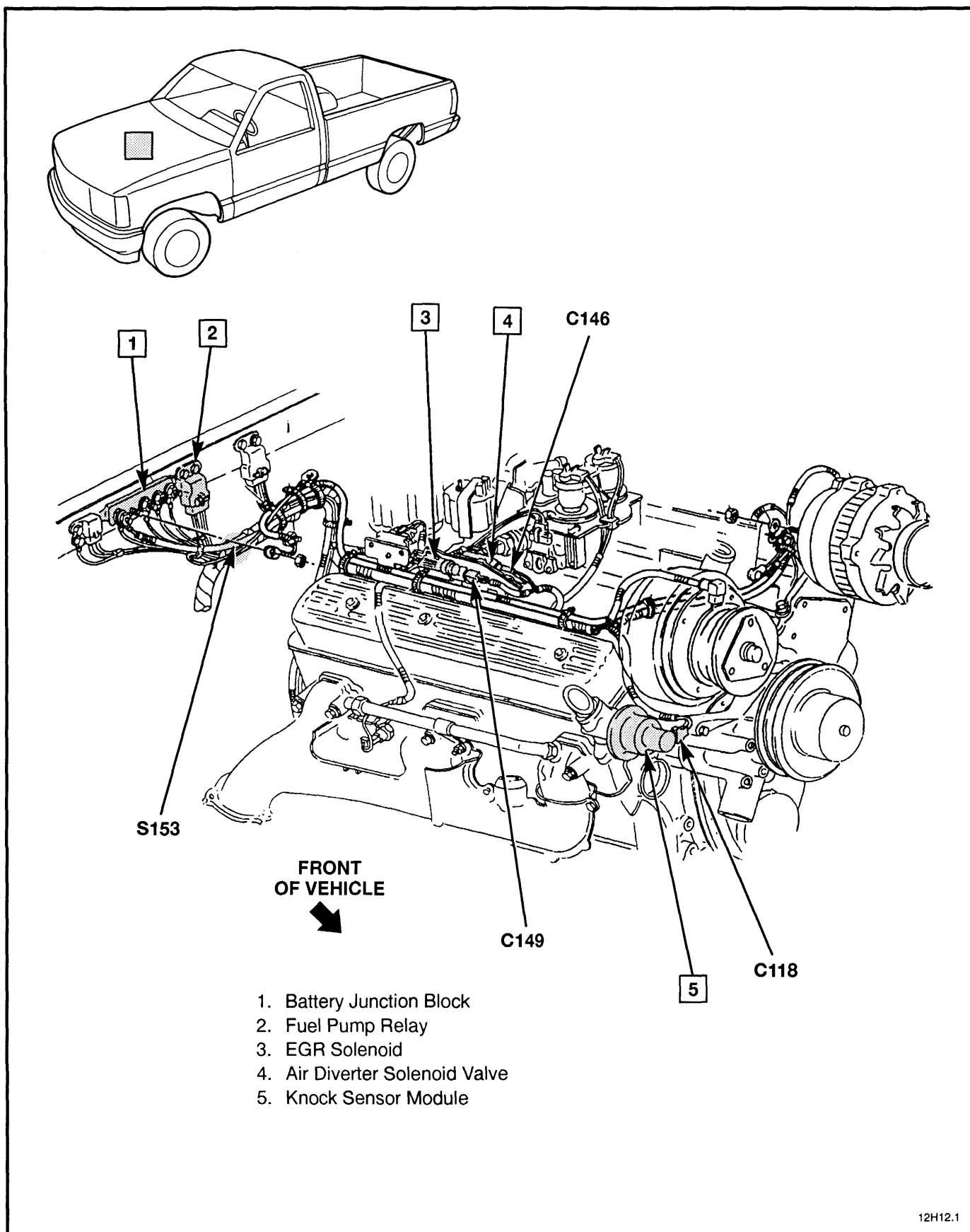
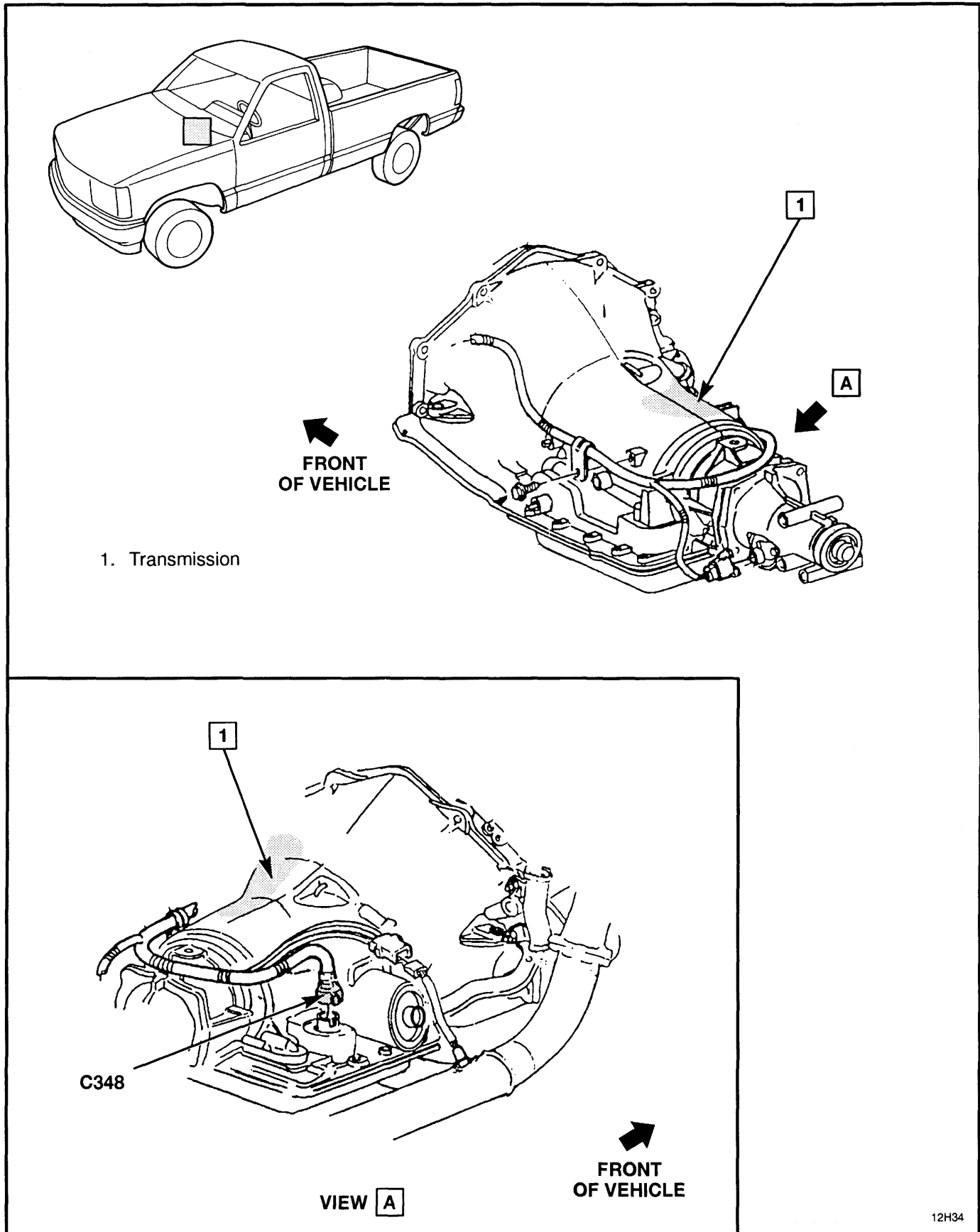


Figure 3 — RH Side of Engine, 5.0L (305 CID) Gasoline Engine



12H34

Figure 4 — Transmission Wiring

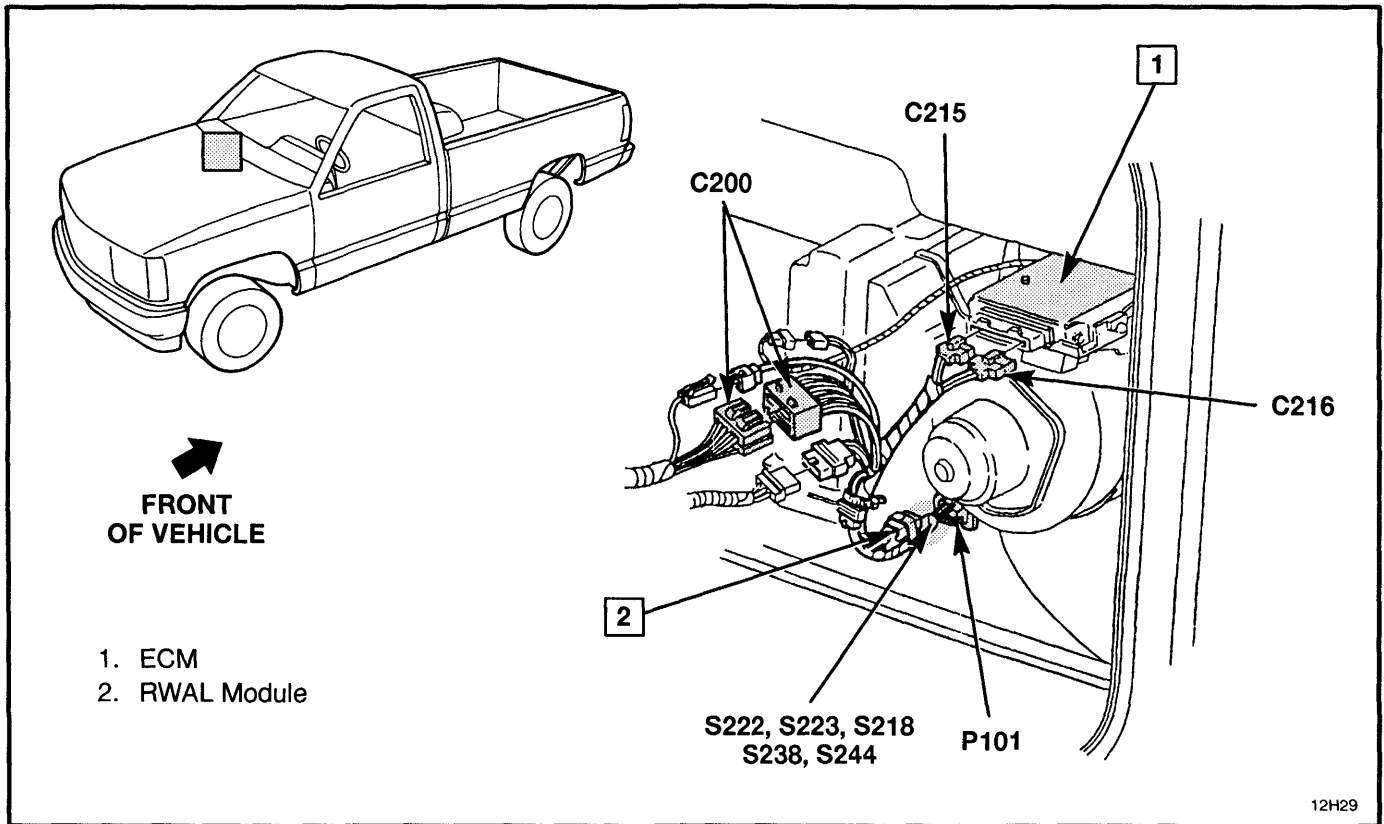


Figure 5 — ECM Wiring

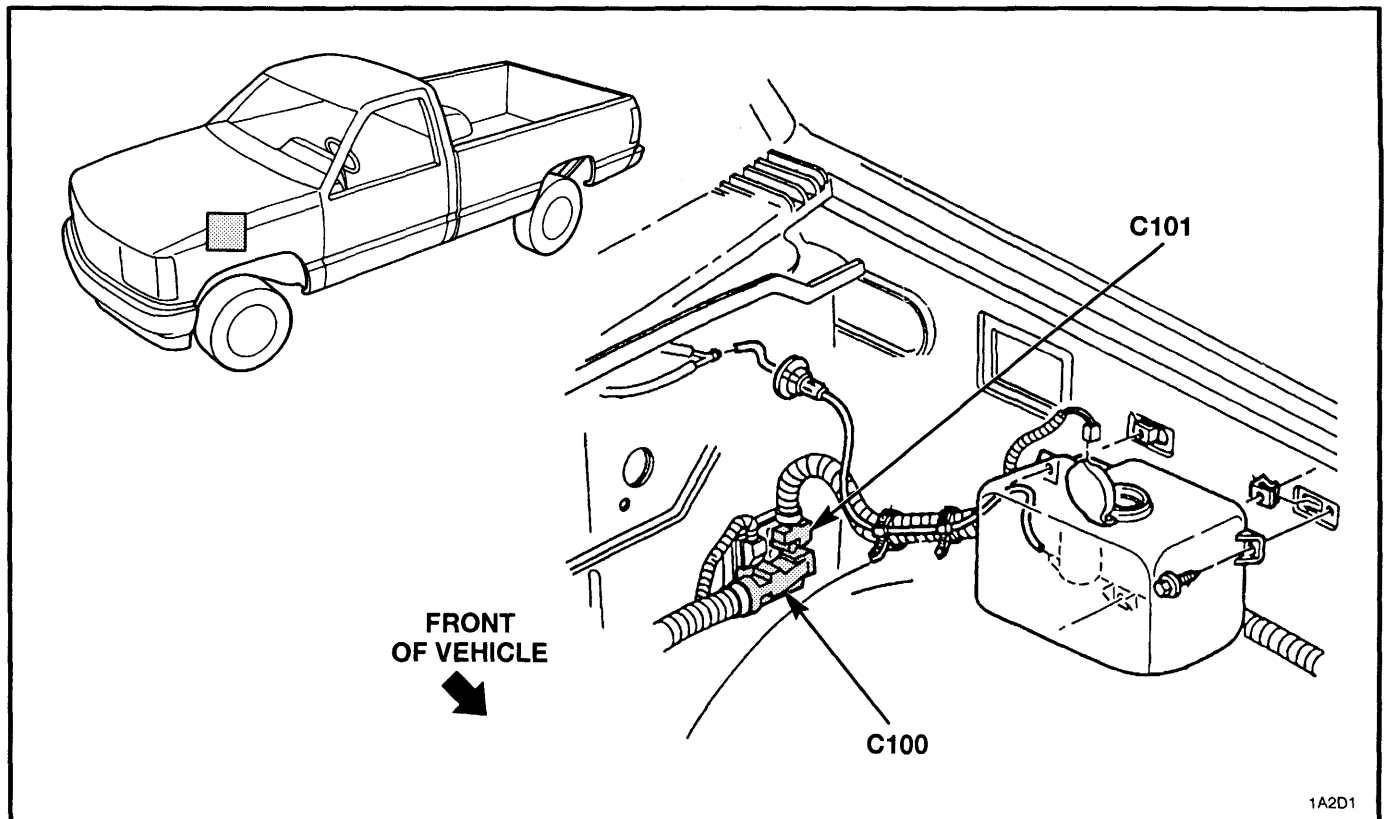


Figure 6 — Cowl Wiring, LH Side



# 8A-21A-18 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

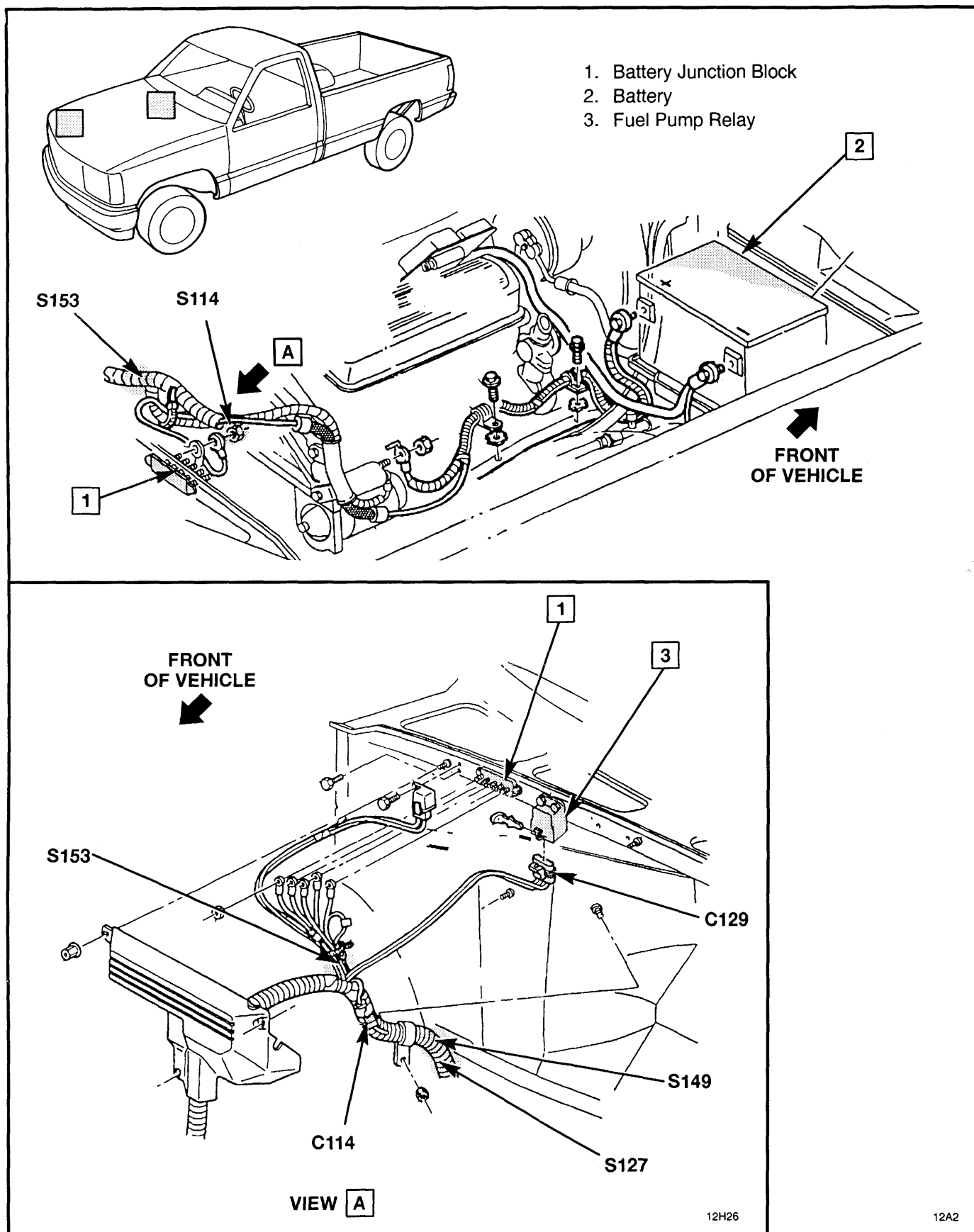


Figure 7 — Battery Wiring, Fuel Pump Relay and Battery Junction Block

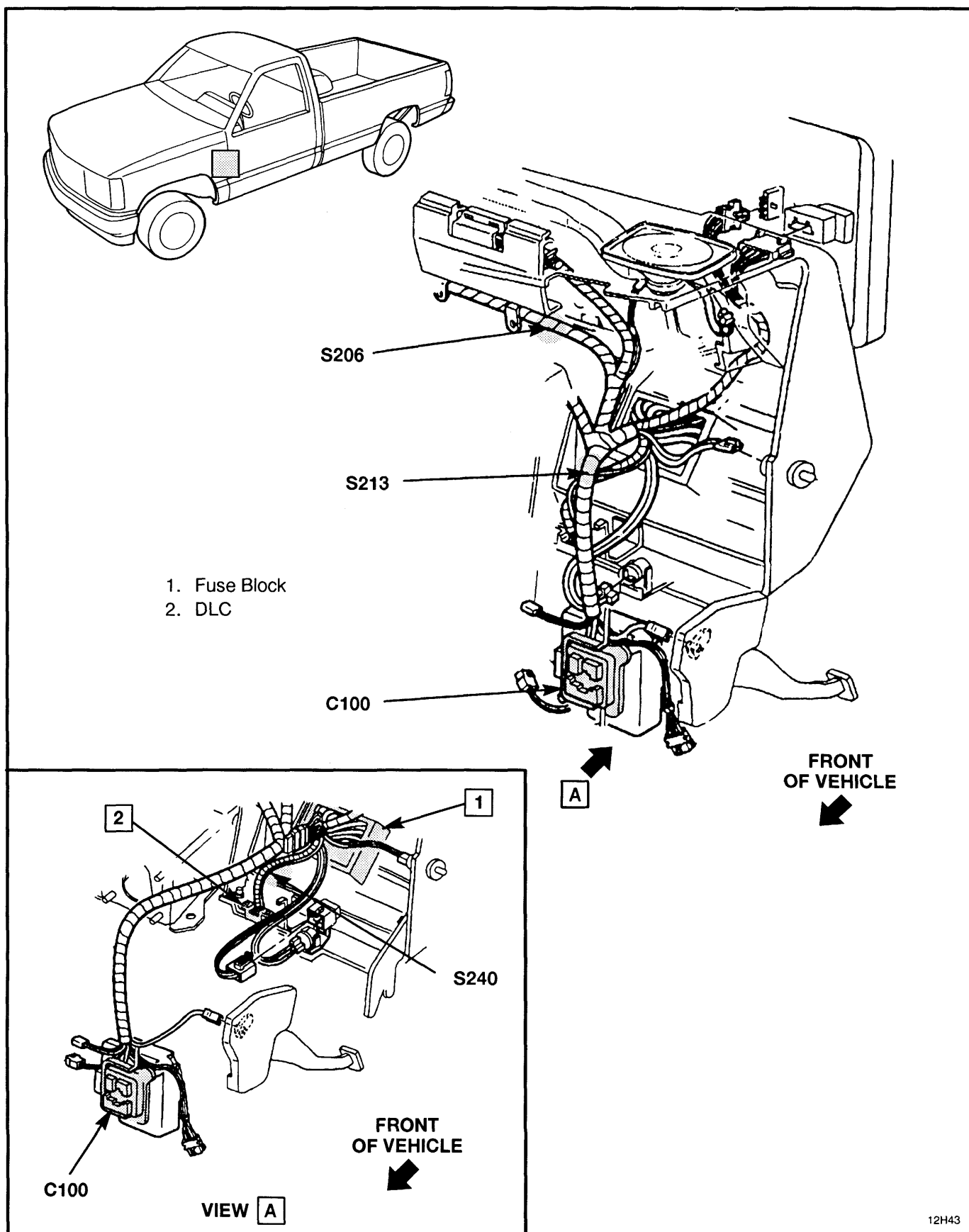


Figure 8 — LH Side of Instrument Panel



**BLANK**

# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-1

## COMPONENT LOCATION

## Page — Figure

|                                                     |                                                      |           |   |
|-----------------------------------------------------|------------------------------------------------------|-----------|---|
| Battery Junction Block                              | RH rear engine compartment, at cowl                  | 21B-16    | 3 |
| Distributor Ignition Control Module                 | Center rear of engine                                | 21B-14    | 1 |
| ECM                                                 | Under RH end of I/P                                  | 21B-19    | 7 |
| Electronic 4-speed Automatic Overdrive Transmission | Behind rear of engine                                | 21B-18    | 6 |
| EGR Solenoid Valve                                  | LH rear top of engine                                | 21B-15    | 2 |
| Engine Coolant Temperature Sensor                   | RH top front of engine                               | 21B-15    | 2 |
| Evaporative Canister Purge Control Solenoid         | On engine                                            | Not Shown |   |
| Fuel Pump and Sender                                | Inside fuel tank                                     | Not Shown |   |
| Fuel Pump Oil Pressure Switch and Sender            | LH rear of engine, near exhaust manifold             | 21B-14    | 1 |
| Fuel Pump Relay                                     | RH rear of engine compartment, near battery junction | 21B-16    | 3 |
| Fuse Block                                          | Lower LH side of I/P                                 | 21B-20    | 9 |
| Heated Oxygen Sensor                                | At Y connection of exhaust pipe                      | 21B-18    | 6 |
| Heated Oxygen Sensor (W/NB2)                        | In exhaust Y-pipe                                    | 21B-18    | 6 |
| Idle Air Control Motor                              | RH rear of TBI unit                                  | 21B-15    | 2 |
| Ignition Coil                                       | Center rear of engine                                | 21B-14    | 1 |
| Instrument Cluster                                  | LH side of I/P                                       | Not Shown |   |
| Knock Sensor                                        | RH side of engine, below exhaust manifold            | 21B-15    | 2 |
| MAP Sensor                                          | RH rear top of engine                                | 21B-15    | 2 |
| Oxygen Sensor                                       | In LH exhaust manifold                               | 21B-14    | 1 |
| TCC Stoplamp Switch                                 | Top of brake pedal                                   | 21B-19    | 8 |
| Throttle Body Fuel Injector #1                      | Top of throttle body unit                            | 21B-15    | 2 |
| Throttle Body Fuel Injector #2                      | Top of throttle body unit                            | 21B-15    | 2 |
| TP Sensor                                           | RH side of TBI                                       | 21B-15    | 2 |

## CONNECTORS:

|       |                                                    |           |   |
|-------|----------------------------------------------------|-----------|---|
| C100  | At bulkhead connector                              | 21B-16    | 4 |
| C101  | At bulkhead connector C100                         | 21B-16    | 4 |
| C106A | Near LH lower cowl (engine compartment)            | Not Shown |   |
| C114  | Center of cowl, under battery junction block cover | 21B-17    | 5 |
| C200  | Under RH side of I/P, near blower motor            | 21B-19    | 7 |

## GROMMETS:

|      |                                    |           |  |
|------|------------------------------------|-----------|--|
| P101 | RH lower cowl (engine compartment) | Not Shown |  |
|------|------------------------------------|-----------|--|

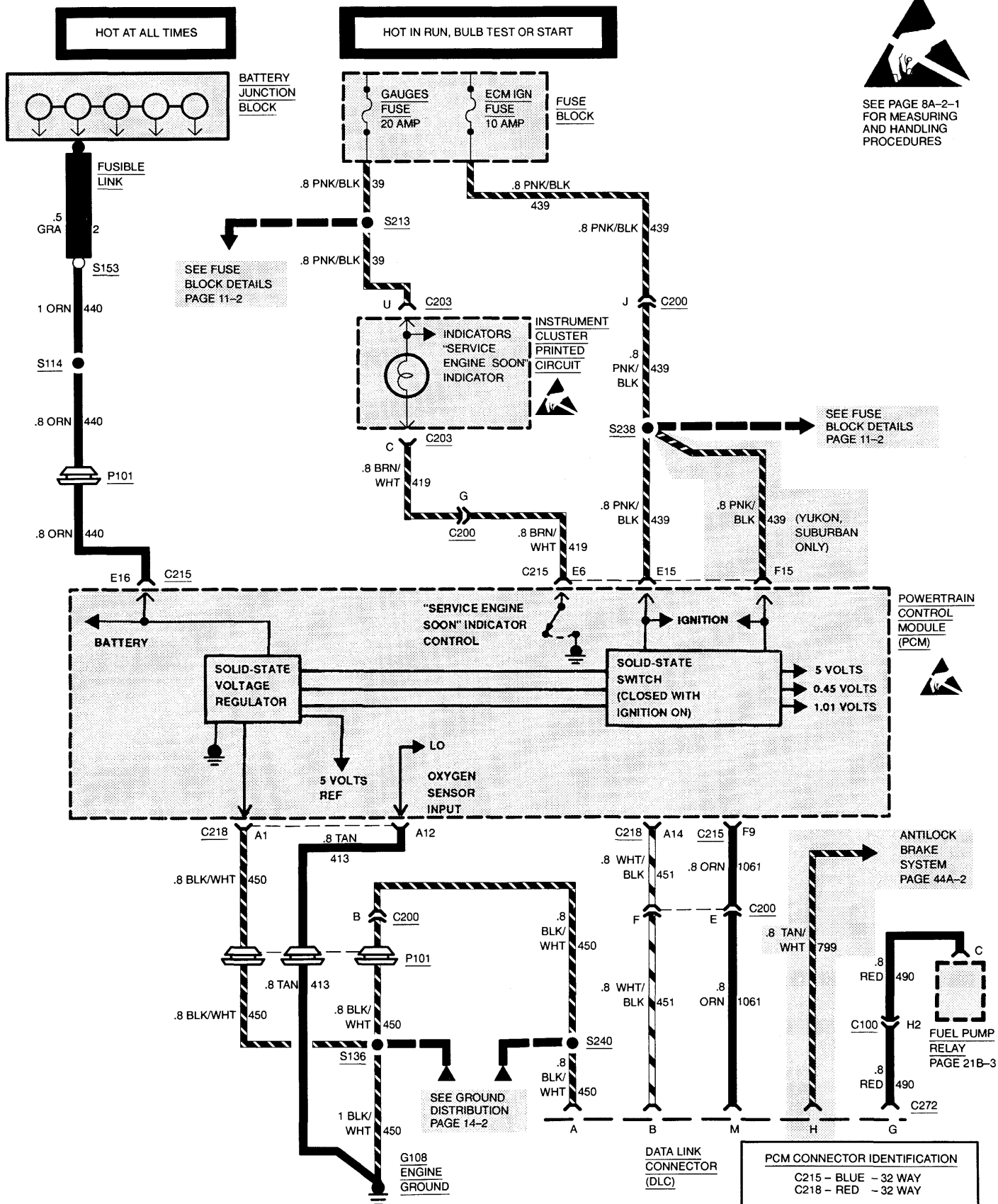
## GROUND:

|      |                          |        |   |
|------|--------------------------|--------|---|
| G106 | Rear of RH cylinder head | 21B-14 | 1 |
| G108 | LH top front of engine   | 21B-15 | 2 |
| G109 | LH top of engine         | 21B-15 | 2 |

## SPLICES:

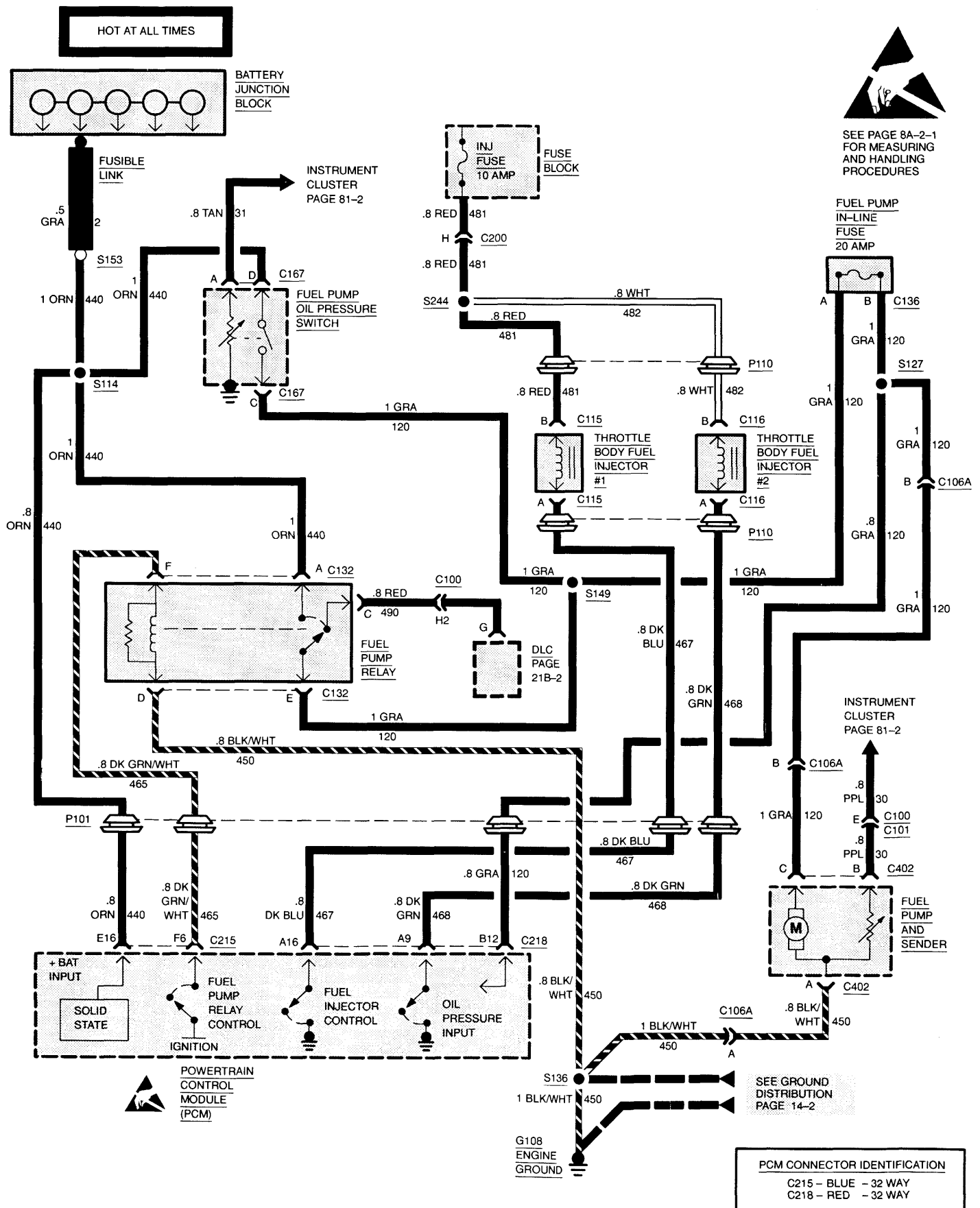
|      |                                                      |           |   |
|------|------------------------------------------------------|-----------|---|
| S114 | RH rear engine compartment, near A/C accumulator     | 21B-17    | 5 |
| S118 | Engine harness, near cowl LH rear engine compartment | 21B-14    | 1 |
| S127 | Near P101, RH cowl                                   | 21B-17    | 5 |
| S136 | Rear of engine compartment, near center              | 21B-14    | 1 |
| S153 | Center of cowl, below battery junction block         | 21B-17    | 5 |
| S213 | Under LH side of I/P                                 | 21B-20    | 9 |
| S222 | Near PCM, under RH side of I/P                       | 21B-19    | 7 |
| S238 | Engine harness, near PCM                             | 21B-19    | 7 |
| S240 | Behind LH side of I/P                                | 21B-20    | 9 |
| S243 | Engine harness, near P101                            | Not Shown |   |
| S244 | Near PCM, under RH side of I/P                       | 21B-19    | 7 |
| S290 | Near PCM, under RH side of I/p                       | 21B-19    | 7 |

**W/AUTOMATIC TRANSMISSION**

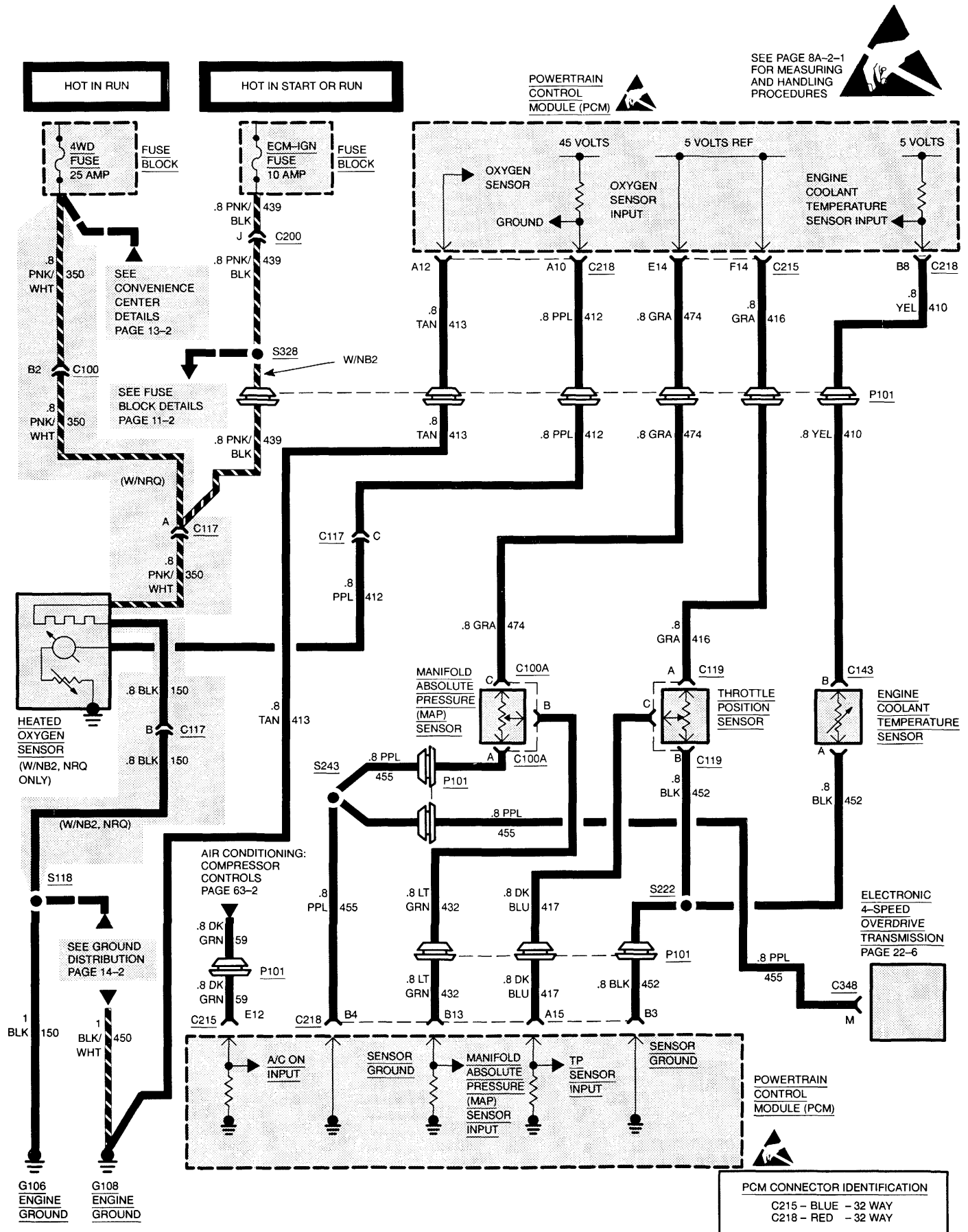


# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-3

## W/AUTOMATIC TRANSMISSION



**8A-21B-4 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H  
W/AUTOMATIC TRANSMISSION**

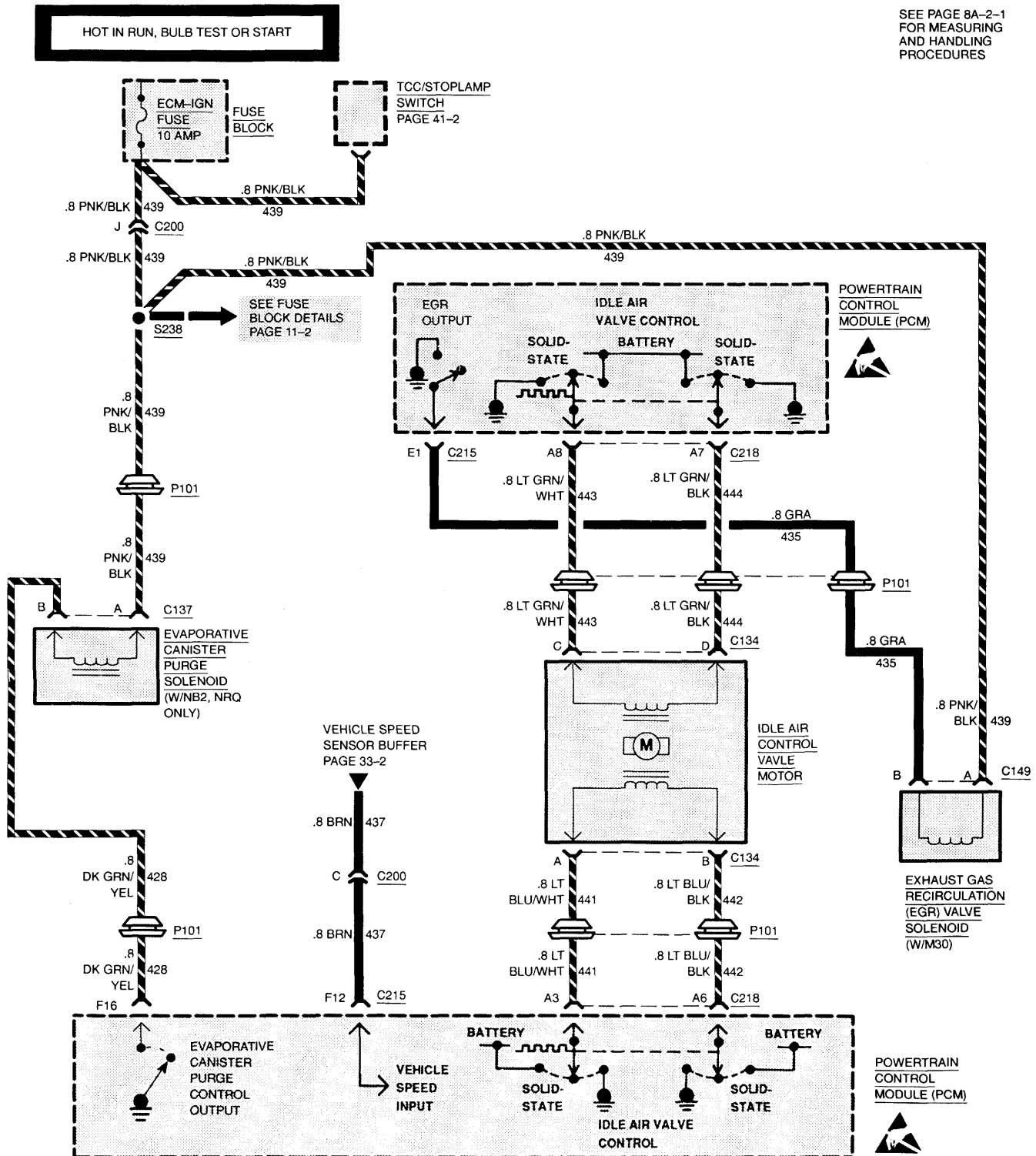


# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-5

## W/AUTOMATIC TRANSMISSION

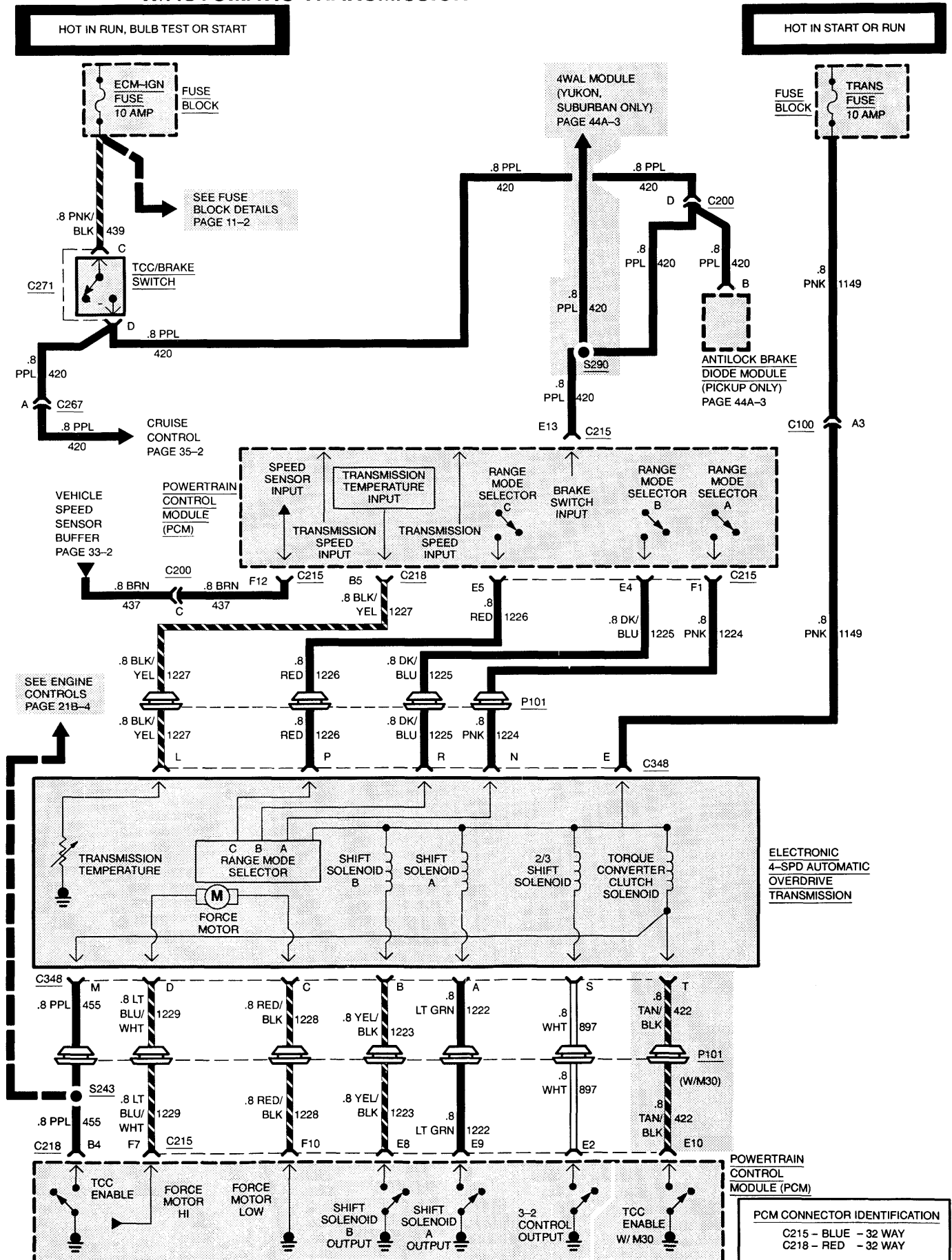


SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



# 8A-21B-6 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

## W/AUTOMATIC TRANSMISSION



[illegible]

C215 - BLUE - 32 WAY  
C218 - RED - 32 WAY

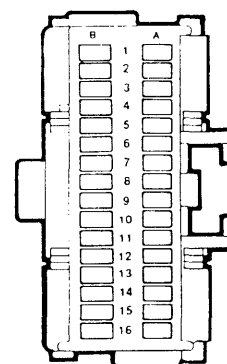


## 8A-21B-8 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

### POWERTRAIN CONTROL MODULE – 5.0L (305 CID) W/AUTO TRANSMISSION ENGINE (32-Pin Red)

| CIRCUIT NO. | WIRE SIZE | COLOR       | CAVITY | DESCRIPTION                       |
|-------------|-----------|-------------|--------|-----------------------------------|
| 450         | 1.0       | BLK/WHT     | A1     | SYSTEM GROUND                     |
| 551         | 1.0       | TAN/WHT     | A2     | SYSTEM GROUND                     |
| 441         | .8        | LT BLU/WHT  | A3     | STEPPER COIL A HIGH               |
| 430         | .8        | PPL/WHT     | A4     | DISTRIBUTOR REF HIGH              |
| 453         | .8        | BLK/RED     | A5     | DISTRIBUTOR REF LOW               |
| 442         | .8        | LT BLU/BLK  | A6     | STEPPER COIL A LOW                |
| 444         | .8        | LT GRN/ BLK | A7     | STEPPER COIL B LOW                |
| 443         | .8        | LT GRN/WHT  | A8     | STEPPER COIL B HIGH               |
| 468         | .8        | DK GRN      | A9     | LOW SIDE INJ B                    |
| 412         | .8        | PPL         | A10    | OXYGEN SENSOR HIGH                |
|             |           |             | A11    | NOT USED                          |
| 413         | .8        | TAN         | A12    | OXYGEN SENSOR LOW                 |
|             |           |             | A13    | NOT USED                          |
| 451         | .8        | WHT/BLK     | A14    | DLC                               |
| 417         | .8        | DK BLU      | A15    | TRHOTTLE POSITION SENSOR          |
| 467         | .8        | DK BLU      | A16    | LOW SIDE INJ A                    |
|             |           |             | B1     | NOT USED                          |
| 424         | .8        | TAN/BLK     | B2     | IGNITION BYPASS                   |
| 452         | .8        | BLK         | B3     | 5V RETURN B                       |
| 455         | .8        | PPL         | B4     | 5V SYSTEM RETURN A                |
| 1227        | .8        | BLK/YEL     | B5     | PCM TO TRANS TEMP SENSOR          |
|             |           |             | B6     | NOT USED                          |
|             |           |             | B7     | NOT USED                          |
| 410         | .8        | YEL         | B8     | ENGINE COOLANT TEMPERATURE SENSOR |
|             |           |             | B9     | NOT USED                          |
| 85          | .8        | WHT         | B10    | CRUS IND REG CNTRLD GRD           |
|             |           |             | B11    | NOT USED                          |
| 120         | 1.0       | GRA         | B12    | ELEC FUEL PUMP – INPUT            |
| 432         | .8        | LT GRN      | B13    | MANIFOLD ABSOLUTE PRESSURE SENSOR |
|             |           |             | B14    | NOT USED                          |
| 496         | .8        | DK BLU      | B15    | KNOCK SENSOR                      |
|             |           |             | B16    | NOT USED                          |

**C218  
RED**

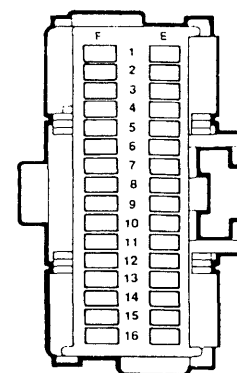


# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-9

## POWERTRAIN CONTROL MODULE – 5.0L (305 CID) W/AUTO TRANSMISSION ENGINE (32-Pin Blue)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                    |
|-------------|-----------|------------|--------|------------------------------------------------|
| 435         | .8        | GRA        | E1     | EXHAUST GAS RECIRCULATION (EGR) VALVE SOLENOID |
| 897         | .8        | WHT        | E2     | TRANS SHIFT 2/3 SOL                            |
|             |           |            | E3     | NOT USED                                       |
| 1225        | .8        | DK BLU     | E4     | PCM TRANS RANGE MODE B                         |
| 1226        | .8        | RED        | E5     | PCM TRANS RANGE MODE C                         |
| 419         | .8        | BRN/WHT    | E6     | MALFUNCTION INDICATOR LAMP                     |
|             |           |            | E7     | NOT USED                                       |
| 1223        | .8        | YEL/BLK    | E8     | PCM TRANS SHIFT SOL B                          |
| 1222        | .8        | LT GRN     | E9     | PCM TRANS SHIFT SOL A                          |
| 422         | .8        | TAN/BLK    | E10    | TORQUE CONVERTER CLUTCH                        |
|             |           |            | E11    | NOT USED                                       |
| 59          | .8        | DK GRN     | E12    | AIR CONDITIONING                               |
| 420         | .8        | PPL        | E13    | BRAKE SW TO PCM                                |
| 474         | .8        | GRA        | E14    | 5V REF VOLTAGE                                 |
| 439         | .8        | PNK/BLK    | E15    | 12V IGNITION FUSED                             |
| 440         | 1.0       | ORN        | E16    | 12 BATTERY FUSED                               |
| 1224        | .8        | PNK        | F1     | PCM TRANS RANGE MODE A                         |
|             |           |            | F2     | NOT USED                                       |
|             |           |            | F3     | NOT USED                                       |
|             |           |            | F4     | NOT USED                                       |
|             |           |            | F5     | NOT USED                                       |
| 465         | .8        | DK GRN/WHT | F6     | FUEL PUMP RELAY DRIVE                          |
| 1229        | .8        | LT BLU/WHT | F7     | PCM TRANS FORCE MTR LOW                        |
| 1493        | .8        | DK BLU     | F8     | SHIFT PERFORMANCE SELECT SWITCH INPUT          |
| 1061        | .8        | ORN/BLK    | F9     | DLC SERIAL DATA                                |
| 1228        | .8        | RED/BLK    | F10    | PCM TRANS FORCE MOTOR HIGH                     |
| 423         | .8        | WHT        | F11    | IGNITION CONTROL (IC)                          |
| 437         | .8        | BRN        | F12    | VEHICLE SPEED SENSOR BUFFER SIGNAL             |
| 1716        | .8        | DK BLU     | F13    | VEHICLE SPEED SENSOR BUFFER SIGNAL             |
| 416         | .8        | GRA        | F14    | 5V SENSOR REF                                  |
| *439        | .8        | PNK/BLK    | F15    | 12V IGNITION FUSED                             |
| □428        | .8        | DK GRN/YEL | F16    | EVAPORATIVE CANISTER PURGE CONTROL             |

**C215  
BLUE**

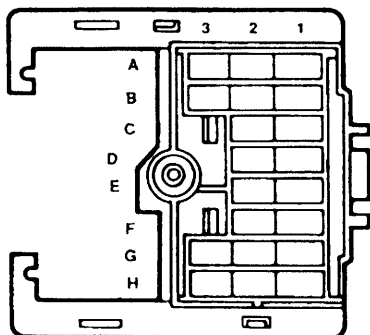


\*YUKON, SUBURBAN ONLY

□W/NB2, NRQ EMISSIONS

# 8A-21B-10 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

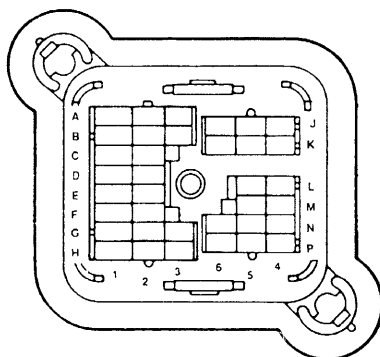
12020183



**GRAY**  
Metri-Pack

**C100**  
Bulkhead Connector – Eng

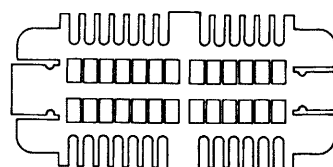
12020184



**GRAY**  
Metri-Pack

**C100**  
Bulkhead Connector – I/P

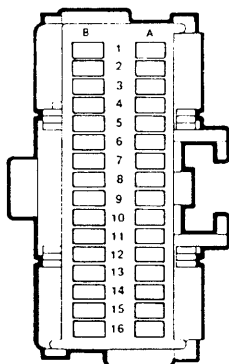
12089908



**BLACK**  
Bow Series

**C203**  
I/P Cluster

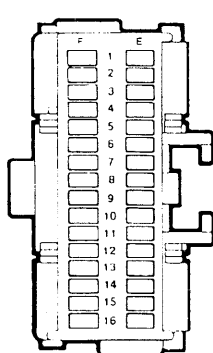
12110113



**RED**  
Metri-Pack 280

**C215**  
PCM

12110115



**BLUE**  
Metri-Pack 280

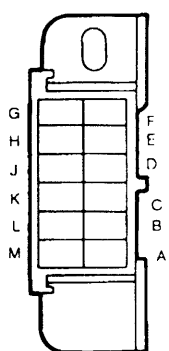
**C218**  
PCM

12020403



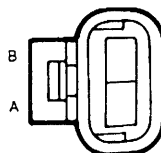
**BLACK**  
**C100A**  
MAP Sensor

12020043



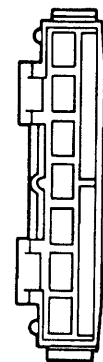
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

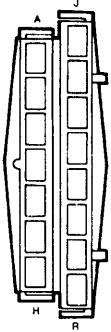
12041254



**C200**  
I/P to PCM

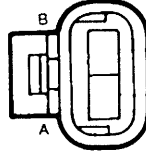
# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-11

12020213



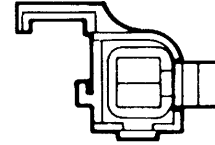
**C200**  
PCM to I/P

12078084



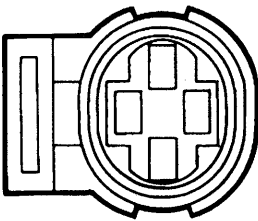
**BLACK**  
Metri-Pack 150  
**C143**  
Engine Coolant Temperature  
Sensor

12040705



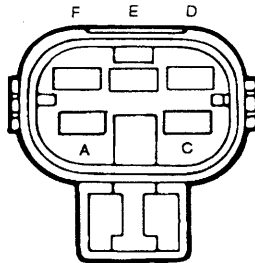
**GRAY**  
Metri-Pack 280  
**C111**  
Ignition Coil

12065401



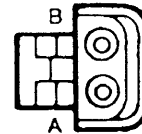
**GRAY**  
Metri-Pack 150  
**C167**  
Fuel Pump Oil Pressure Switch

12052287



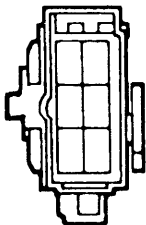
**BLACK**  
Metri-Pack  
**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack  
**C106A**  
Fuse to Fuel Pump and Sender

12020099



**C101**  
Bulkhead - Rear Lamps

12015791



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

## 8A-21B-12 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

12015791



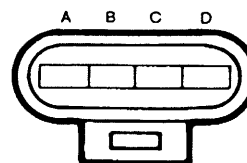
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



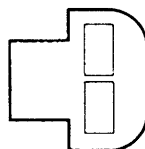
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12052641



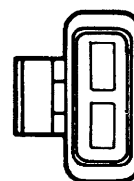
**BLACK**  
Metri-Pack 150  
**C149**  
EGR Solenoid

12103584



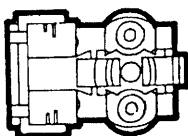
**BROWN**  
**C118**  
Air Switch Solenoid

12066681



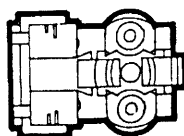
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



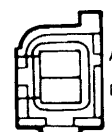
**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

12040706



**C145**  
Ignition Coil

# ENGINE CONTROLS 5.0L (305 CID) V8 VIN H 8A-21B-13

12015375



GRAY

C144  
Knock Sensor

## 8A-21B-14 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

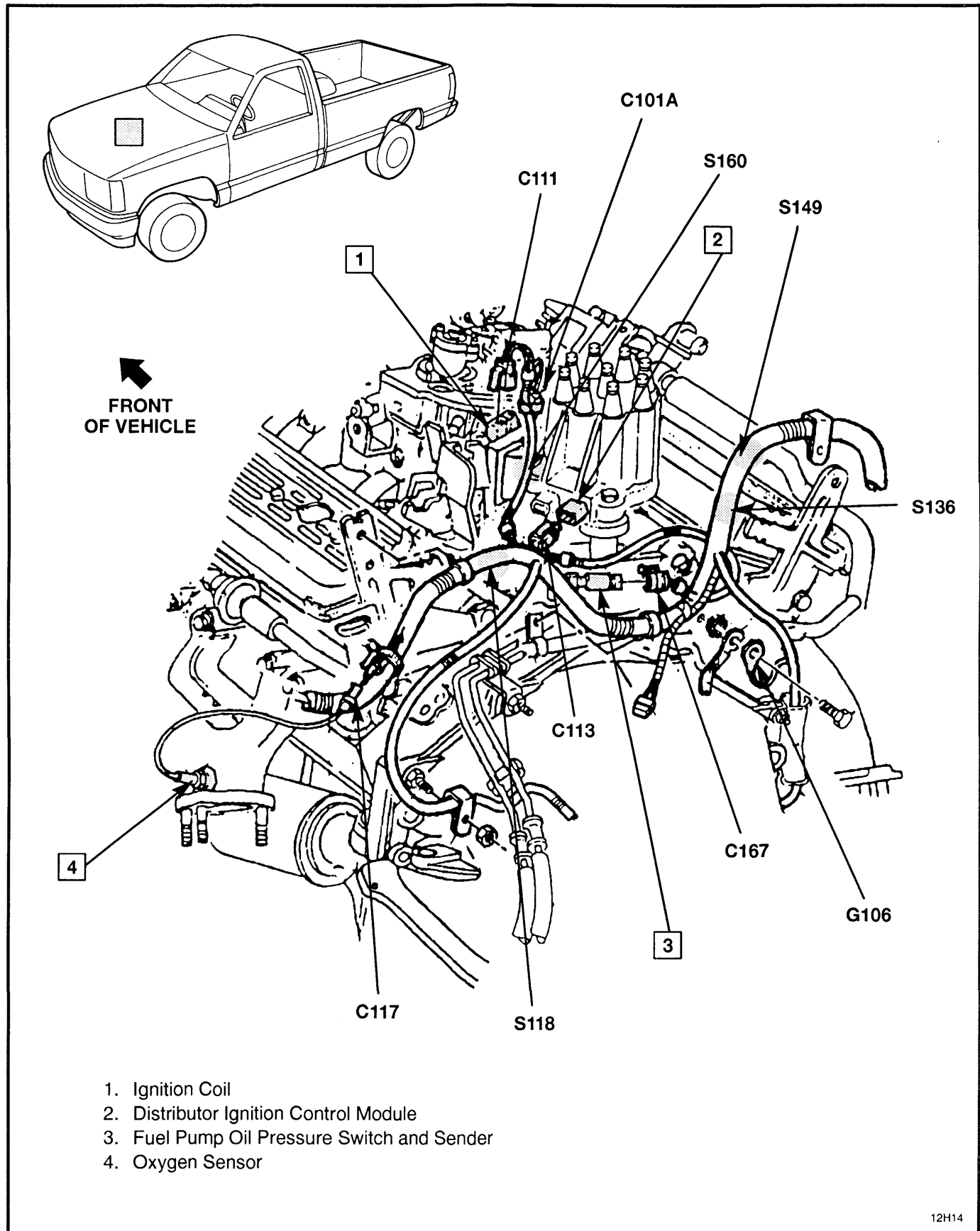


Figure 1 — 5.0L Engine Wiring Rear

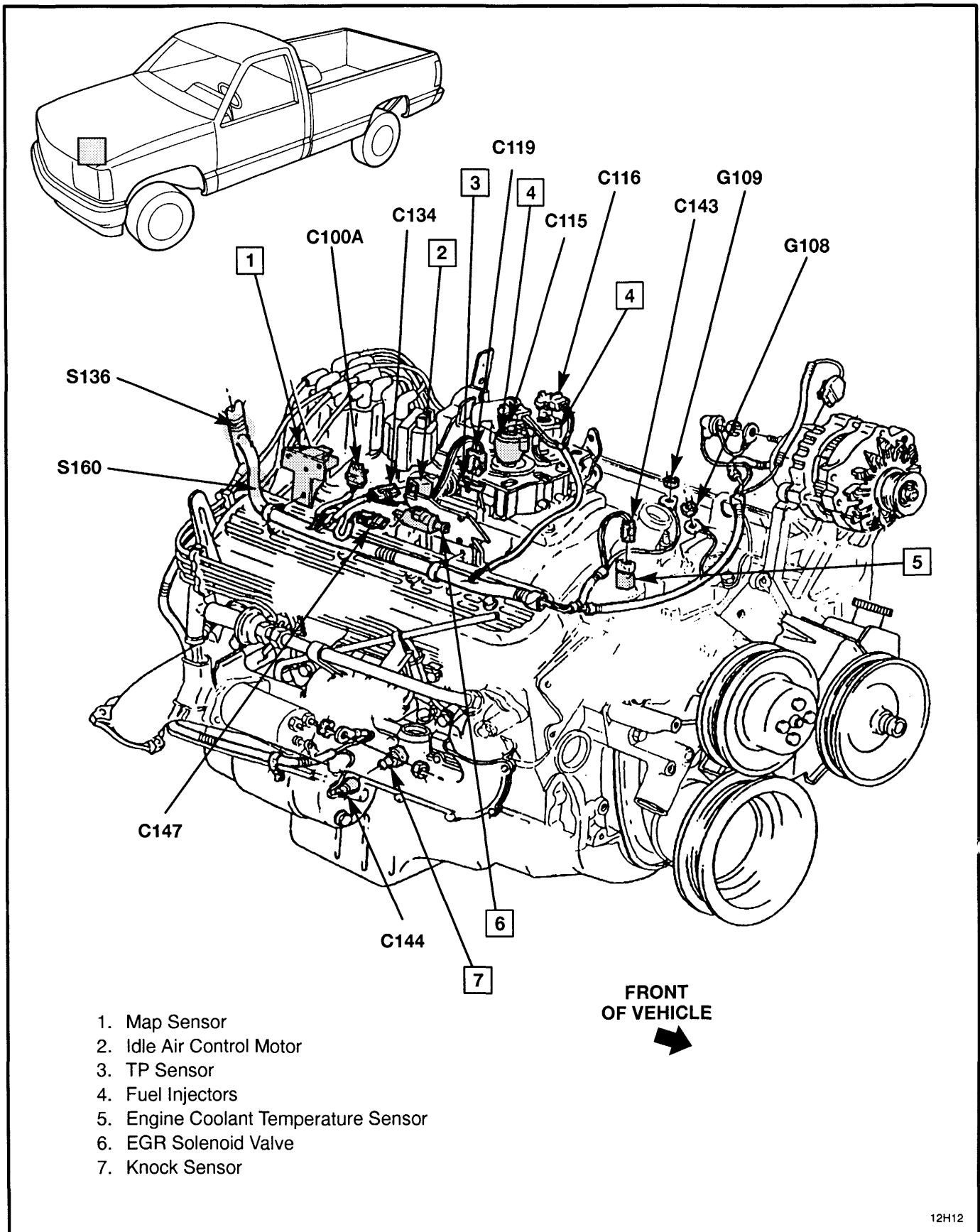


Figure 2 — RH Side of Engine, 5.0L (305 CID) Engine — Gasoline



## 8A-21B-16 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

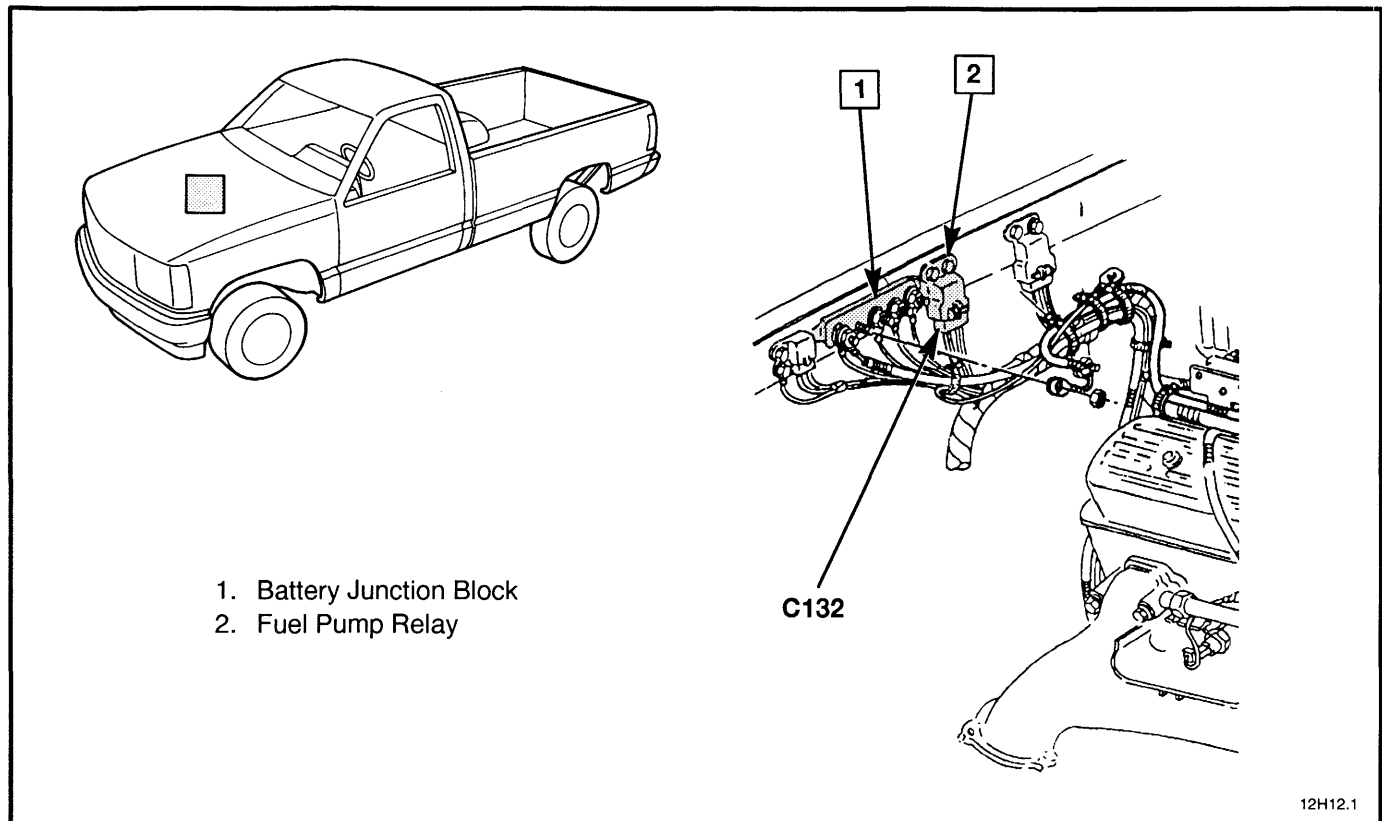


Figure 3 — RH Side of Engine 5.0L (305 CID) Gasoline Engine

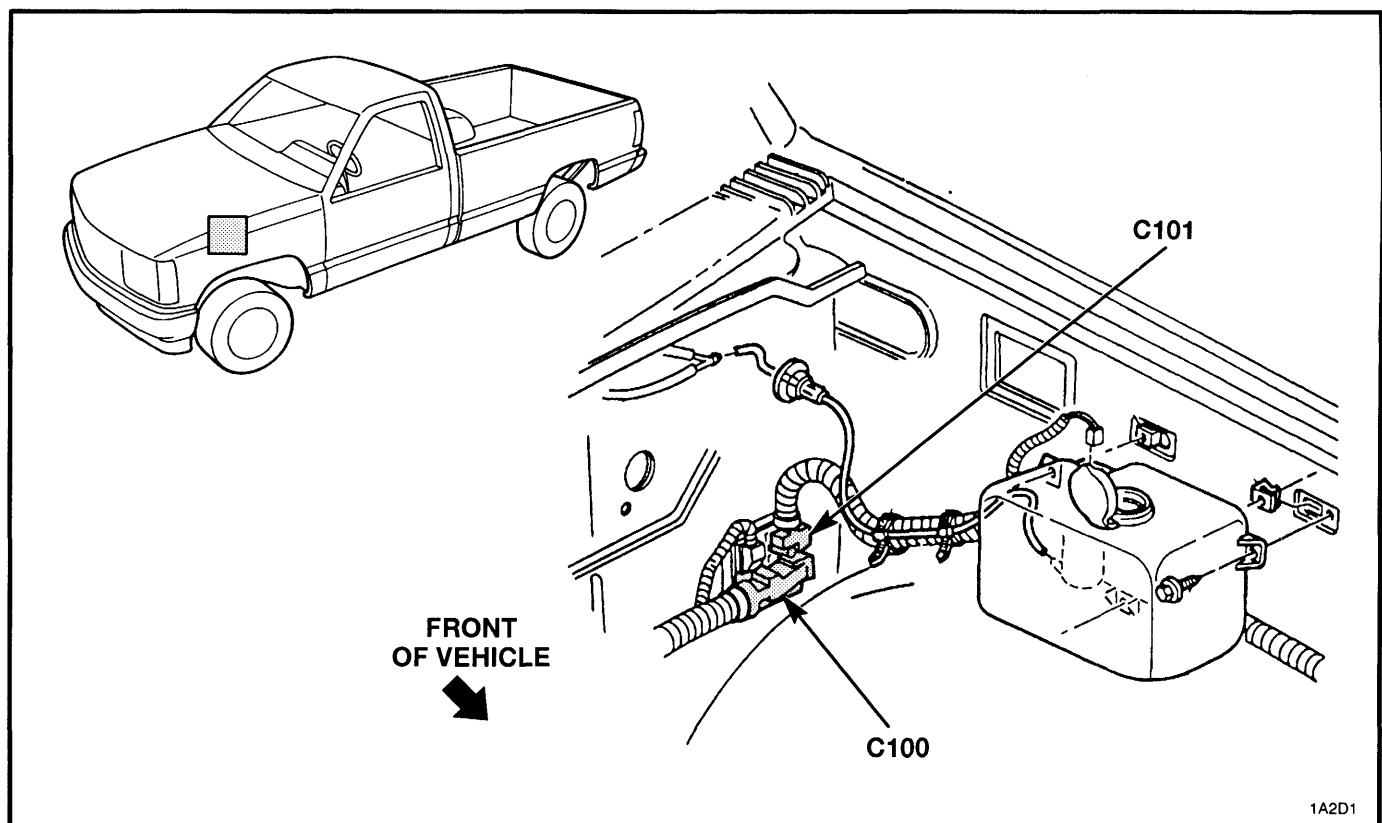
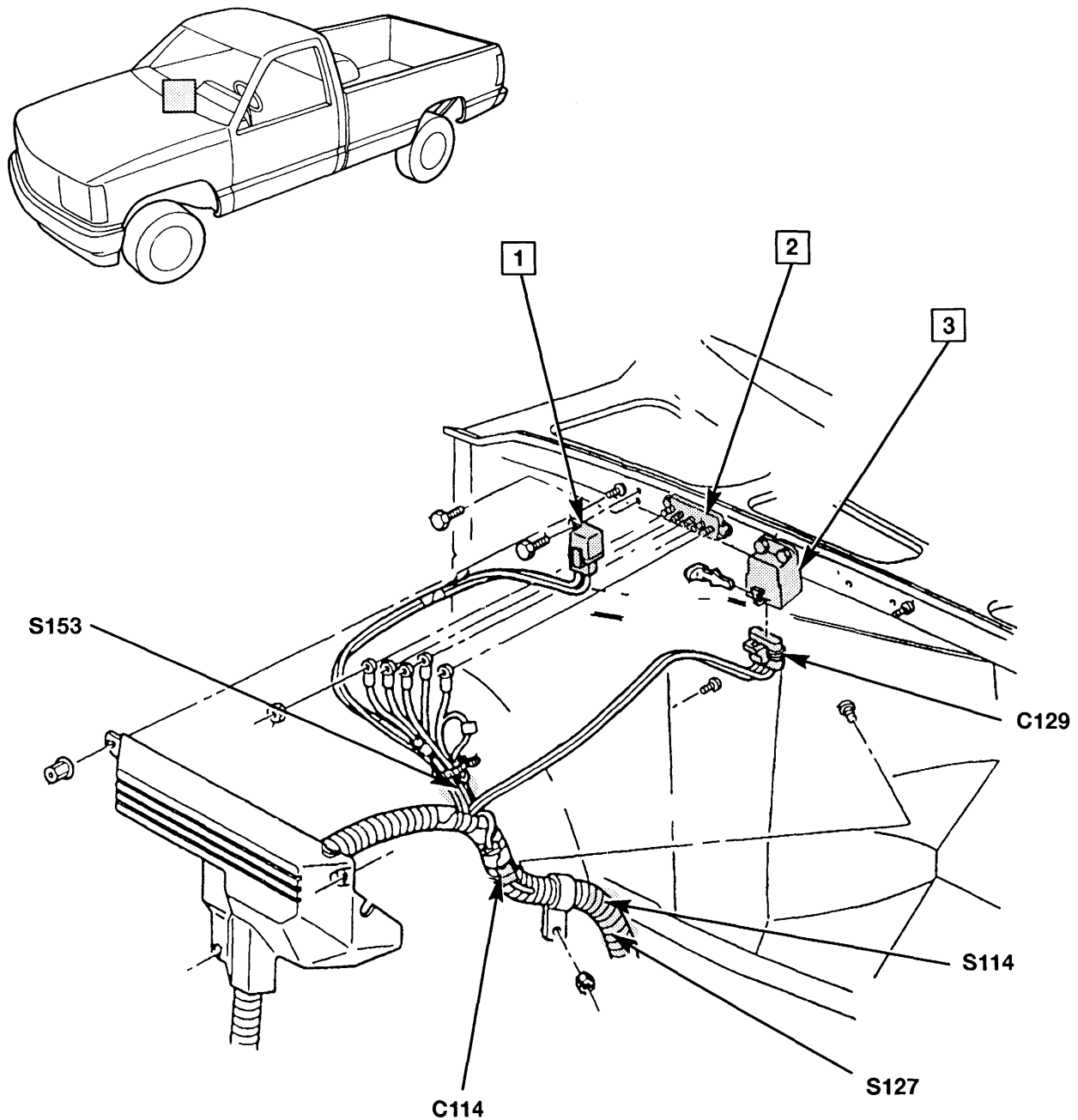


Figure 4 — LH Cowl Wiring



1. In-Line Fuse
2. Battery Junction Block
3. Fuel Pump Relay
4. Fusible Links

Figure 5 — Battery Junction Block and Relay Wiring

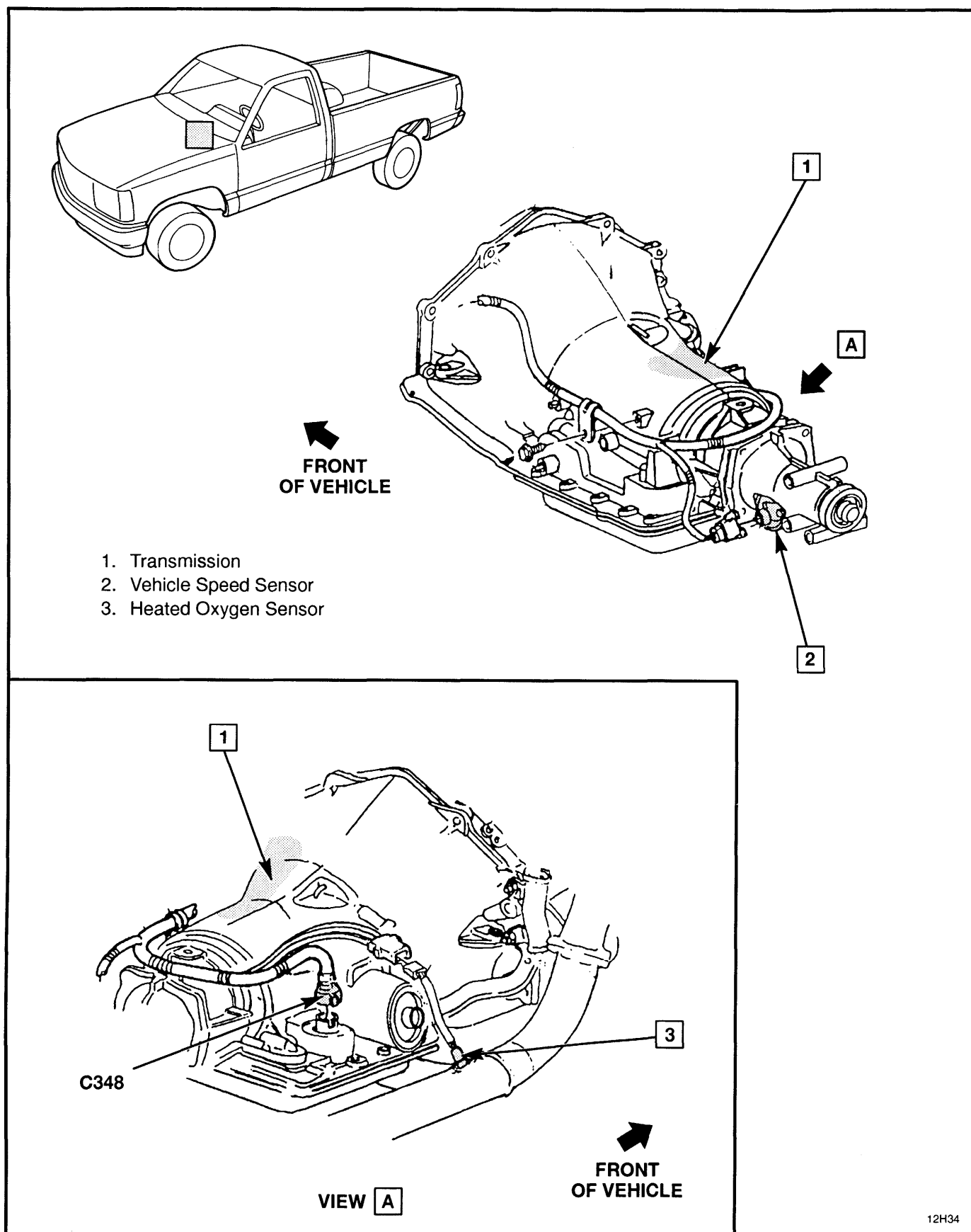


Figure 6 — Transmission Wiring

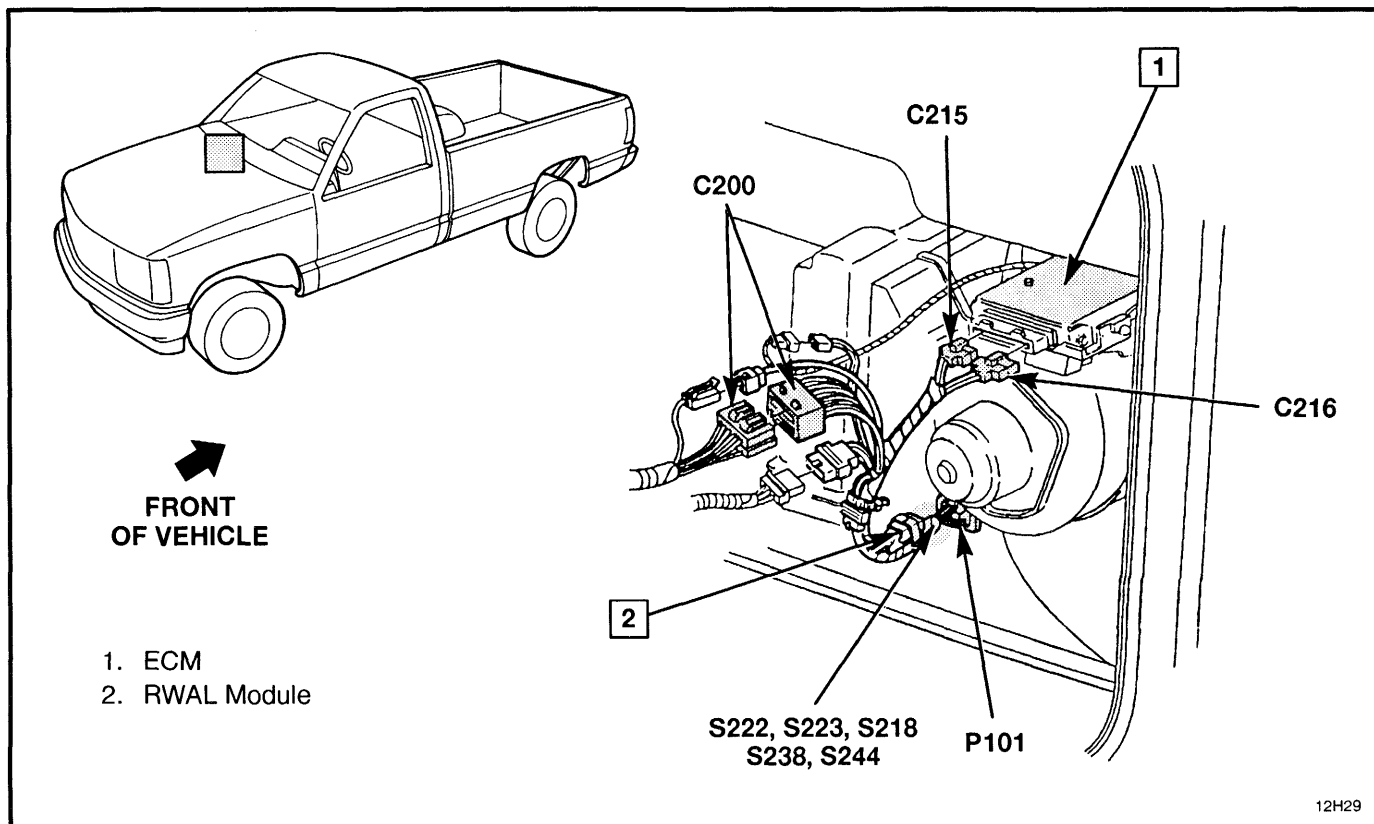


Figure 7 — Behind RH Side of I/P

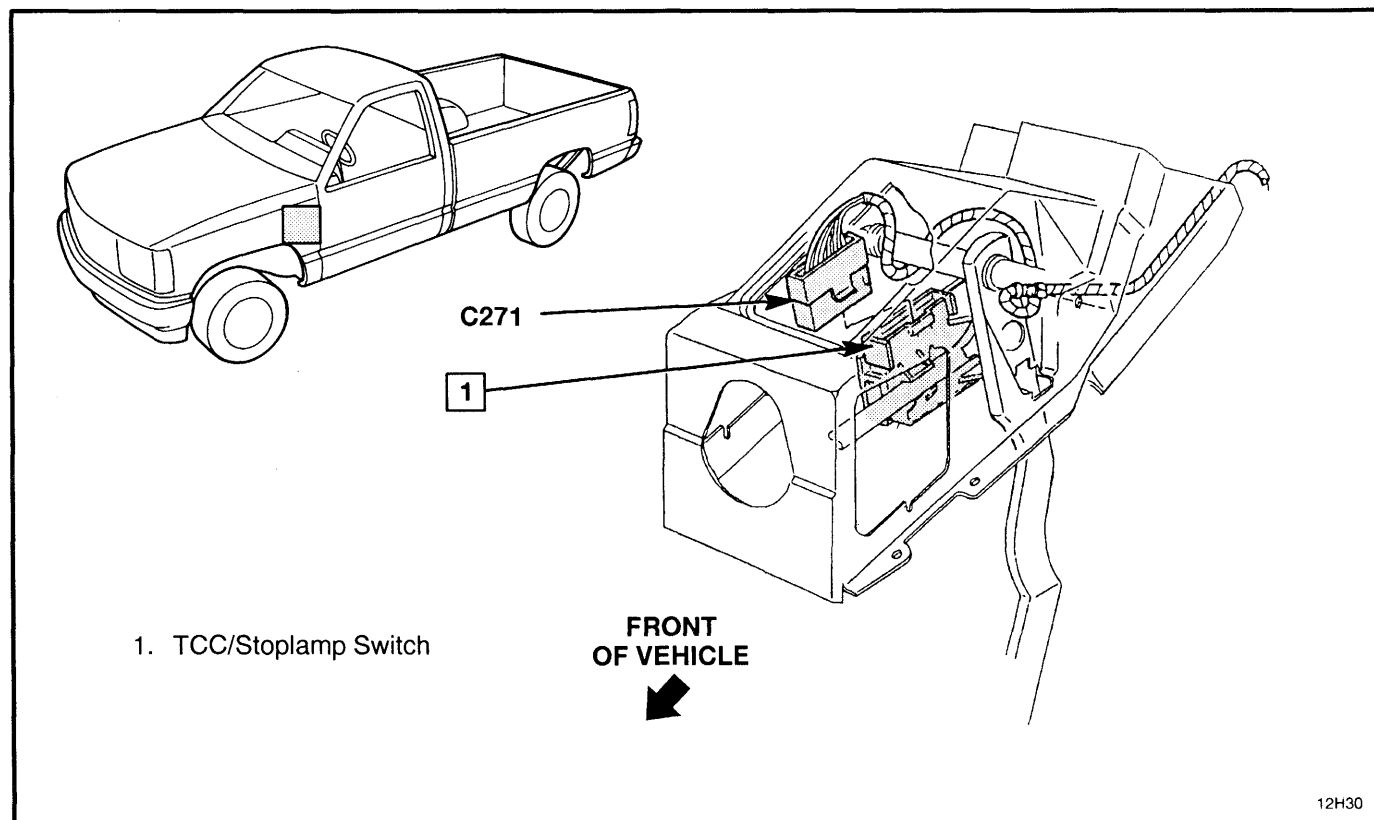


Figure 8 — TCC/Stoplamp Switch

# 8A-21B-20 ENGINE CONTROLS 5.0L (305 CID) V8 VIN H

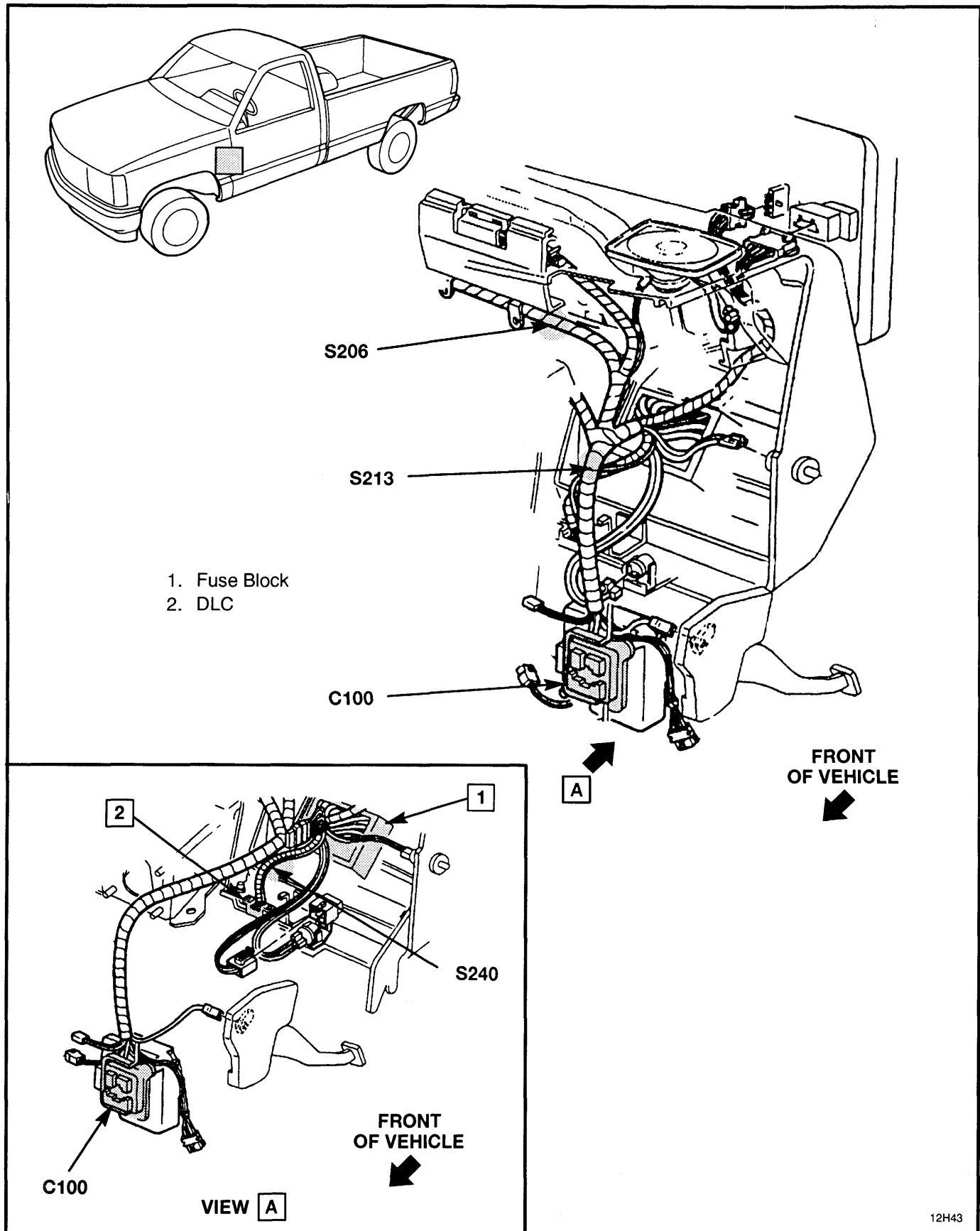


Figure 9 — LH Side of Instrument Panel

## ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22A-1

### COMPONENT LOCATION

### Page — Figure

|                                                         |                                                   |           |   |
|---------------------------------------------------------|---------------------------------------------------|-----------|---|
| Air Divert Solenoid .....                               | RH front of engine .....                          | 22A-15    | 3 |
| Battery Junction Block .....                            | RH rear engine compartment, at cowl .....         | 22A-15    | 3 |
| Distributor Ignition Control<br>Module .....            | Center rear of engine .....                       | 22A-13    | 1 |
| EGR (Exhaust Gas Recirculation)<br>Solenoid Valve ..... | LH rear top of engine .....                       | 22A-15    | 3 |
| Engine Coolant Temperature<br>Sensor .....              | RH top front of engine .....                      | 22A-14    | 2 |
| Fuel Pump and Sender .....                              | Inside fuel tank .....                            | Not Shown |   |
| Fuel Pump Oil Pressure Switch<br>and Sender .....       | LH rear of engine, near exhaust manifold .....    | 22A-13    | 1 |
| Fuel Pump Relay .....                                   | RH rear of engine compartment, near battery ..... | 22A-15    | 3 |
| Fuse Block .....                                        | Lower LH side of I/P .....                        | 22A-19    | 8 |
| Idle Air Control Motor .....                            | RH rear of TBI unit .....                         | 22A-14    | 2 |
| Ignition Coil .....                                     | Center rear of engine .....                       | 22A-13    | 1 |
| Instrument Cluster .....                                | LH side of I/P .....                              | Not Shown |   |
| Knock Sensor .....                                      | RH side of engine, below exhaust manifold .....   | 22A-14    | 2 |
| Knock Sensor Module .....                               | Above RH rocker cover .....                       | 22A-15    | 3 |
| MAP Sensor .....                                        | RH rear top of engine .....                       | 22A-14    | 2 |
| Oxygen Sensor .....                                     | In LH exhaust manifold .....                      | 22A-13    | 1 |
| ECM .....                                               | Under RH end of I/P .....                         | 22A-17    | 5 |
| TCC Stoplamp Switch .....                               | Top of brake pedal .....                          | Not Shown |   |
| Throttle Body Fuel Injector #1 .....                    | Top of throttle body unit .....                   | 22A-14    | 2 |
| Throttle Body Fuel Injector #2 .....                    | Top of throttle body unit .....                   | 22A-14    | 2 |
| TP Sensor .....                                         | RH side of TBI .....                              | 22A-14    | 2 |

### CONNECTORS:

|             |                                                          |           |   |
|-------------|----------------------------------------------------------|-----------|---|
| C100 .....  | At bulkhead connector .....                              | 22A-17    | 6 |
| C101 .....  | At bulkhead connector C100 .....                         | 22A-17    | 6 |
| C106A ..... | Near LH lower cowl (engine compartment) .....            | Not Shown |   |
| C114 .....  | Center of cowl, under battery junction block cover ..... | 22A-18    | 7 |
| C200 .....  | Under RH side of I/P, near blower motor .....            | 22A-17    | 5 |

### GROMMETS:

|            |                                          |        |   |
|------------|------------------------------------------|--------|---|
| P101 ..... | RH lower cowl (engine compartment) ..... | 22A-17 | 5 |
|------------|------------------------------------------|--------|---|

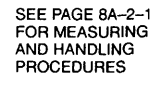
### GROUND:

|                       |                                  |        |   |
|-----------------------|----------------------------------|--------|---|
| G108 .....            | LH top front of engine .....     | 22A-14 | 2 |
| G109 (Gasoline) ..... | Top front of center engine ..... | 22A-14 | 2 |

### SPLICES:

|            |                                                            |           |   |
|------------|------------------------------------------------------------|-----------|---|
| S114 ..... | RH rear engine compartment, near A/C accumulator .....     | 22A-18    | 7 |
| S118 ..... | Engine harness, near cowl LH rear engine compartment ..... | 22A-13    | 1 |
| S119 ..... | Engine harness, near cowl LH rear engine compartment ..... | Not Shown |   |
| S127 ..... | Near P101, RH cowl .....                                   | 22A-14    | 2 |
| S136 ..... | Rear of engine compartment, near center .....              | 22A-13    | 1 |
| S149 ..... | Rear of engine compartment, near junction block .....      | 22A-18    | 7 |
| S153 ..... | Center of cowl, below battery junction block .....         | 22A-15    | 3 |
| S160 ..... | Upper rear of engine .....                                 | 22A-13    | 1 |
| S206 ..... | Under LH side of I/P .....                                 | 22A-19    | 8 |
| S213 ..... | Under LH side of I/P .....                                 | 22A-19    | 8 |
| S222 ..... | Near PCM, under RH side of I/P .....                       | 22A-17    | 5 |
| S223 ..... | Near PCM, under RH side of I/P .....                       | 22A-17    | 5 |
| S238 ..... | Engine harness, near PCM .....                             | 22A-12    | 5 |
| S244 ..... | Near PCM, under RH side of I/P .....                       | 22A-17    | 5 |
| S243 ..... | Engine harness, near P101 .....                            | Not Shown |   |

**W/MANUAL TRANSMISSION**



**W/MANUAL TRANSMISSION**

## OXYGEN SENSOR

AIR CONDITIONING:  
COMPRESSOR  
CONTROLS  
PAGE 63-1

SEE GROUND  
DISTRIBUTION  
PAGE 14-3

G108  
ENGINE  
GROUND

**ENGINE  
COOLANT  
TEMPERATURE  
SENSOR**  
99°C (210°F)–  
85 OHMS  
21°C (70°F)–  
3400 OHMS  
4°C (40°F)–  
7500 OHMS

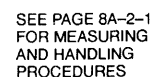
ENGINE  
CONTROL  
MODULE (ECM)

**ECM CONNECTOR IDENTIFICATION**

C215 – BLACK – 32 WAY  
C216 – BLACK – 24 WAY



**W/MANUAL TRANSMISSION**



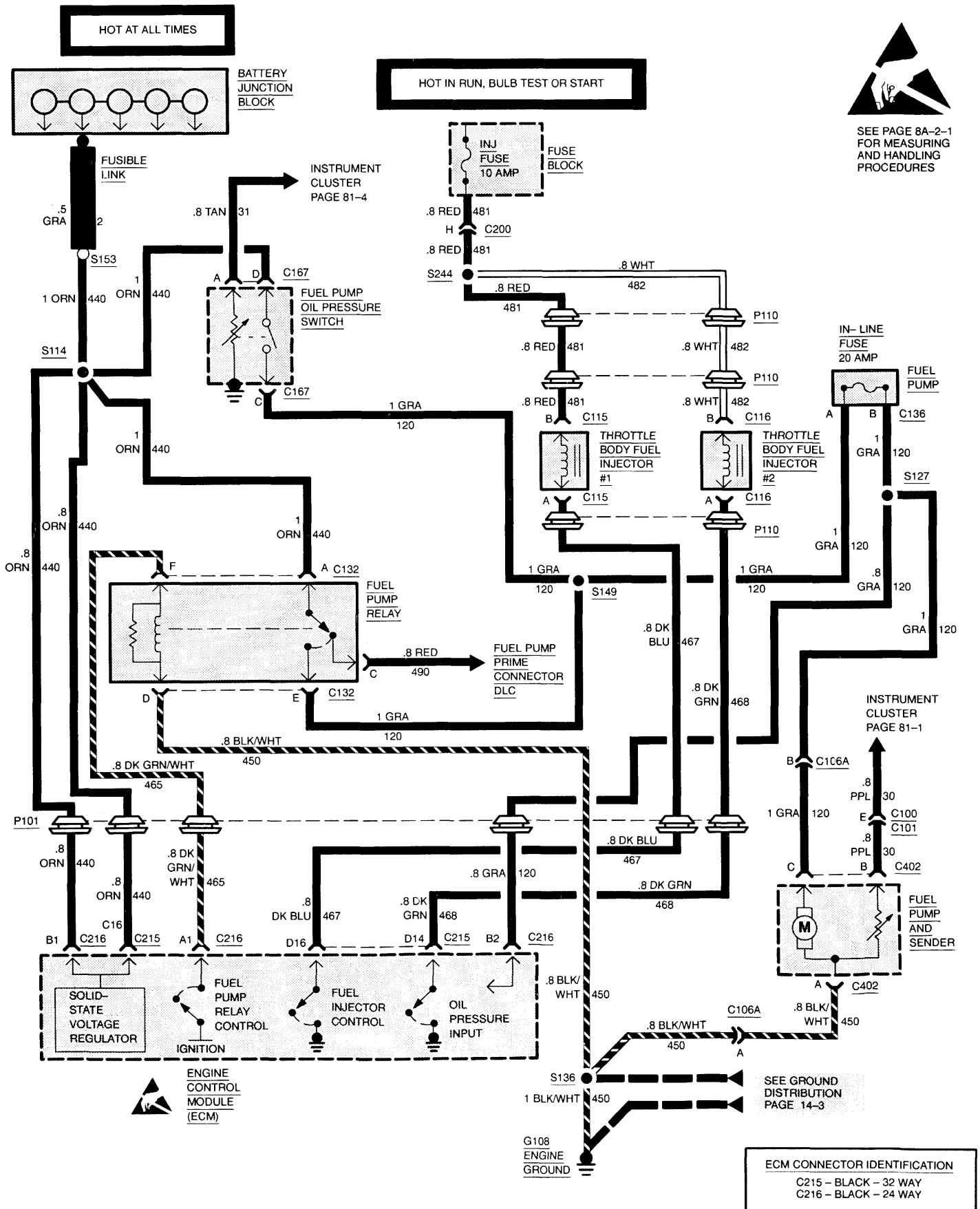
ENGINE  
CONTROL  
MODULE (ECM)



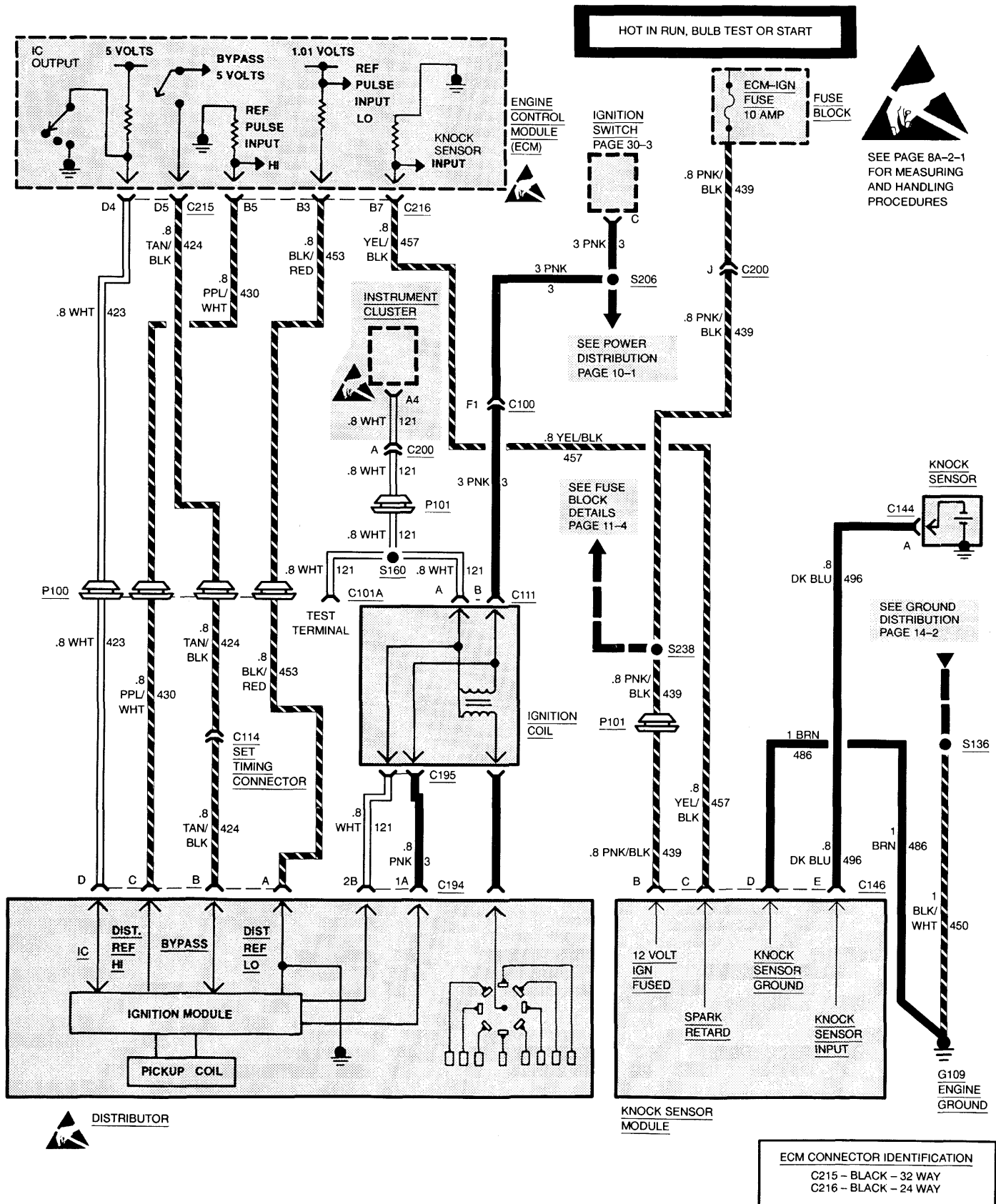
C215 - BLACK - 32 WAY  
C216 - BLACK - 24 WAY

# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22A-5

## W/MANUAL TRANSMISSION



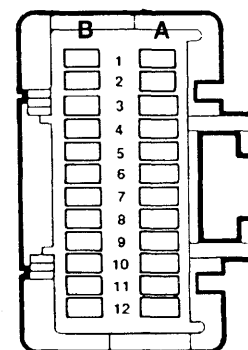
# 8A-22A-6 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K W/MANUAL TRANSMISSION



# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22A-7

## ELECTRONIC CONTROL MODULE — 5.7L (350 CID) ENGINE (32-PIN) W/MANUAL TRANSMISSION (32-Pin Red)

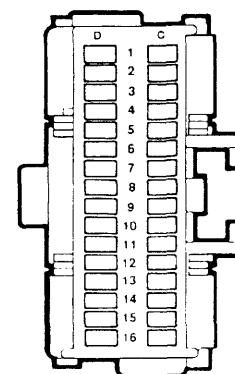
| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                        |
|-------------|-----------|------------|--------|------------------------------------|
| 465         | .8        | DK GRN/WHT | A1     | FUEL PUMP RELAY DRIVE              |
|             |           |            | A2     | NOT USED                           |
|             |           |            | A3     | NOT USED                           |
| 435         | .8        | GRA        | A4     | EGR SOLENOID                       |
| 419         | .8        | BRN/WHT    | A5     | MALFUNCTION INDICATOR LAMP CONTROL |
| 439         | .8        | PNK/BLK    | A6     | 12V IGNITION (FUSED)               |
| 456         | .8        | TAN/BLK    | A7     | UPSHIFT LAMP CONTROL               |
| 461         | .8        | ORN        | A8     | DLC SERIAL DATA                    |
| 451         | .8        | WHT/BLK    | A9     | DLC DIAGNOSTIC TEST                |
| 1716        | .8        | DK BLU     | A10    | VEHICLE SPEED SENSOR BUFFER SIGNAL |
| 455         | .8        | PPL        | A11    | MAP SENSOR 5V RETURN GROUND        |
| 450         | .8        | BLK/WHT    | A12    | SYSTEM GROUND                      |
| 440         | .8        | ORN        | B1     | 12V BATTERY (FUSED)                |
| 120         | .8        | GRA        | B2     | FUEL PUMP SIGNAL (INPUT)           |
| 453         | .8        | BLK/RED    | B3     | DISTRIBUTOR REF LOW                |
|             |           |            | B4     | NOT USED                           |
| 430         | .5        | PPL/WHT    | B5     | DISTRIBUTOR REF HIGH               |
|             |           |            | B6     | NOT USED                           |
| 457         | .8        | YEL/BLK    | B7     | SPARK RETARD SIGNAL                |
| 59          | .8        | DK GRN     | B8     | A/C REQUEST SIGNAL                 |
|             |           |            | B9     | NOT USED                           |
|             |           |            | B10    | NOT USED                           |
|             |           |            | B11    | NOT USED                           |
|             |           |            | B12    | NOT USED                           |



# 8A-22A-8 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

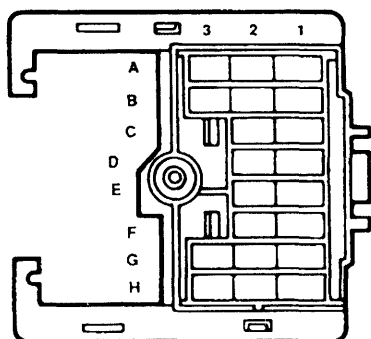
## ELECTRONIC CONTROL MODULE — 2.8L (173 CID) ENGINE (32-Pin) W/MANUAL TRANSMISSION (32-Pin Red)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                          |
|-------------|-----------|------------|--------|------------------------------------------------------|
| 436         | .8        | BRN        | C1     | NOT USED                                             |
|             |           |            | C2     | AIR SWITCH SOLENOID (PICKUP ONLY)                    |
| 444         | .8        | LTGRN/BLK  | C3     | IAC COIL B LOW                                       |
| 443         | .8        | LT GRN/WHT | C4     | IAC COIL B HIGH                                      |
| 441         | .8        | LT BLU/WHT | C5     | IAC COIL A HIGH                                      |
| 442         | .8        | LT BLU/BLK | C6     | IAC COIL A LOW                                       |
|             |           |            | C7     | NOT USED                                             |
|             |           |            | C8     | NOT USED                                             |
| 806         | .8        | PPL/WHT    | C9     | CRANK SIGNAL                                         |
| 410         | .8        | YEL        | C10    | ENGINE COOLANT TEMPERATURE SENSOR SIGNAL             |
| 432         | .8        | LT GRN     | C11    | MAP SENSOR SIGNAL                                    |
|             |           |            | C12    | NOT USED                                             |
| 417         | .5        | DK BLU     | C13    | TP SENSOR SIGNAL                                     |
| 416         | .5        | GRA        | C14    | 5V SENSOR REFERENCE                                  |
|             |           |            | C15    | NOT USED                                             |
| 440         | .8        | ORN        | C16    | 12V BATTERY (FUSED)                                  |
| 450         | .8        | BLK        | D1     | SYSTEM GROUND                                        |
| 452         | .8        | BLK        | D2     | TP SENSOR AND ENGINE COOLANT SENSOR 5V RETURN GROUND |
|             |           |            | D3     | NOT USED                                             |
| 423         | .5        | NAT/WHT    | D4     | IGNITION CONTROL (IC)                                |
| 424         | .8        | TAN/BLK    | D5     | IC BYPASS                                            |
| 413         | .5        | TAN        | D6     | OXYGEN SENSOR GROUND                                 |
| 412         | .5        | PPL        | D7     | OXYGEN SENSOR SIGNAL                                 |
|             |           |            | D8     | NOT USED                                             |
|             |           |            | D9     | NOT USED                                             |
|             |           |            | D10    | NOT USED                                             |
|             |           |            | D11    | NOT USED                                             |
|             |           |            | D12    | NOT USED                                             |
|             |           |            | D13    | NOT USED                                             |
| 468         | .8        | DK GRN     | D14    | INJECTOR 2 DRIVER                                    |
|             |           |            | D15    | NOT USED                                             |
| 467         | .8        | DK BLU     | D16    | INJECTOR 1 DRIVER                                    |



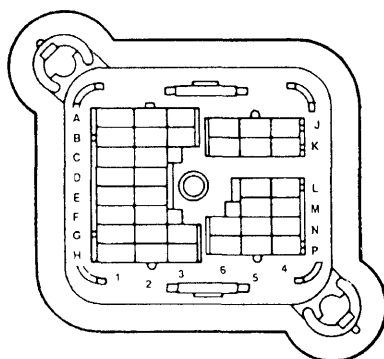
# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22A-9

12020183



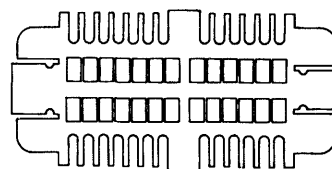
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



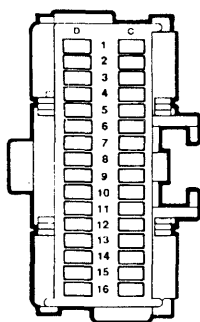
**GRAY**  
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**C100**  
Bulkhead Connector – I/P

12089908



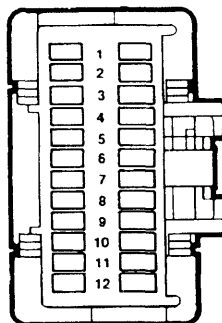
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12052177



**C215**  
ECM

12052175



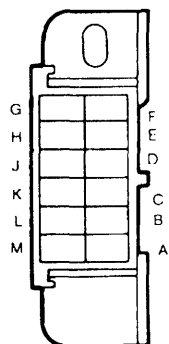
**C216**  
ECM

12020403



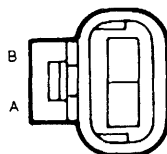
**BLACK**  
**C100A**  
MAP Sensor

12020043



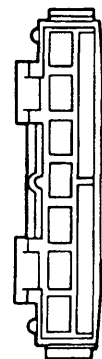
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



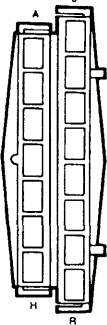
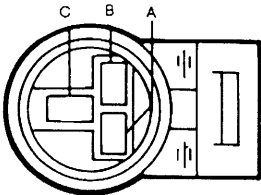
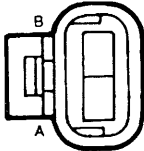
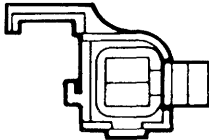
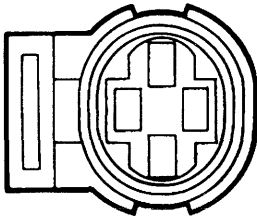
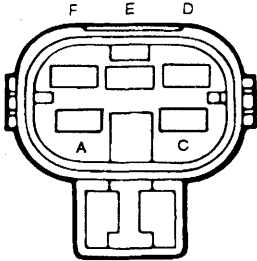
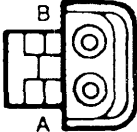
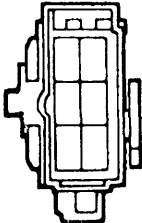
**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

12041254



**C200**  
I/P to ECM

8A-22A-10 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

|                                                                                                                                                                                            |                                                                                                                                                                                            |                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>12020213</p>  <p><b>C200</b><br/>ECM to I/P</p>                                                        | <p>12078090</p>  <p><b>BLACK</b><br/>Metri-Pack 150<br/><b>C119</b><br/>TP Sensor</p>                     | <p>12078084</p>  <p><b>BLACK</b><br/>Metri-Pack 150<br/><b>C143</b><br/>Engine Coolant Temperature<br/>Sensor</p> |
| <p>12040705</p>  <p><b>GRAY</b><br/>Metri-Pack 280<br/><b>C111</b><br/>Ignition Coil</p>                 | <p>12065401</p>  <p><b>GRAY</b><br/>Metri-Pack 150<br/><b>C167</b><br/>Fuel Pump Oil Pressure Switch</p> | <p>12052287</p>  <p><b>BLACK</b><br/>Metri-Pack<br/><b>C132</b><br/>Fuel Pump Relay</p>                          |
| <p>12015792</p>  <p><b>BLACK</b><br/>Weather Pack<br/><b>C106A</b><br/>Fuse to Fuel Pump and Sender</p> | <p>12020099</p>  <p><b>C101</b><br/>Bulkhead - Rear Lamps</p>                                           | <p>12015791</p>  <p><b>BLACK</b><br/>Weather Pack<br/><b>C114</b><br/>Set Timing Connector</p>                  |

# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22A-11

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12015791



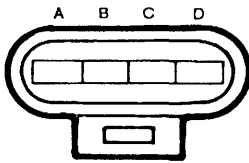
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



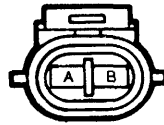
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



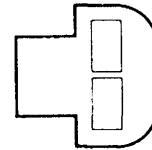
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12052641



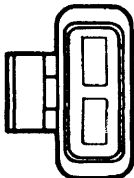
**BLACK**  
Metri-Pack 150  
**C149**  
EGR Solenoid

12103584



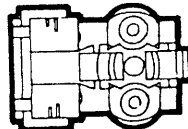
**BROWN**  
**C118**  
Air Switch Solenoid

12066681



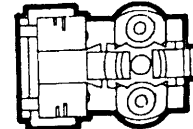
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

12020549

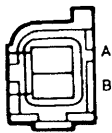


**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2



**8A-22A-12 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K**

12040706



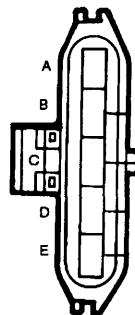
**C145**  
**Ignition Coil**

12015375



**GRAY**  
**C144**  
**Knock Sensor**

12015982



**C146**  
**Knock Sensor Module**

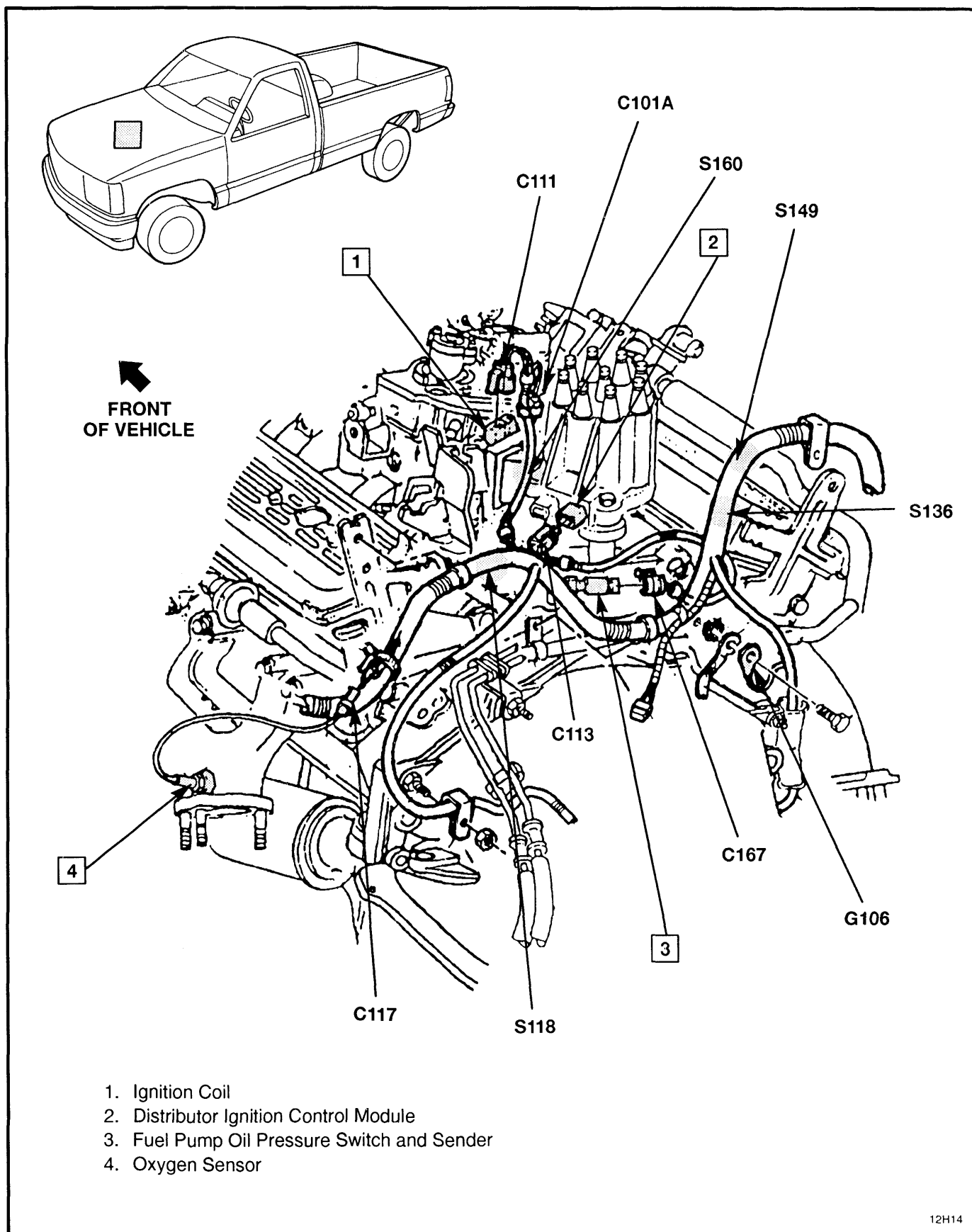


Figure 1 — 5.7L Engine Wiring Rear

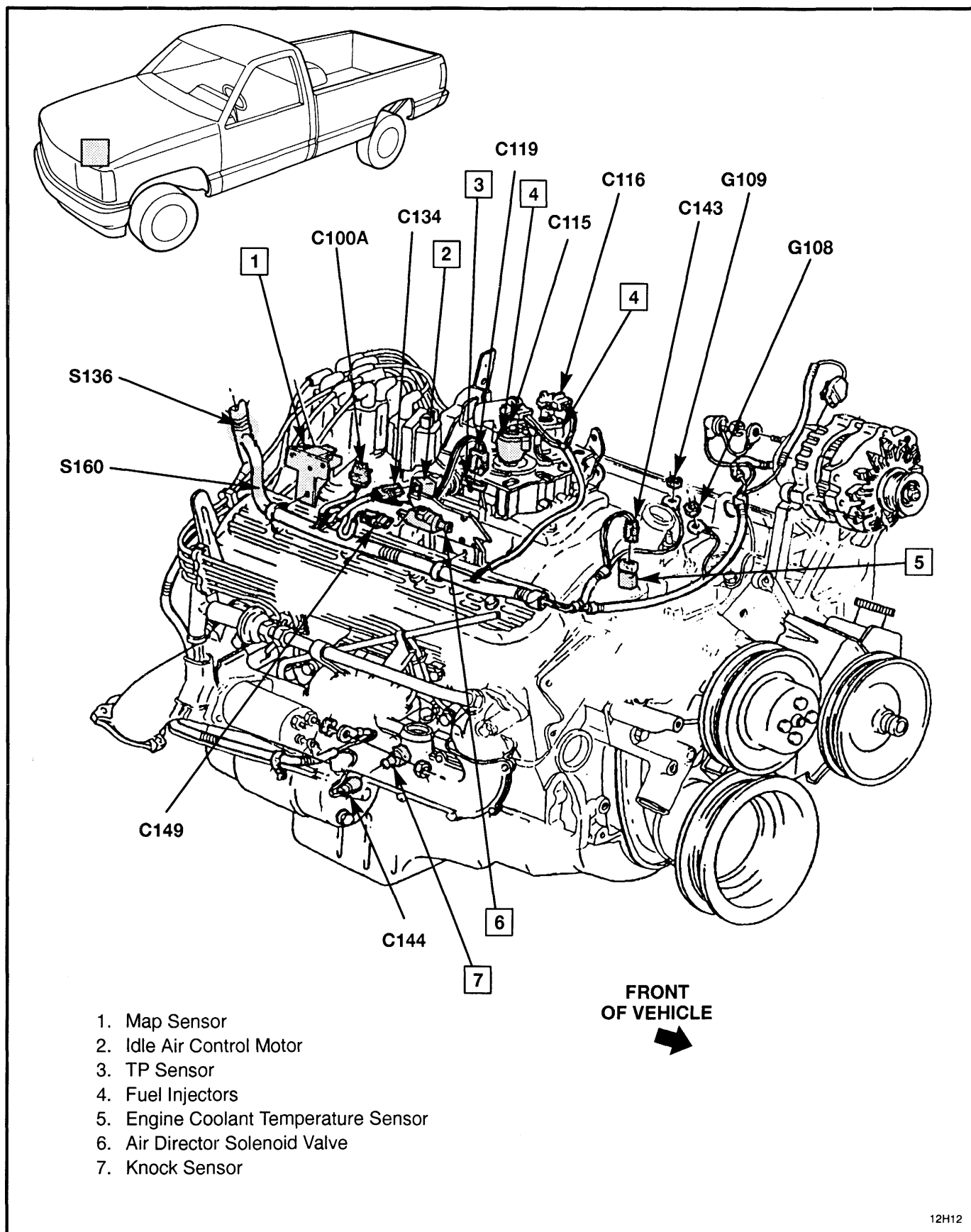


Figure 2 — RH Side of Engine, 5.7L (350 CID) Engine — Gasoline

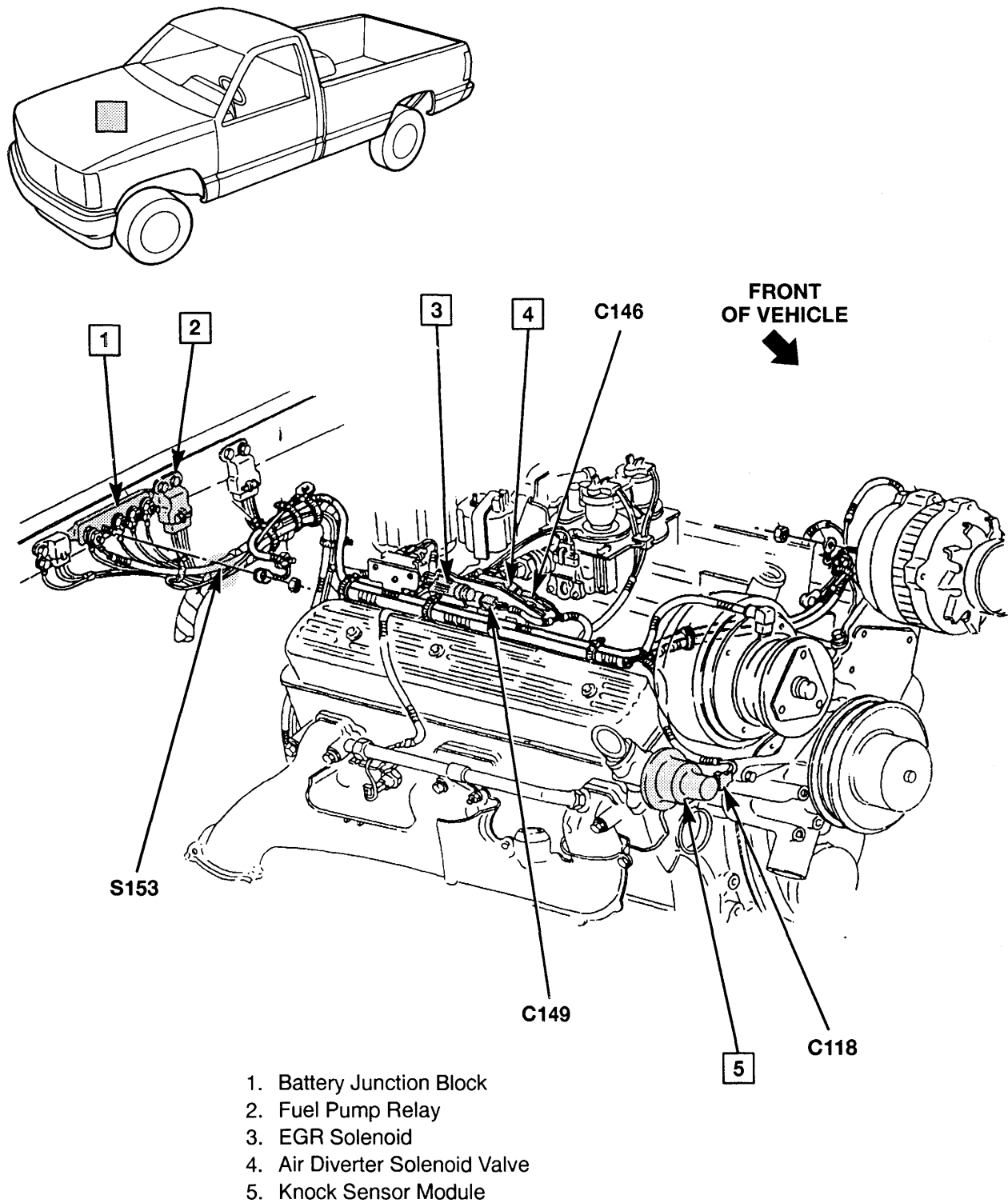


Figure 3 — RH Side of Engine, 5.7L (350 CID) Gasoline Engine

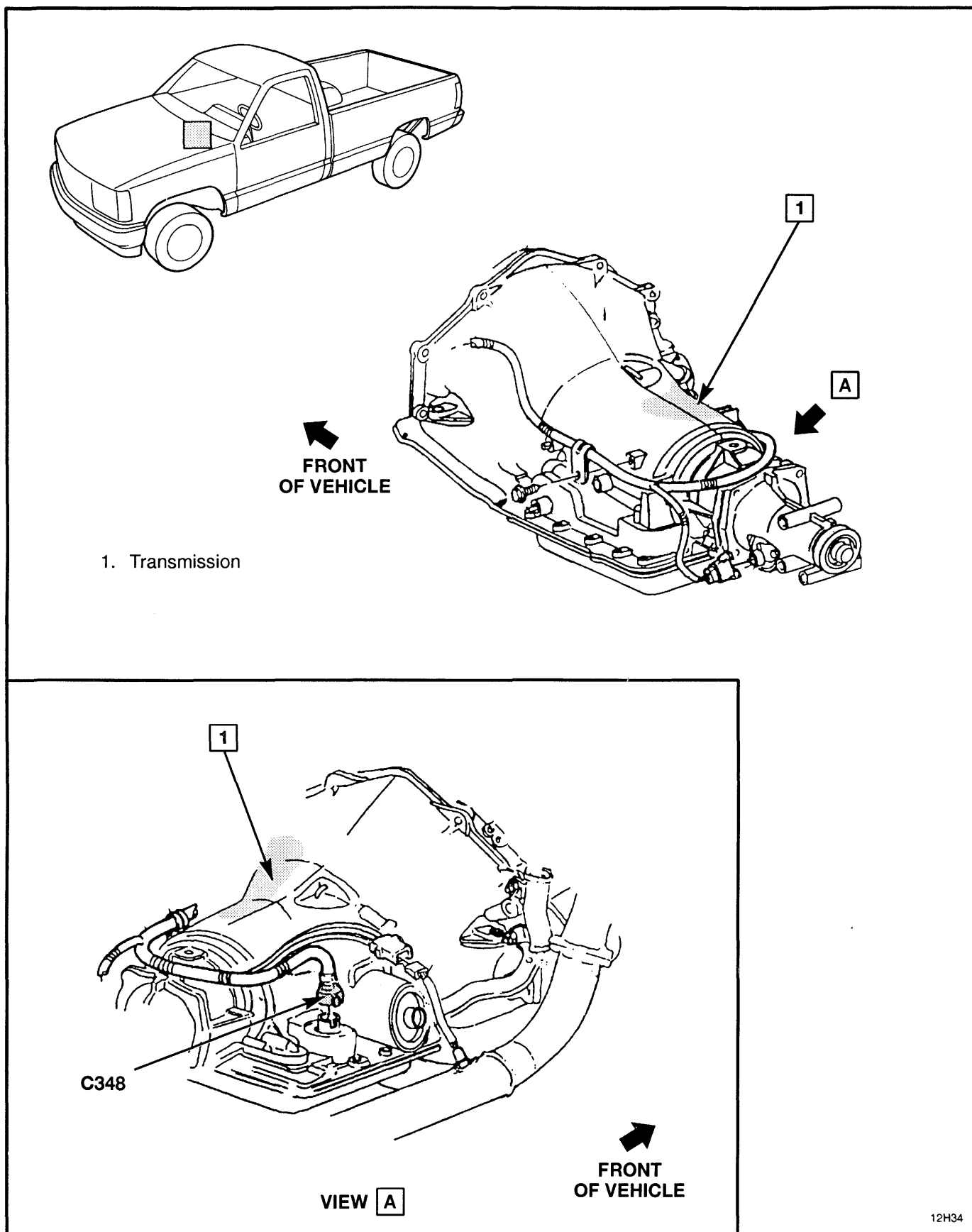


Figure 4 — Transmission Wiring

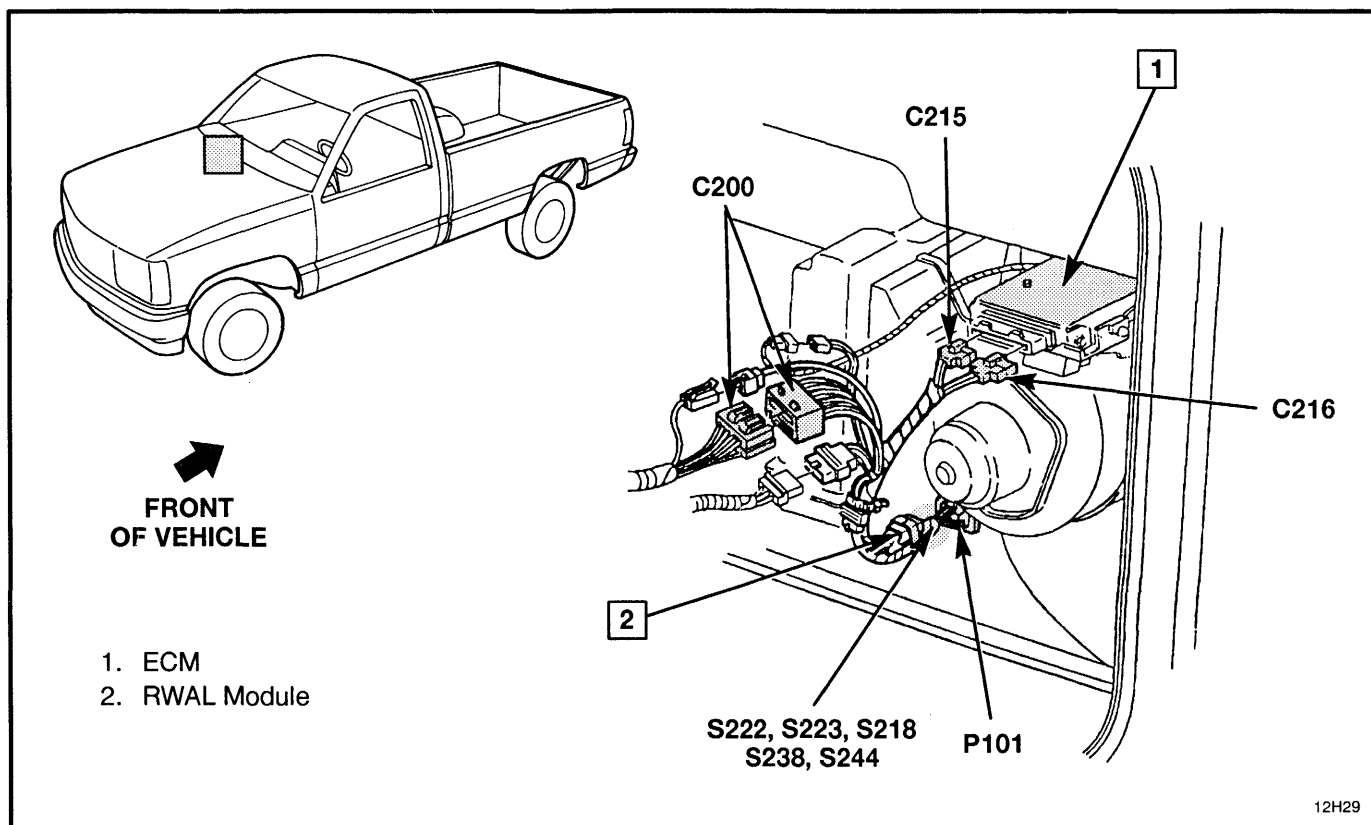


Figure 5 — ECM Wiring

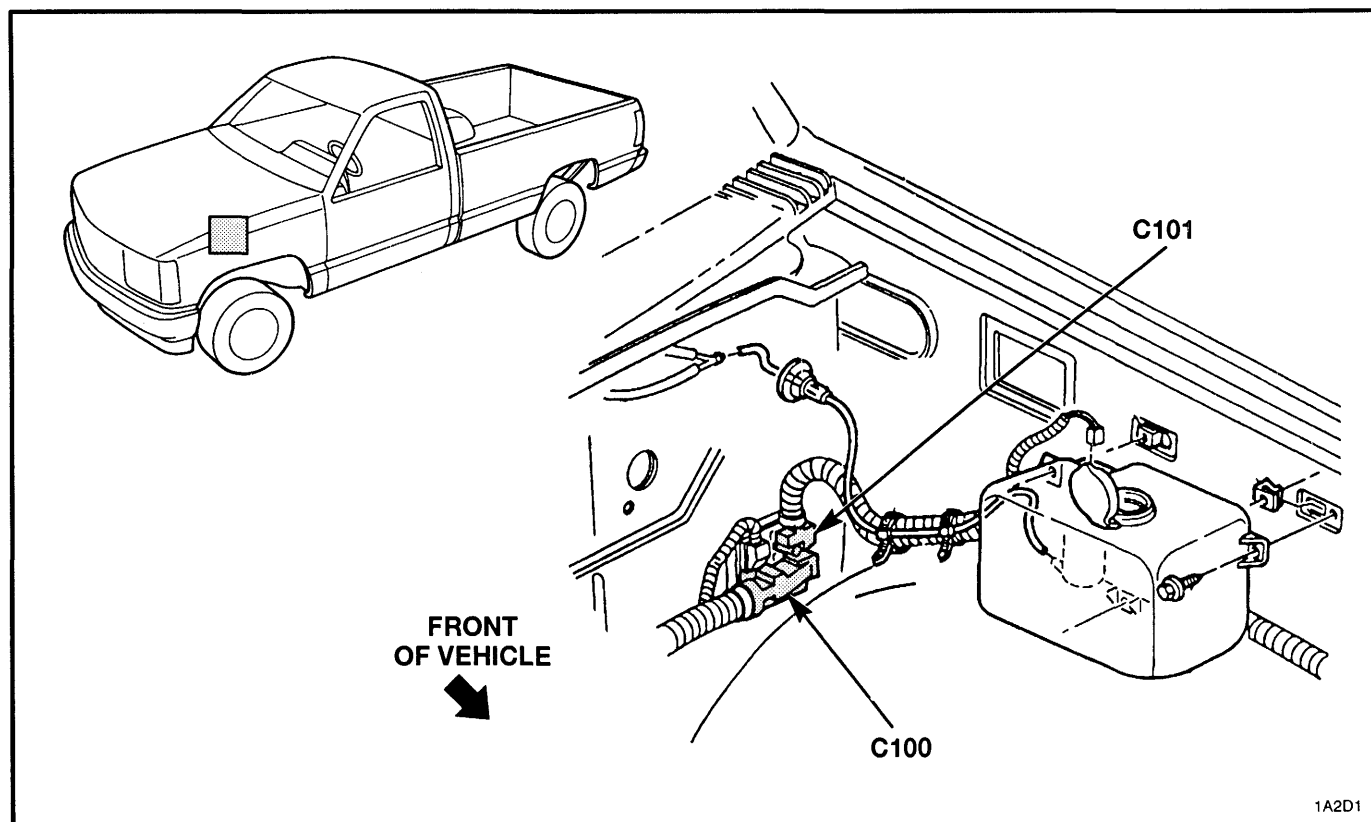


Figure 6 — Cowl Wiring, LH Side

8A-22A-18 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

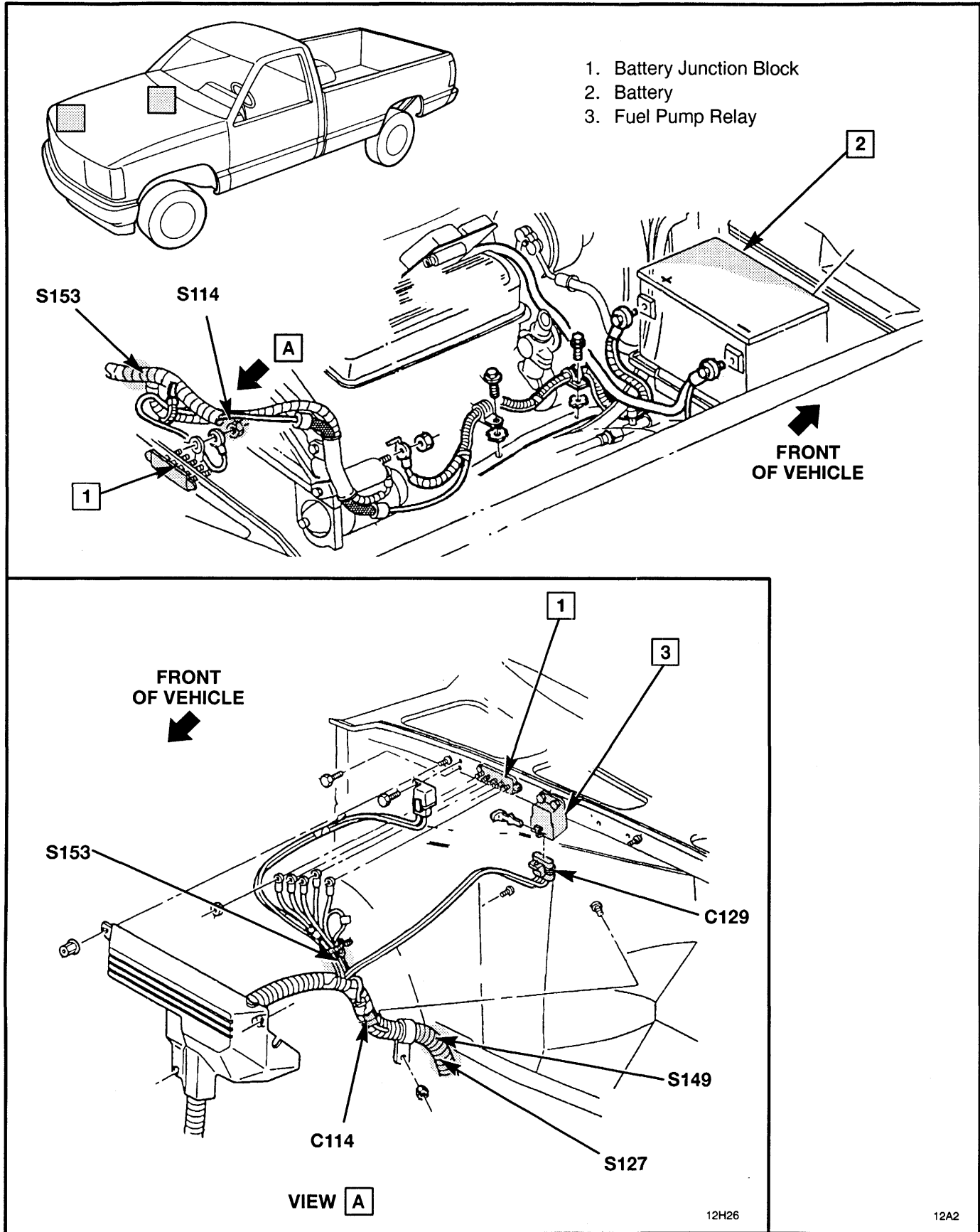
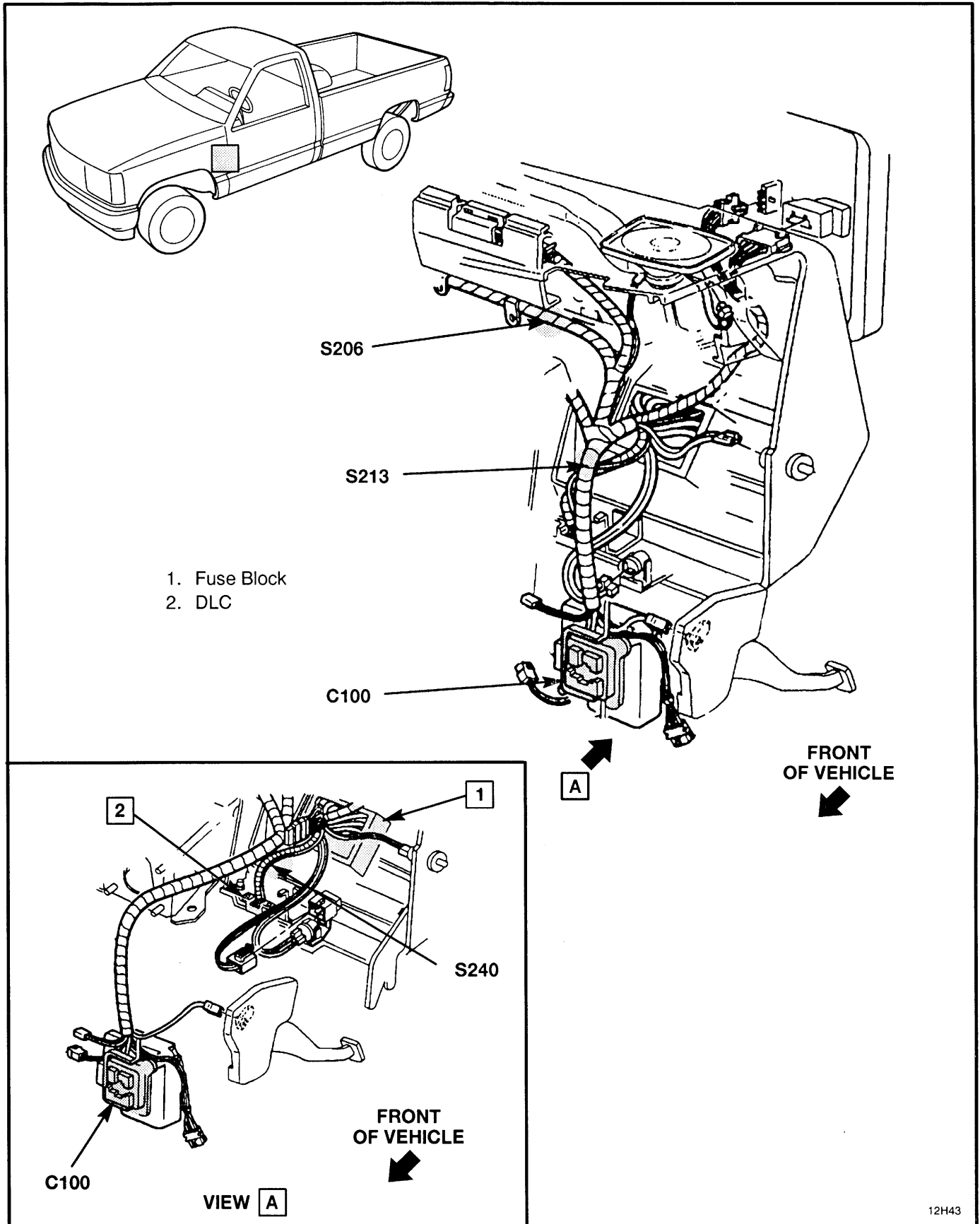


Figure 7 — Battery Wiring, Fuel Pump Relay and Battery Junction Block





**BLANK**

# ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K 8A-22B-1

## MANUAL TRANSMISSION

### COMPONENT LOCATION

### Page — Figure

|                                        |                                                            |           |   |
|----------------------------------------|------------------------------------------------------------|-----------|---|
| Battery Junction Block .....           | RH rear engine compartment, at cowl .....                  | 22B-14    | 3 |
| Distributor Ignition Control Module .. | Center rear of engine .....                                | 22B-13    | 2 |
| ECM .....                              | Under RH end of I/P .....                                  | 22B-16    | 5 |
| EGR Electronic Vacuum Regulator        |                                                            |           |   |
| Solenoid Valve .....                   | Top of engine RH side .....                                | 22B-12    | 1 |
| Engine Coolant Temperature             |                                                            |           |   |
| Sensor .....                           | RH top front of engine .....                               | 22B-12    | 1 |
| Fuel Pump and Sender .....             | Inside fuel tank .....                                     | Not Shown |   |
| Fuel Pump Oil Pressure Switch          |                                                            |           |   |
| and Sender .....                       | LH rear of engine, near exhaust manifold .....             | 22B-13    | 2 |
| Fuel Pump Relay .....                  | RH rear of engine compartment, near battery junction ..... | 22B-14    | 3 |
| Fuse Block .....                       | Lower LH side of I/P .....                                 | 22B-15    | 4 |
| Idle Air Control Motor .....           | RH rear of TBI unit .....                                  | 22B-12    | 1 |
| Ignition Coil .....                    | Center rear of engine .....                                | 22B-13    | 2 |
| Instrument Cluster .....               | LH side of I/P .....                                       | Not Shown |   |
| Knock Sensor .....                     | RH side of engine, below exhaust manifold .....            | 22B-12    | 1 |
| MAP Sensor .....                       | RH rear top of engine .....                                | 22B-12    | 1 |
| Oxygen Sensor .....                    | In LH exhaust manifold .....                               | 22B-13    | 2 |
| Throttle Body Fuel Injector #1 .....   | Top of throttle body unit .....                            | 22B-12    | 1 |
| Throttle Body Fuel Injector #2 .....   | Top of throttle body unit .....                            | 22B-12    | 1 |
| TP Sensor .....                        | RH side of TBI .....                                       | 22B-12    | 1 |

### CONNECTORS:

|             |                                                          |           |   |
|-------------|----------------------------------------------------------|-----------|---|
| C100 .....  | At bulkhead connector .....                              | 22B-15    | 4 |
| C101 .....  | At bulkhead connector C100 .....                         | 22B-16    | 6 |
| C106A ..... | Near LH lower cowl (engine compartment) .....            | Not Shown |   |
| C114 .....  | Center of cowl, under battery junction block cover ..... | 22B-14    | 3 |
| C200 .....  | Under RH side of I/P, near blower motor .....            | 22B-16    | 5 |

### GROMMETS:

|            |                                          |           |   |
|------------|------------------------------------------|-----------|---|
| P101 ..... | RH lower cowl (engine compartment) ..... | Not Shown |   |
| P110 ..... | At throttle body .....                   | 22B-12    | 1 |

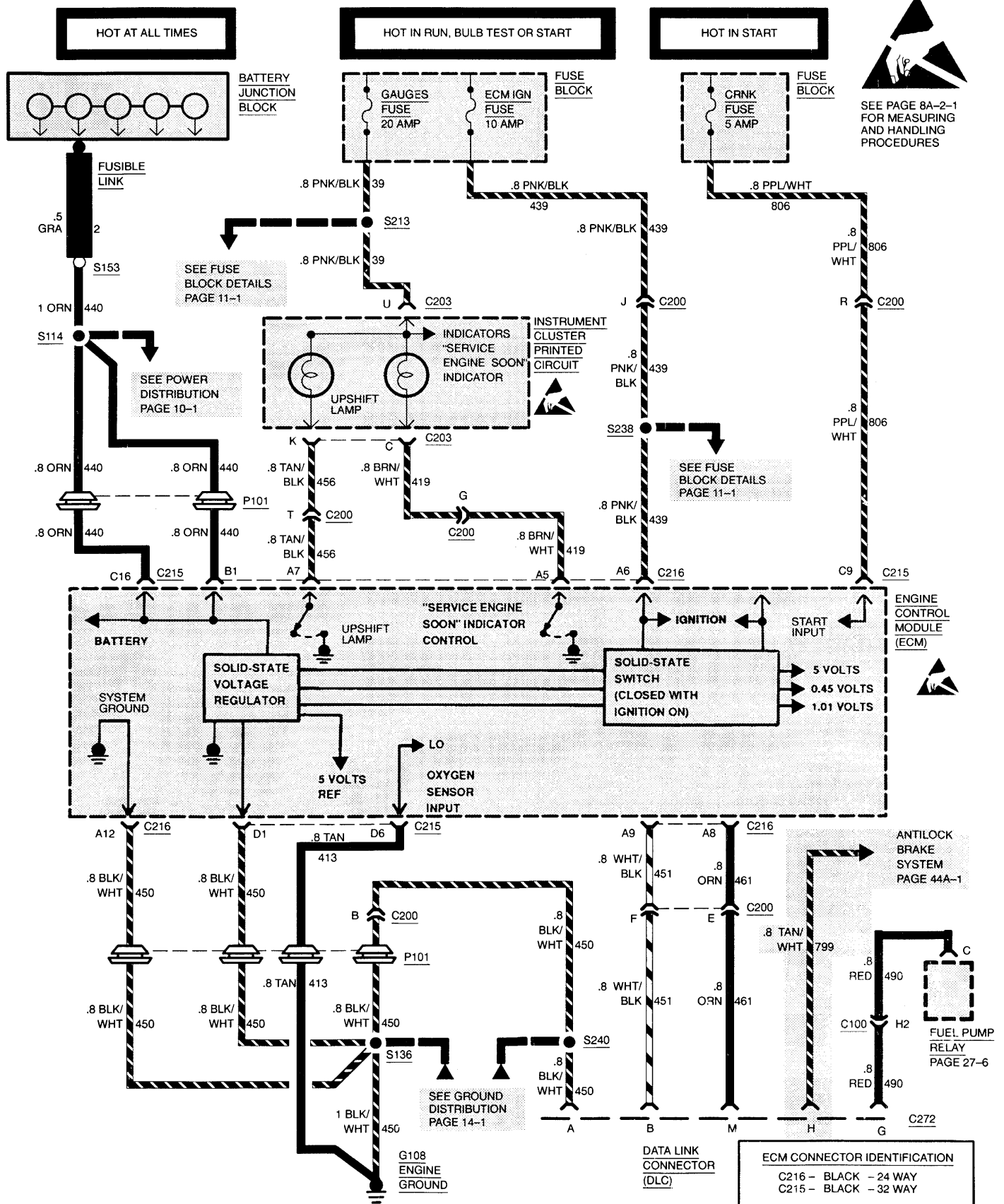
### GROUND:

|            |                              |        |   |
|------------|------------------------------|--------|---|
| G108 ..... | LH top front of engine ..... | 22B-12 | 1 |
| G109 ..... | LH top front of engine ..... | 22B-12 | 1 |

### SPLICES:

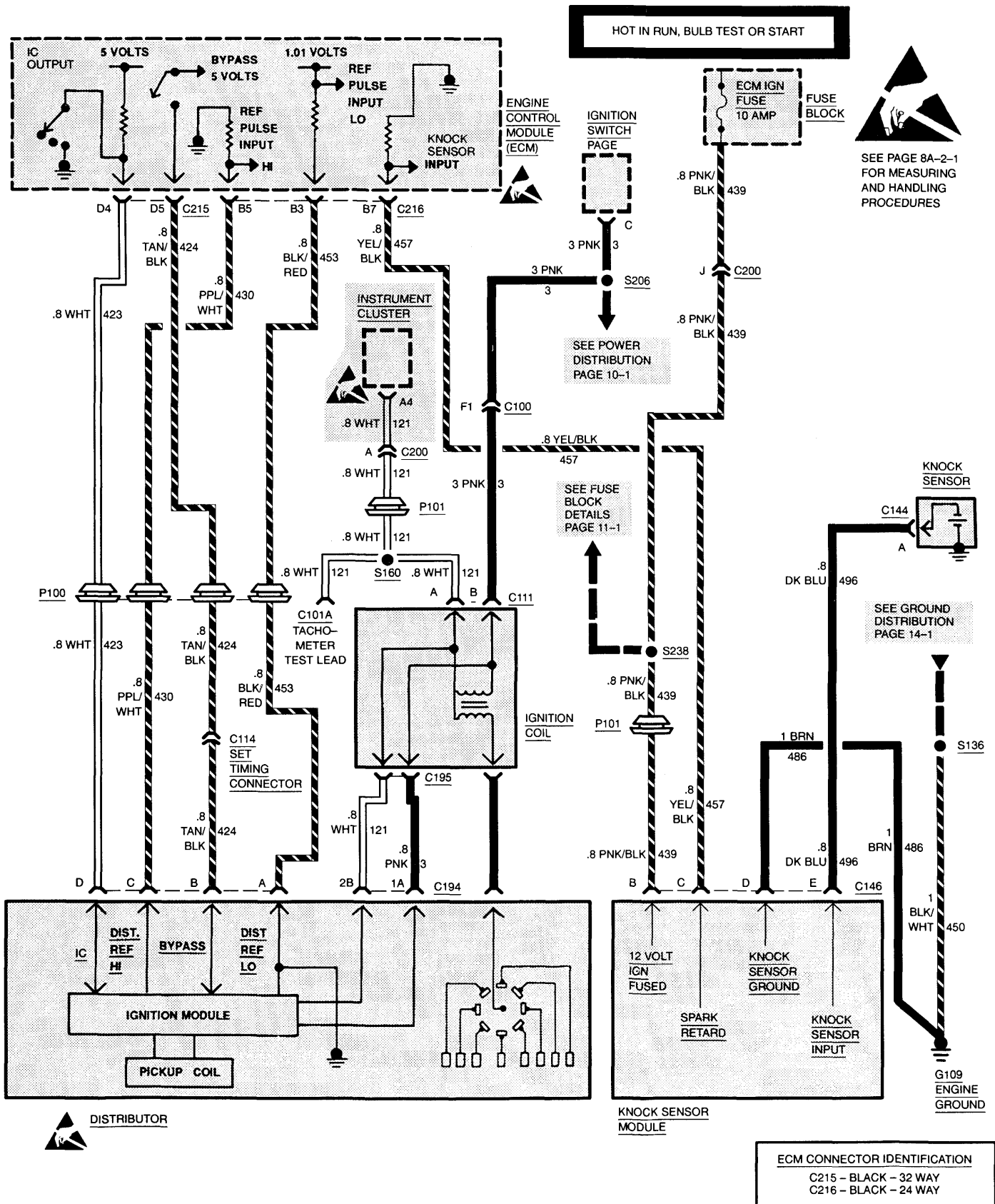
|            |                                                        |           |   |
|------------|--------------------------------------------------------|-----------|---|
| S114 ..... | RH rear engine compartment, near A/C accumulator ..... | 22B-14    | 3 |
| S127 ..... | Near P101, RH cowl .....                               | 22B-14    | 3 |
| S136 ..... | Rear of engine compartment, near center .....          | 22B-12    | 1 |
| S149 ..... | At rear of engine .....                                | 22B-13    | 2 |
| S153 ..... | Center of cowl, below battery junction block .....     | 22B-14    | 3 |
| S160 ..... | Upper rear of engine .....                             | 22B-12    | 1 |
| S206 ..... | Under LH side of I/P .....                             | 22B-15    | 4 |
| S213 ..... | Under LH side of I/P .....                             | 22B-15    | 4 |
| S222 ..... | Under RH side of I/P, near ECM .....                   | 22B-16    | 5 |
| S223 ..... | Under RH side of I/P, near ECM .....                   | 22B-16    | 5 |
| S238 ..... | Engine harness, near ECM .....                         | 22B-16    | 5 |
| S240 ..... | Behind LH side of I/P .....                            | Not Shown |   |

# 8A-22B-2 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K W/MANUAL TRANSMISSION



# ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K 8A-22B-3

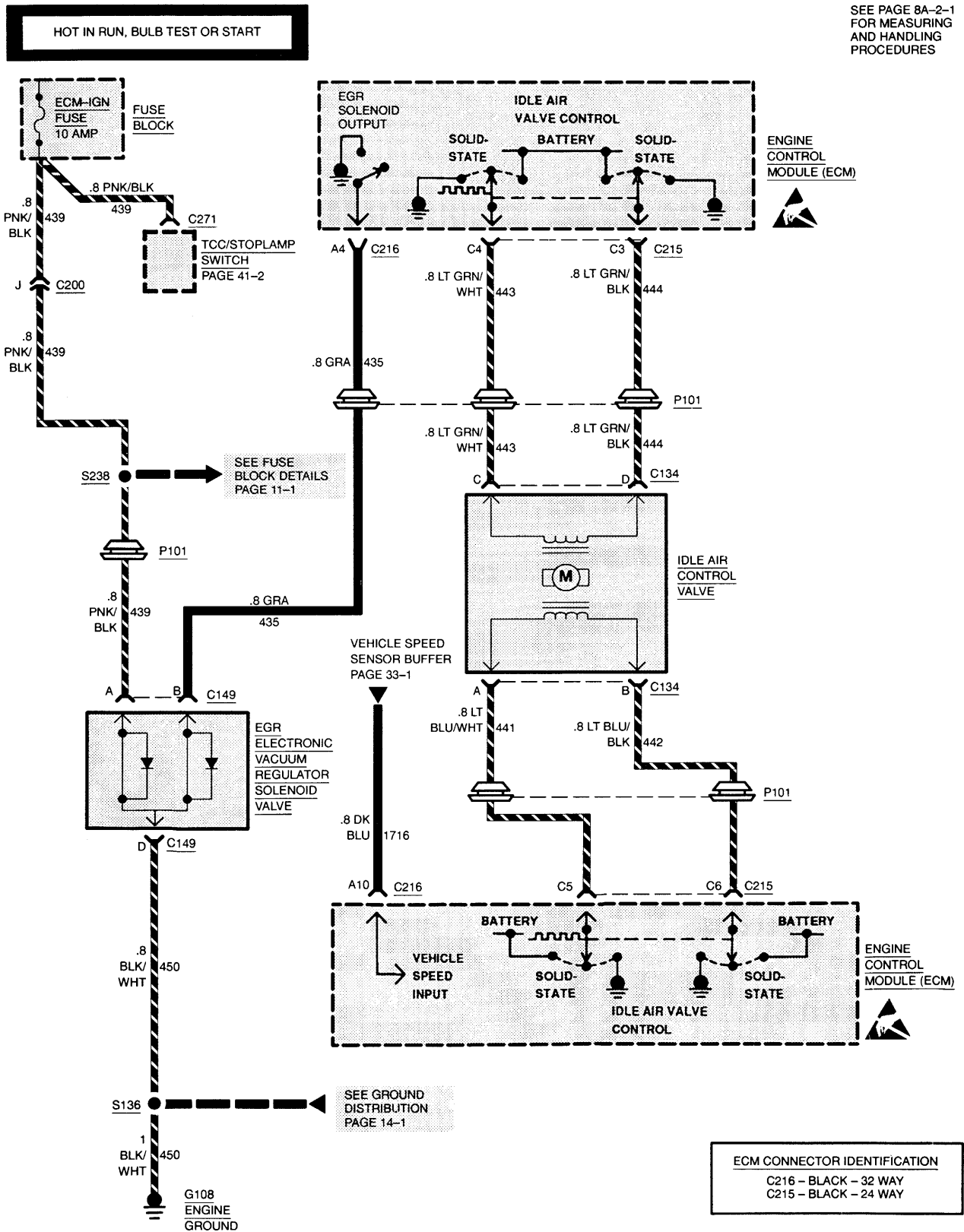
## W/MANUAL TRANSMISSION



# 8A-22B-4 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K W/MANUAL TRANSMISSION



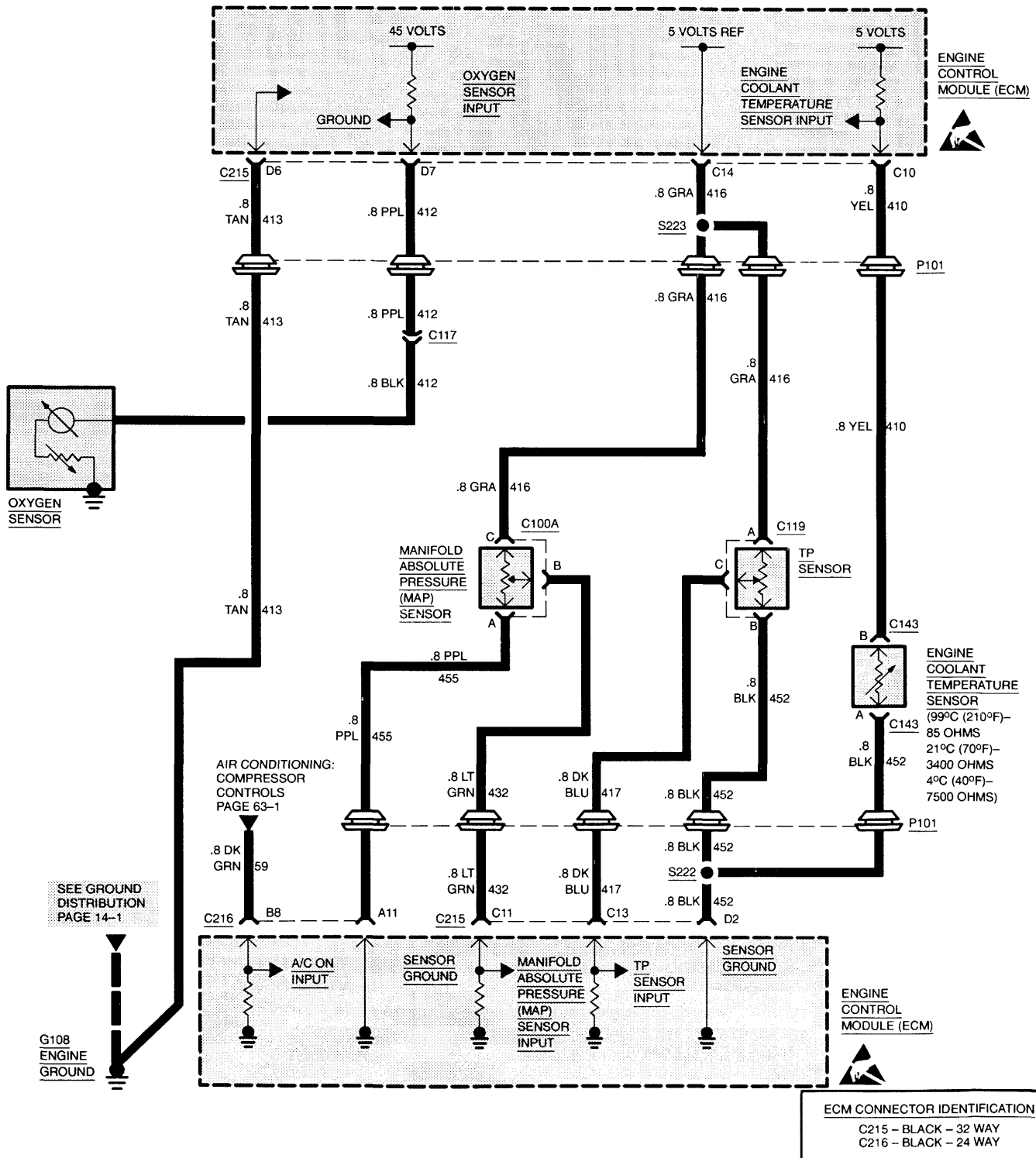
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



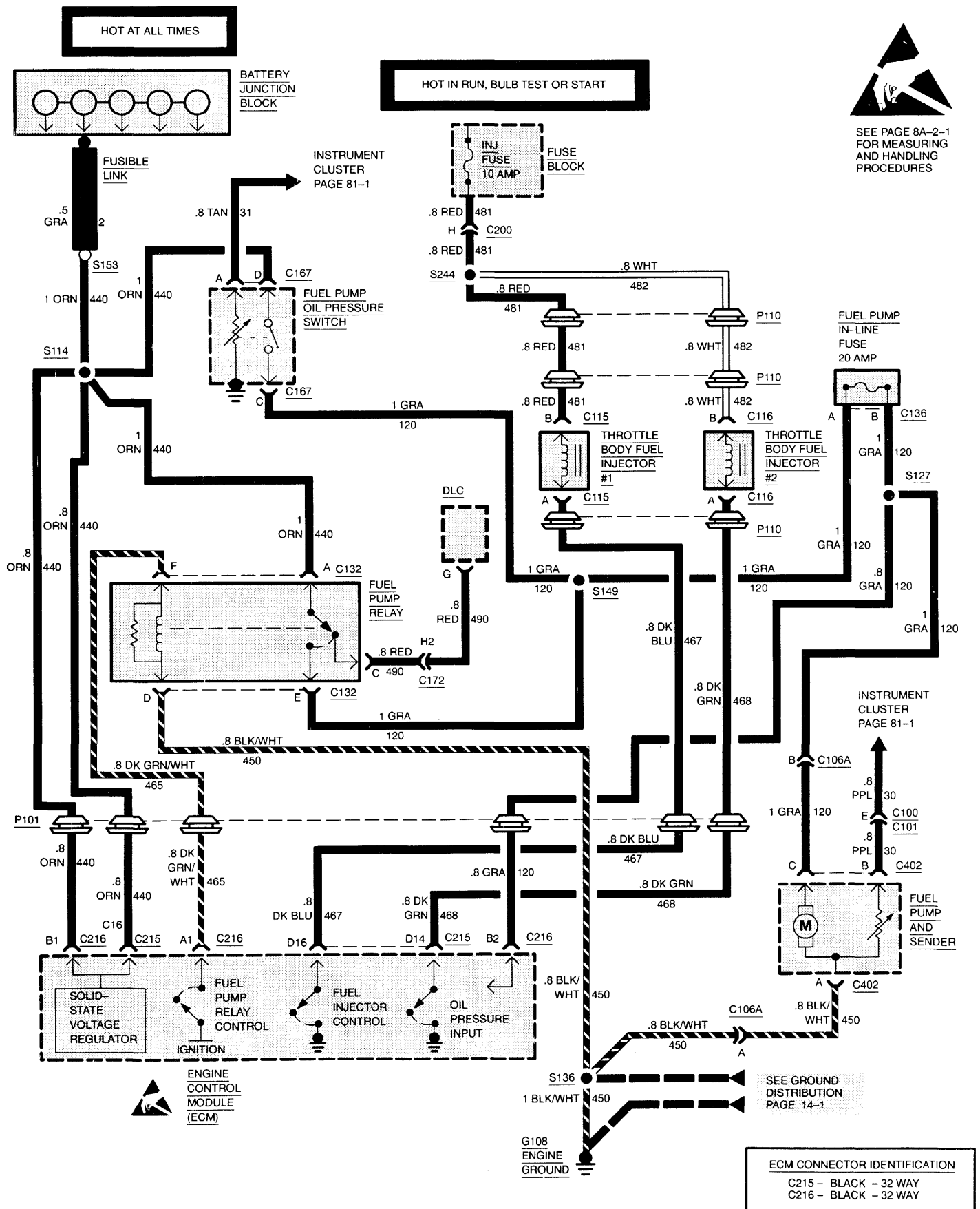
# ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K 8A-22B-5

## W/MANUAL TRANSMISSION

SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



# 8A-22B-6 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K W/MANUAL TRANSMISSION



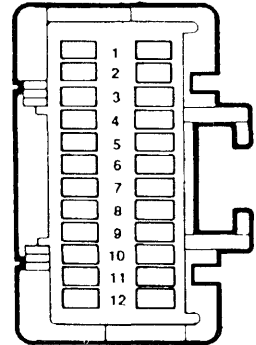
# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22B-7

## MANUAL TRANS

### POWERTRAIN CONTROL MODULE — 5.7L HD (350 CID) ENGINE W/MANUAL TRANSMISSION (32-PIN)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                       |
|-------------|-----------|------------|--------|---------------------------------------------------|
| 465         | .8        | DK GRN/WHT | A1     | FUEL PUMP RELAY DRIVE                             |
| 459         | .8        | DK GRN     | A2     | NOT USED                                          |
|             |           |            | A3     | NOT USED                                          |
| 435         | .8        | GRA        | A4     | EGR ELECTRONIC VACUUM<br>REGULATOR SOLENOID VALVE |
| 419         | .8        | BRN/WHT    | A5     | MALFUNCTION INDICATOR LAMP<br>CONTROL             |
| 439         | .8        | PNK/BLK    | A6     | 12V IGNITION (FUSED)                              |
| 456         | .8        | TAN/BLK    | A7     | UPSHIFT LAMP CONTROL                              |
| 461         | .8        | ORN        | A8     | DLC SERIAL DATA                                   |
| 451         | .8        | WHT/BLK    | A9     | DLC DIAGNOSTIC TEST                               |
| 1716        | .8        | DK BLU     | A10    | VEHICLE SPEED SENSOR BUFFER<br>SIGNAL             |
| 455         | .8        | PPL        | A11    | MAP SENSOR 5V RETURN GROUND                       |
| 450         | .8        | BLK/WHT    | A12    | SYSTEM GROUND                                     |
| 440         | .8        | ORN        | B1     | 12V BATTERY (FUSED)                               |
| 120         | .8        | GRA        | B2     | FUEL PUMP SIGNAL (INPUT)                          |
| 453         | .8        | BLK/RED    | B3     | DISTRIBUTOR REF LOW                               |
|             |           |            | B4     | NOT USED                                          |
| 430         | .5        | PPL/WHT    | B5     | DISTRIBUTOR REF HIGH                              |
|             |           |            | B6     | NOT USED                                          |
| 457         | .8        | YEL/BLK    | B7     | SPARK RETARD SIGNAL                               |
| 59          | .8        | DK GRN     | B8     | A/C REQUEST SIGNAL                                |
|             |           |            | B9     | NOT USED                                          |
|             |           |            | B10    | NOT USED                                          |
|             |           |            | B11    | NOT USED                                          |
|             |           |            | B12    | NOT USED                                          |

C216



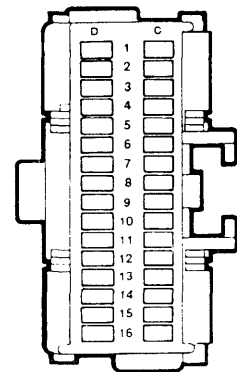


# 8A-22B-8 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K

## POWERTRAIN CONTROL MODULE — 5.7L HD (350 CID) ENGINE W/MANUAL TRANSMISSION (32-Pin)

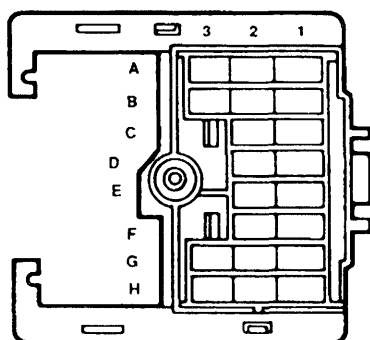
| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                                |
|-------------|-----------|------------|--------|------------------------------------------------------------|
|             |           |            | C1     | NOT USED                                                   |
|             |           |            | C2     | NOT USED                                                   |
| 444         | .8        | LTGRN/BLK  | C3     | IAC COIL B LOW                                             |
| 443         | .8        | LT GRN/WHT | C4     | IAC COIL B HIGH                                            |
| 441         | .8        | LT BLU/WHT | C5     | IAC COIL A HIGH                                            |
| 442         | .8        | LT BLU/BLK | C6     | IAC COIL A LOW                                             |
|             |           |            | C7     | NOT USED                                                   |
|             |           |            | C8     | NOT USED                                                   |
| 806         | .8        | PPL/WHT    | C9     | CRANK SIGNAL                                               |
| 410         | .8        | YEL        | C10    | ENGINE COOLANT TEMPERATURE<br>SENSOR SIGNAL                |
| 432         | .8        | LT GRN     | C11    | MAP SENSOR SIGNAL                                          |
|             |           |            | C12    | NOT USED                                                   |
| 417         | .5        | DK BLU     | C13    | TP SENSOR SIGNAL                                           |
| 416         | .5        | GRA        | C14    | 5V SENSOR REFERENCE                                        |
|             |           |            | C15    | NOT USED                                                   |
| 440         | .8        | ORN        | C16    | 12V BATTERY (FUSED)                                        |
| 450         | .8        | BLK        | D1     | SYSTEM GROUND                                              |
| 452         | .8        | BLK        | D2     | TP SENSOR AND ENGINE<br>COOLANT SENSOR 5V RETURN<br>GROUND |
|             |           |            | D3     | NOT USED                                                   |
| 423         | .5        | NAT/WHT    | D4     | IGNITION CONTROL (IC)                                      |
| 424         | .8        | TAN/BLK    | D5     | IC BYPASS                                                  |
| 413         | .5        | TAN        | D6     | OXYGEN SENSOR GROUND                                       |
| 412         | .5        | PPL        | D7     | OXYGEN SENSOR SIGNAL                                       |
|             |           |            | D8     | NOT USED                                                   |
|             |           |            | D9     | NOT USED                                                   |
|             |           |            | D10    | NOT USED                                                   |
|             |           |            | D11    | NOT USED                                                   |
|             |           |            | D12    | NOT USED                                                   |
|             |           |            | D13    | NOT USED                                                   |
| 468         | .8        | DK GRN     | D14    | INJECTOR 2 DRIVER                                          |
|             |           |            | D15    | NOT USED                                                   |
| 467         | .8        | DK BLU     | D16    | INJECTOR 1 DRIVER                                          |

**C215**



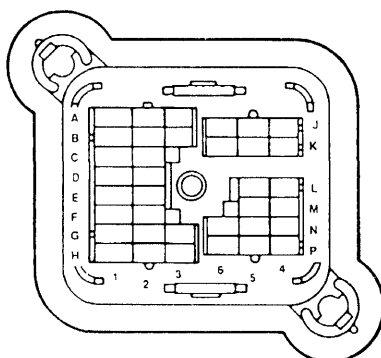
# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22B-9

12020183



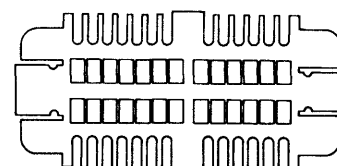
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector - Eng

12020184



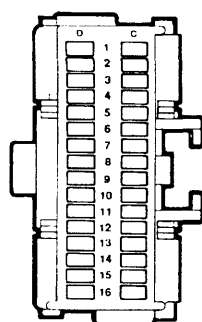
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Metri-Pack  
**C100**  
Bulkhead Connector - I/P

12089908



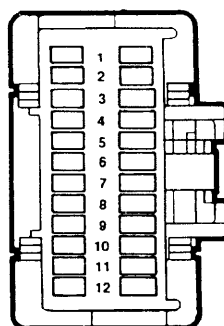
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12055575



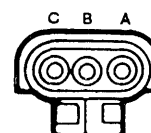
**C215**  
ECM

12097946



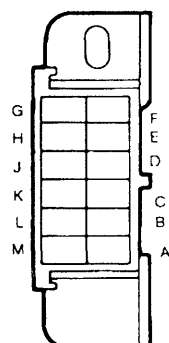
**C216**  
ECM

12020403



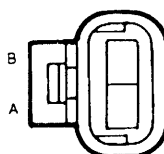
**BLACK**  
**C100A**  
MAP Sensor

12020043



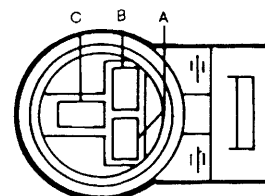
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Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

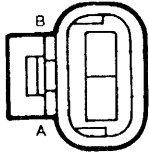
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**BLACK**  
Metri-Pack 150  
**C119**  
TP Sensor

## 8A-22B-10 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

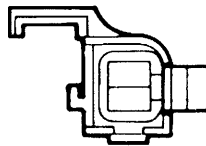
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**BLACK**  
Metri-Pack 150

**C143**  
Engine Coolant Temperature  
Sensor

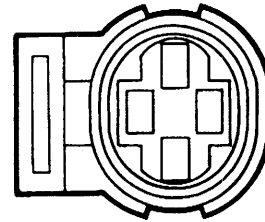
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**GRAY**  
Metri-Pack 280

**C111**  
Ignition Coil

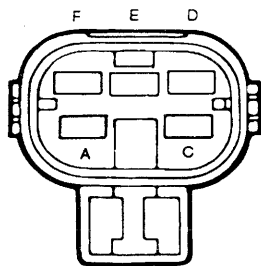
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**GRAY**  
Metri-Pack 150

**C167**  
Fuel Pump Oil Pressure Switch

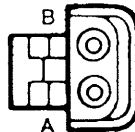
12052287



**BLACK**  
Metri-Pack

**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack

**C106A**  
Fuse to Fuel Pump and Sender

12015791



**BLACK**  
Weather Pack

**C114**  
Set Timing Connector

12010996



**BLACK**  
Weather Pack

**C114**  
Set Timing Connector

12015791



**BLACK**  
Weather Pack

**C117**  
Oxygen Sensor

12010996

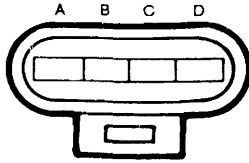


**BLACK**  
Weather Pack

**C117**  
Oxygen Sensor

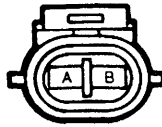
# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-22B-11

12040754



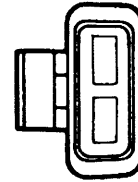
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Metri-Pack 150  
**C134**  
Idle Air Control Valve

12052641



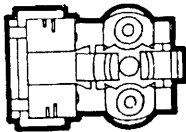
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Metri-Pack 150  
**C149**  
EGR Solenoid

12066681



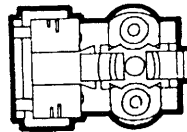
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



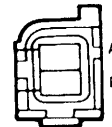
**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

12040706



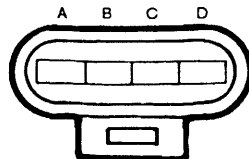
**C145**  
Ignition Coil

12015375



**GRAY**  
**C144**  
Knock Sensor

12040754



**BLACK**  
Metri-Pack 150  
**C113**  
Distributor

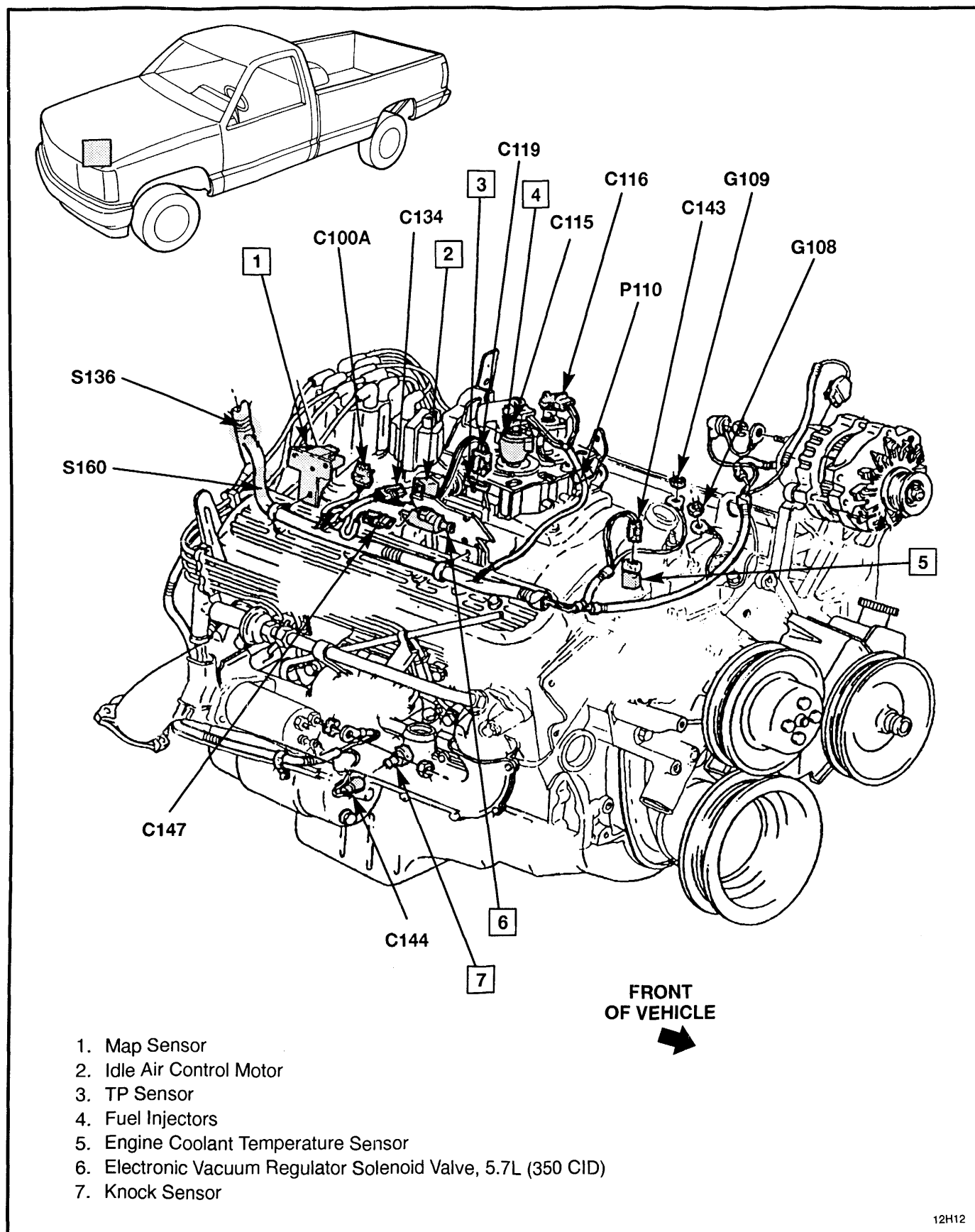


Figure 1 — RH Side of Engine, HD 5.7L (350 CID) Engine — Gasoline

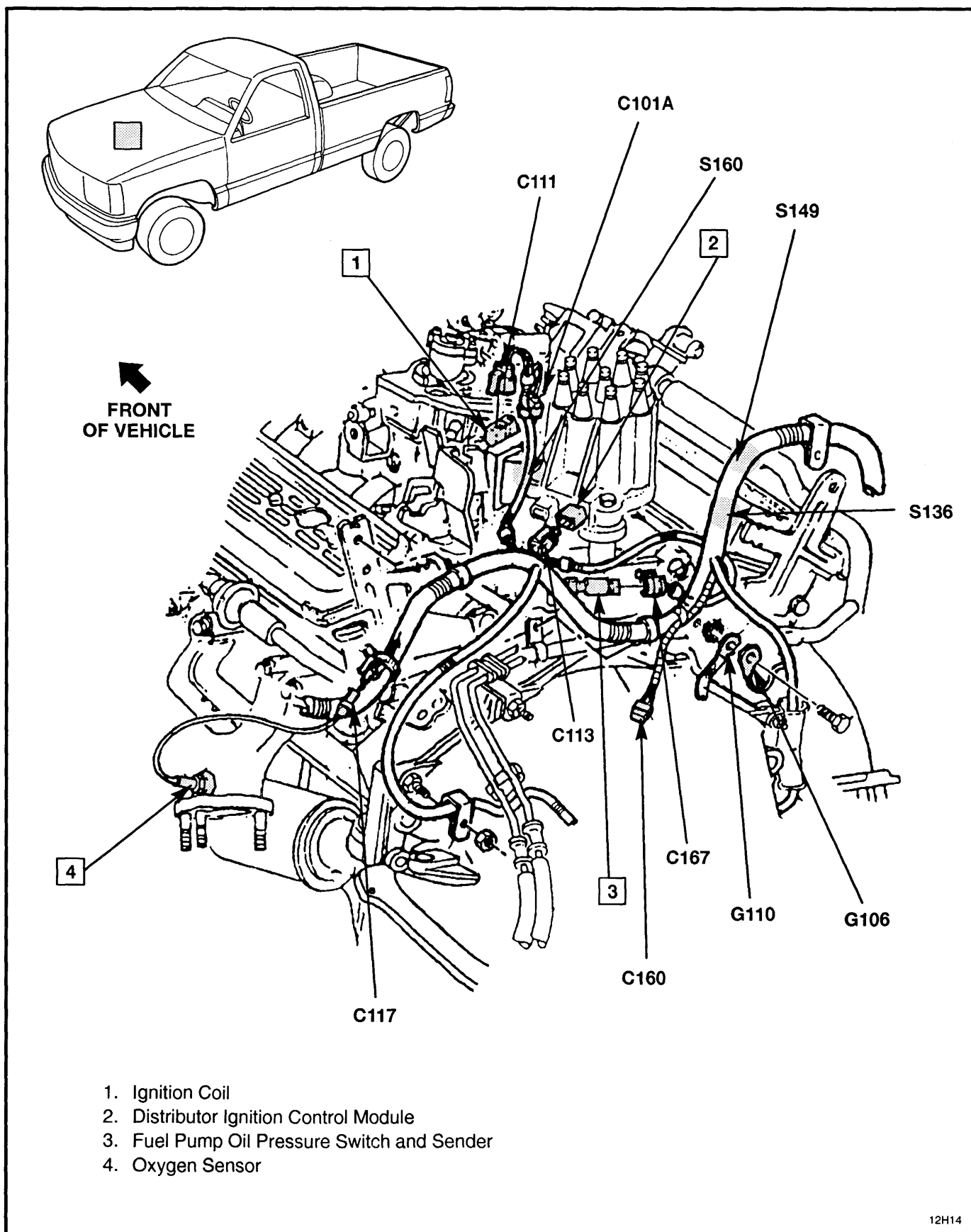


Figure 2 — HD 5.7L Engine Wiring, Rear

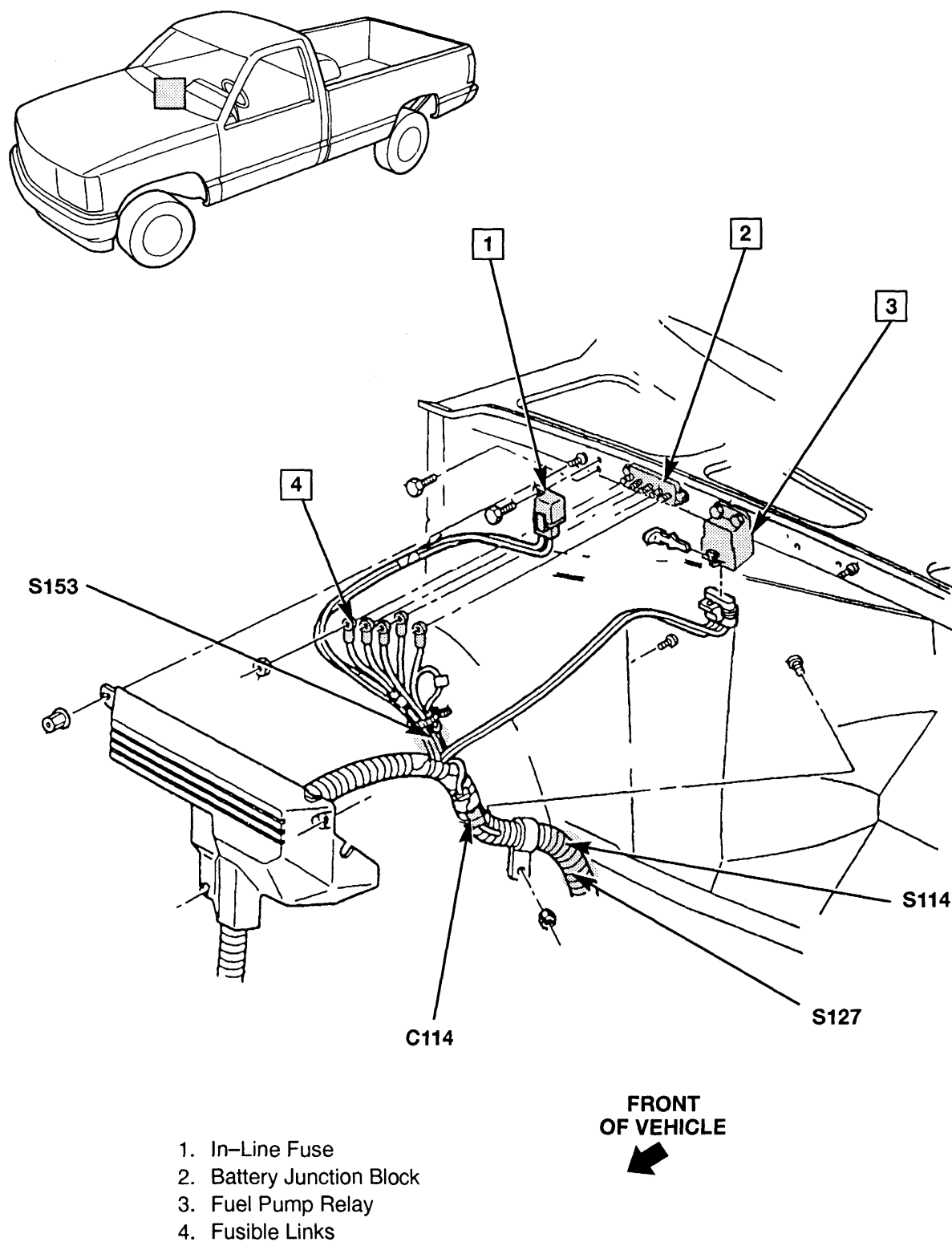


Figure 3 — Battery Junction Block and Relay Wiring

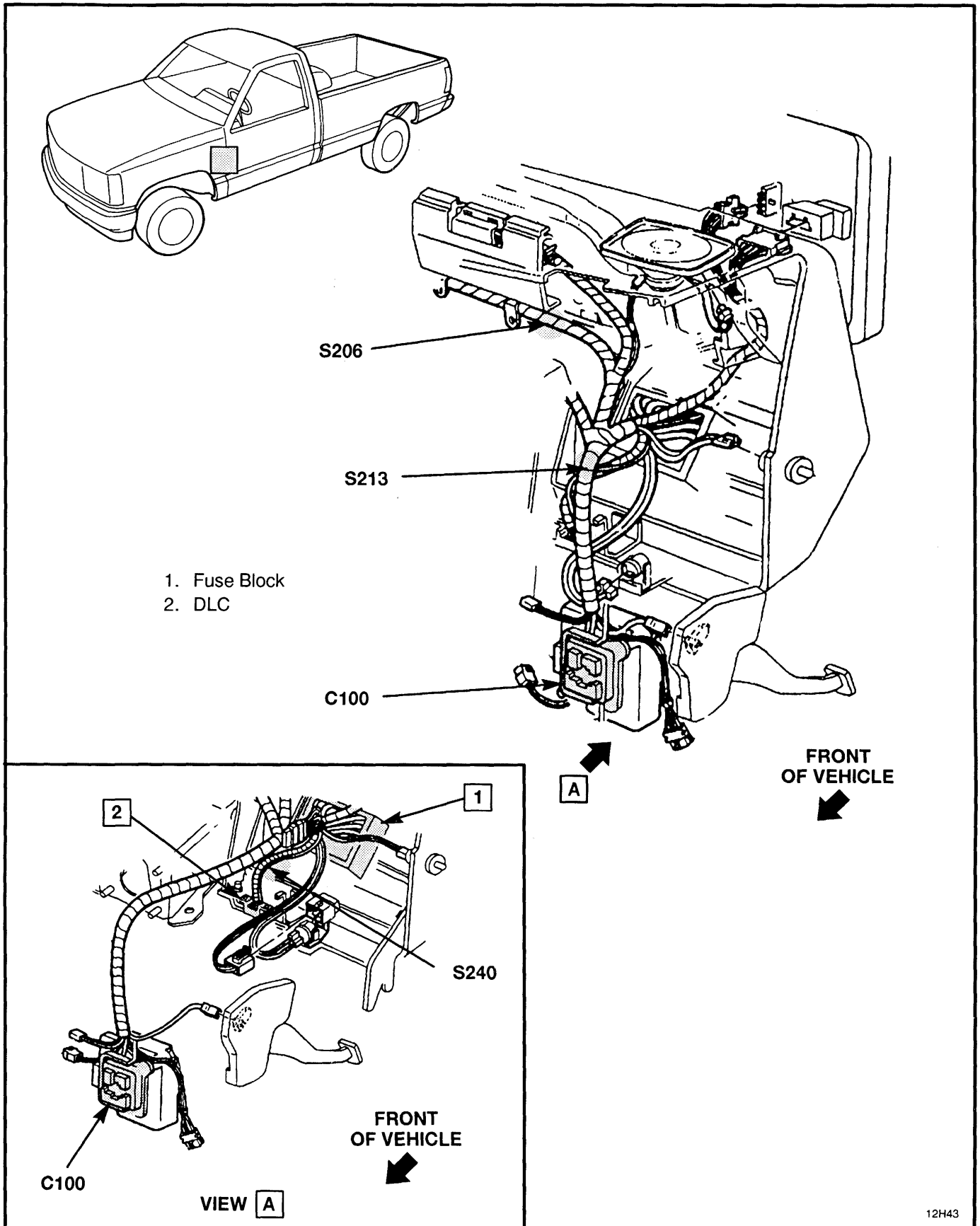


Figure 4 — Instrument Panel, LH Side



## 8A-22B-16 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

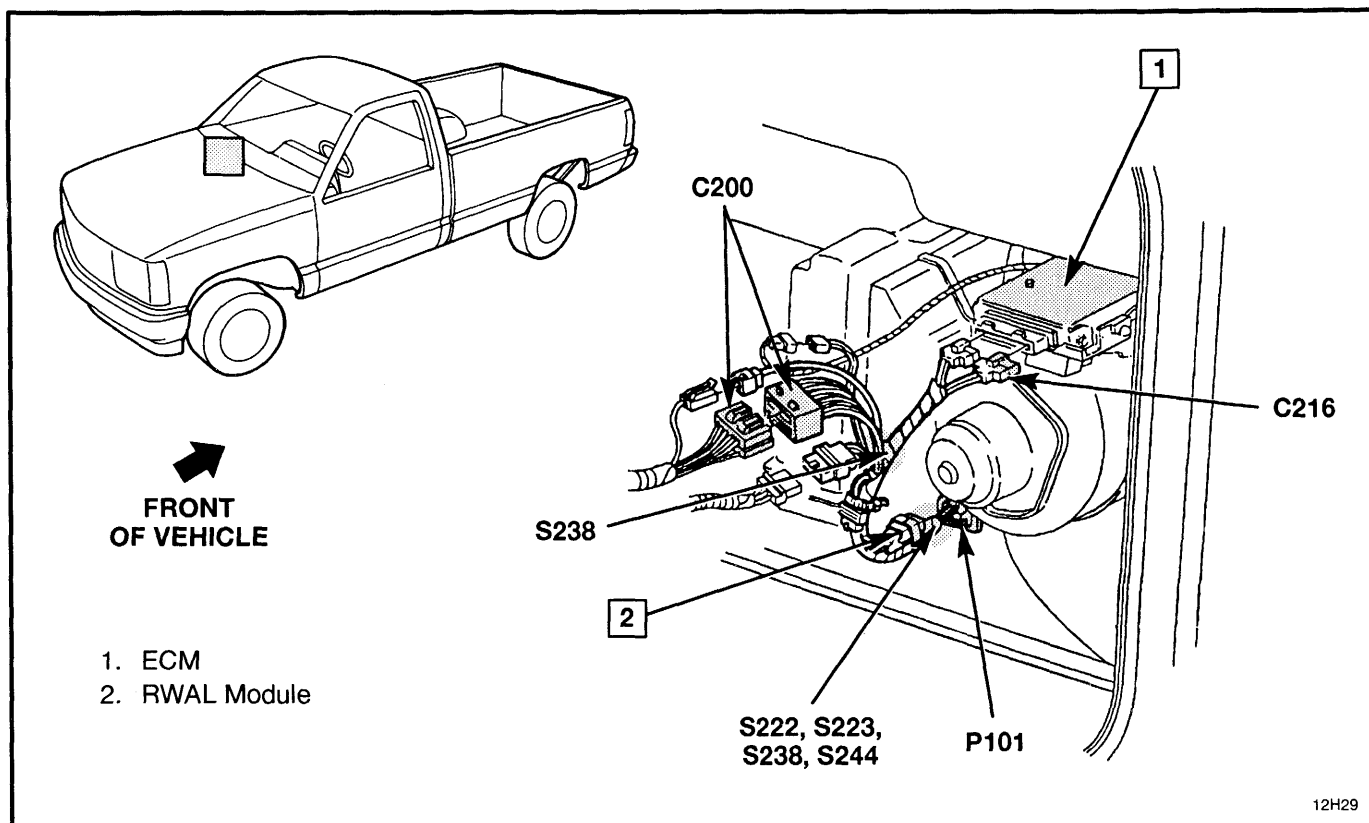


Figure 5 — Behind RH Side of I/P

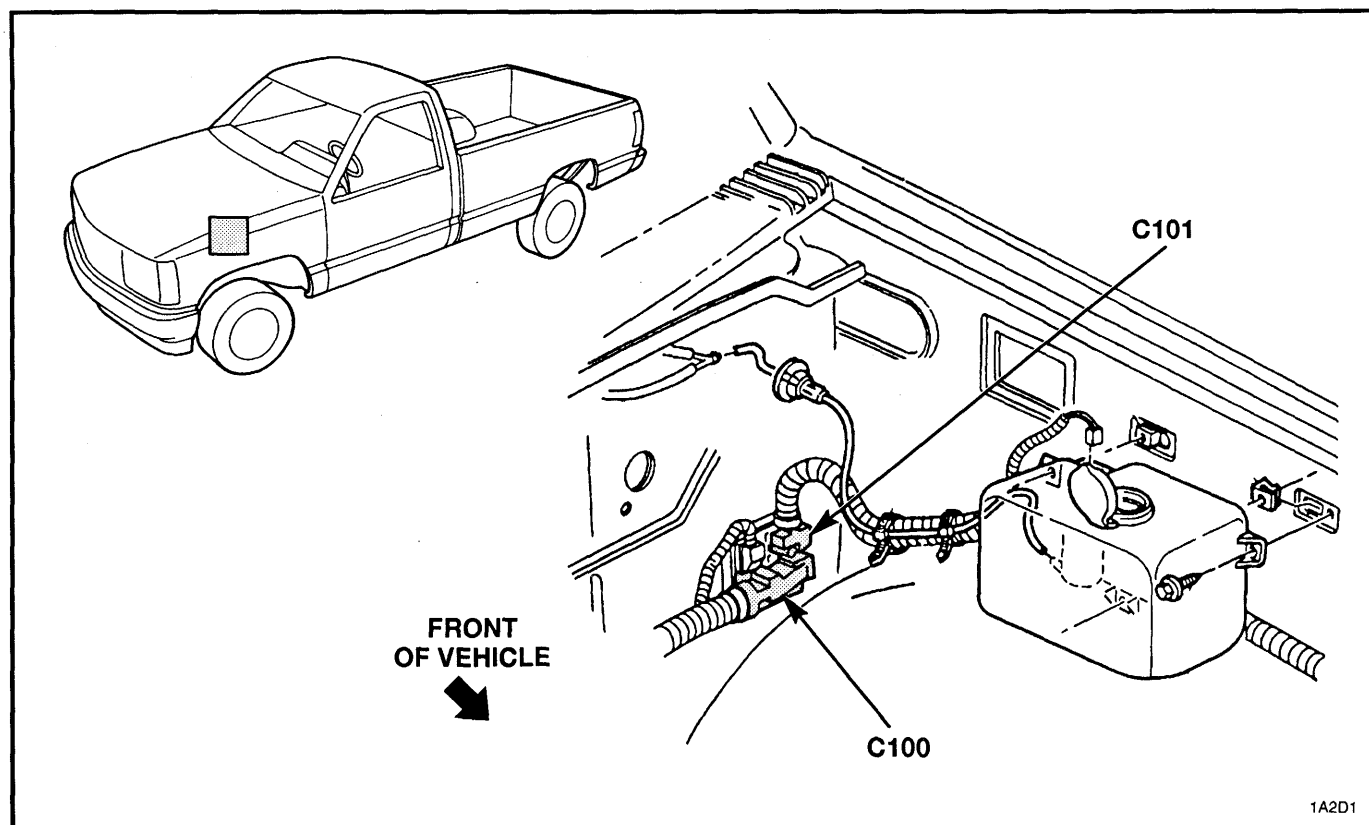


Figure 6 — Cowl Wiring, LH Side

# ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K 8A-23-1

## AUTOMATIC TRANSMISSION

### COMPONENT LOCATION

### Page — Figure

|                                                        |                                             |           |   |
|--------------------------------------------------------|---------------------------------------------|-----------|---|
| Battery Junction Block                                 | RH rear engine compartment, at cowl         | 23-20     | 6 |
| Distributor Ignition Control Module                    | Center rear of engine                       | 23-19     | 5 |
| DLC                                                    | Below LH side of I/P                        | 23-17     | 3 |
| EGR Electronic Vacuum Regulator Solenoid Valve (W/MT1) | Top of engine RH side                       | 23-18     | 4 |
| EGR Solenoid Valve (W/M30)                             | LH rear top of engine                       | Not Shown |   |
| Engine Coolant Temperature Sensor                      | RH top front of engine                      | 23-18     | 4 |
| Fuel Pump and Sender                                   | Inside fuel tank                            | Not Shown |   |
| Fuel Pump Oil Pressure Switch and Sender               | LH rear of engine, near exhaust manifold    | 23-19     | 5 |
| Fuel Pump Relay                                        | RH rear of engine compartment, near battery | 23-20     | 6 |
| Fuse Block                                             | Lower LH side of I/P                        | 23-17     | 3 |
| Idle Air Control Motor                                 | RH rear of TBI unit                         | 23-18     | 4 |
| Ignition Coil                                          | Center rear of engine                       | 23-19     | 5 |
| Instrument Cluster                                     | LH side of I/P                              | Not Shown |   |
| Knock Sensor                                           | RH side of engine, below exhaust manifold   | 23-18     | 4 |
| MAP Sensor                                             | RH rear top of engine                       | 23-18     | 4 |
| Oxygen Sensor                                          | In LH exhaust manifold                      | 23-19     | 5 |
| PCM                                                    | Under RH end of I/P                         | 23-21     | 8 |
| TCC Stoplamp Switch                                    | Top of brake pedal                          | 23-16     | 2 |
| Throttle Body Fuel Injector #1                         | Top of throttle body unit                   | 23-18     | 4 |
| Throttle Body Fuel Injector #2                         | Top of throttle body unit                   | 23-18     | 4 |
| TP Sensor                                              | RH side of TBI                              | 23-18     | 4 |
| Transmission Input Speed Sensor                        | LH side of transmission                     | 23-21     | 9 |

### CONNECTORS:

|       |                                                    |           |   |
|-------|----------------------------------------------------|-----------|---|
| C100  | At bulkhead connector                              | 23-17     | 3 |
| C101  | At bulkhead connector C100                         | 23-21     | 7 |
| C106A | Near LH lower cowl (engine compartment)            | Not Shown |   |
| C114  | Center of cowl, under battery junction block cover | 23-20     | 6 |
| C200  | Under RH side of I/P, near blower motor            | 23-21     | 8 |

### GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 23-21 | 8 |
|------|------------------------------------|-------|---|

### GROUND:

|      |                          |       |   |
|------|--------------------------|-------|---|
| G106 | Rear of RH cylinder head | 23-19 | 5 |
| G108 | LH top front of engine   | 23-18 | 4 |
| G109 | LH top front of engine   | 23-18 | 4 |

### SPLICES:

|      |                                                      |       |   |
|------|------------------------------------------------------|-------|---|
| S114 | RH rear engine compartment, near A/C accumulator     | 23-20 | 6 |
| S118 | Engine harness, near cowl LH rear engine compartment | 23-19 | 5 |
| S127 | Near P101, RH cowl                                   | 23-19 | 5 |
| S136 | Rear of engine compartment, near center              | 23-18 | 4 |
| S153 | Center of cowl, below battery junction block         | 23-20 | 6 |
| S160 | Upper rear of engine                                 | 23-19 | 5 |
| S206 | Under LH side of I/P                                 | 23-17 | 3 |
| S213 | Under LH side of I/P                                 | 23-17 | 3 |

## **8A-23-2 ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K**

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### **AUTOMATIC TRANSMISSION**

#### **COMPONENT LOCATION**

**Page — Figure**

#### **SPLICES (Continued):**

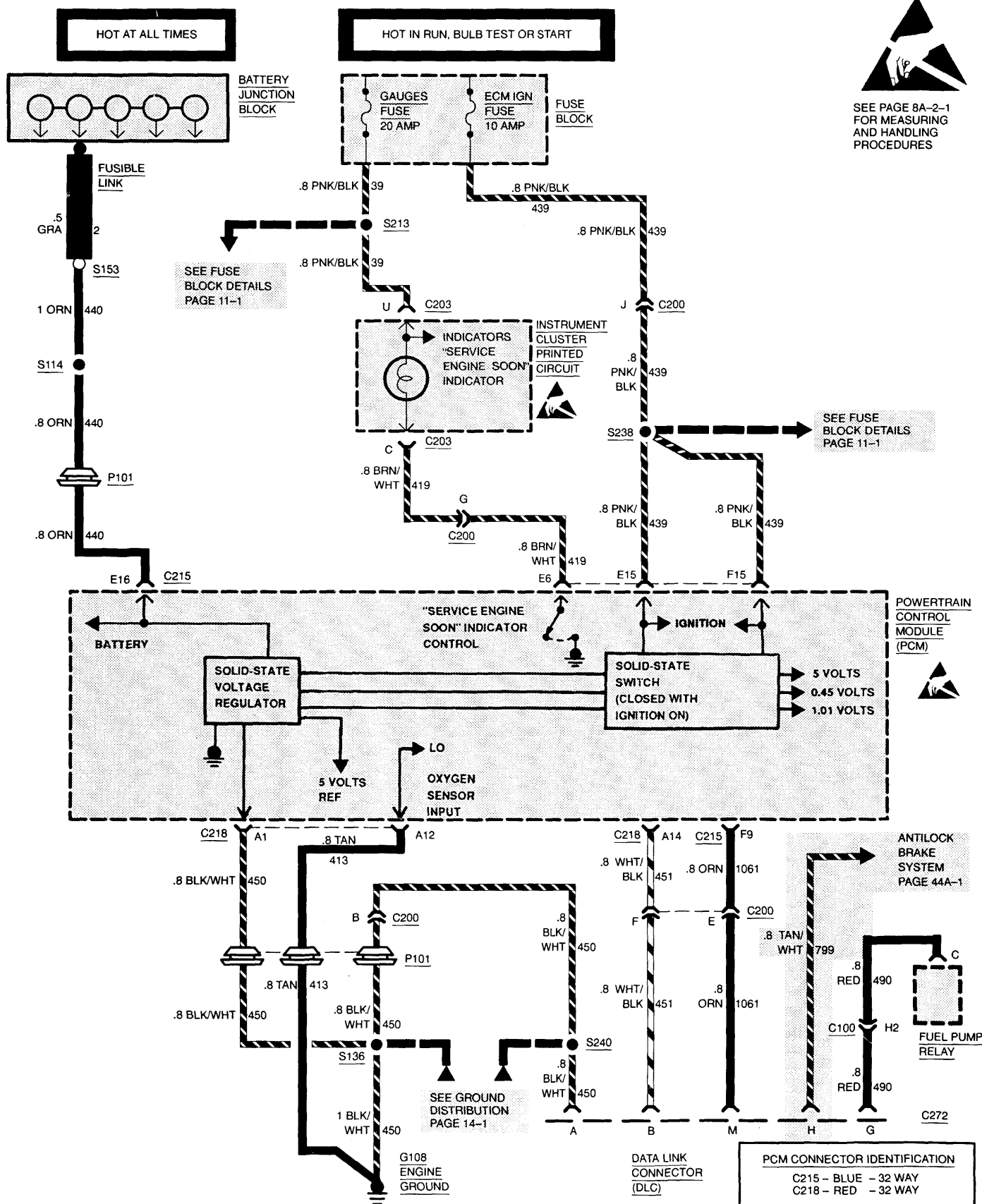
|      |       |                                |       |       |   |
|------|-------|--------------------------------|-------|-------|---|
| S222 | ..... | Near PCM, under RH side of I/P | ..... | 23-21 | 9 |
| S238 | ..... | Engine harness, near PCM       | ..... | 23-21 | 8 |
| S243 | ..... | Engine harness, near P101      | ..... | 23-21 | 8 |
| S244 | ..... | Engine harness, near P101      | ..... | 23-21 | 8 |

# ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K 8A-23-3

## W/AUTOMATIC AND HD AUTOMATIC TRANSMISSIONS



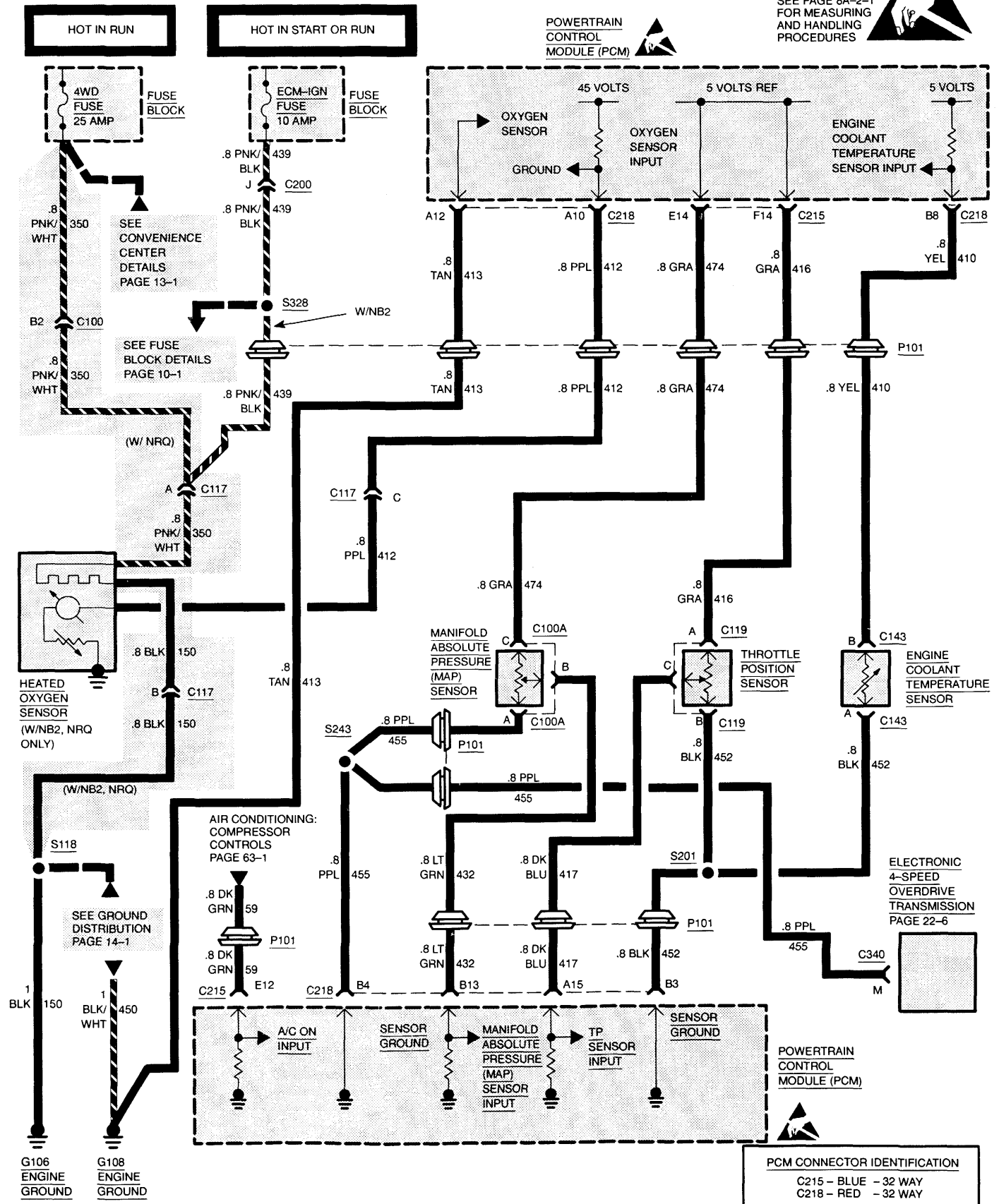
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



# 8A-23-4 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K

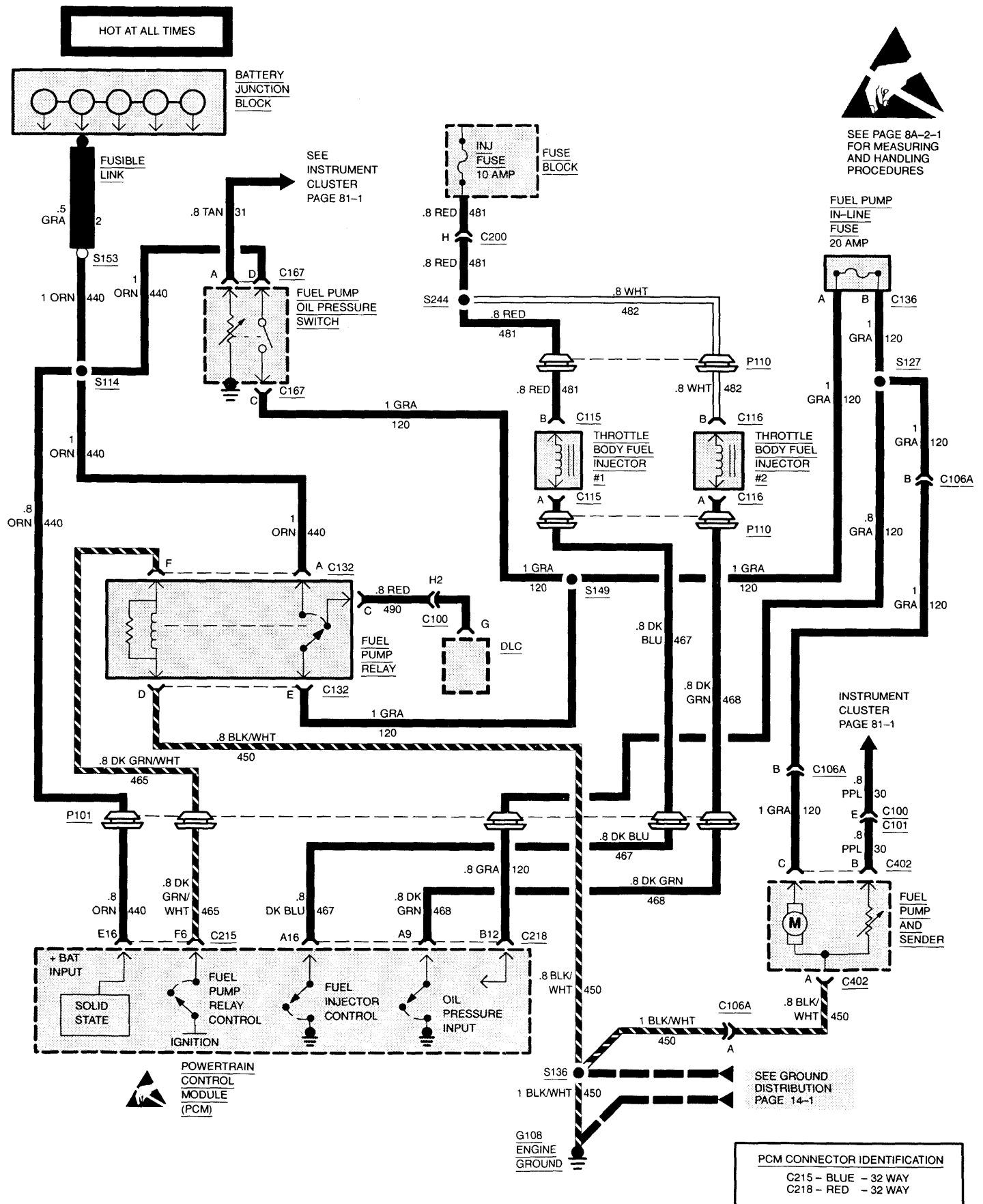
## W/AUTOMATIC AND HD AUTOMATIC TRANSMISSION

SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

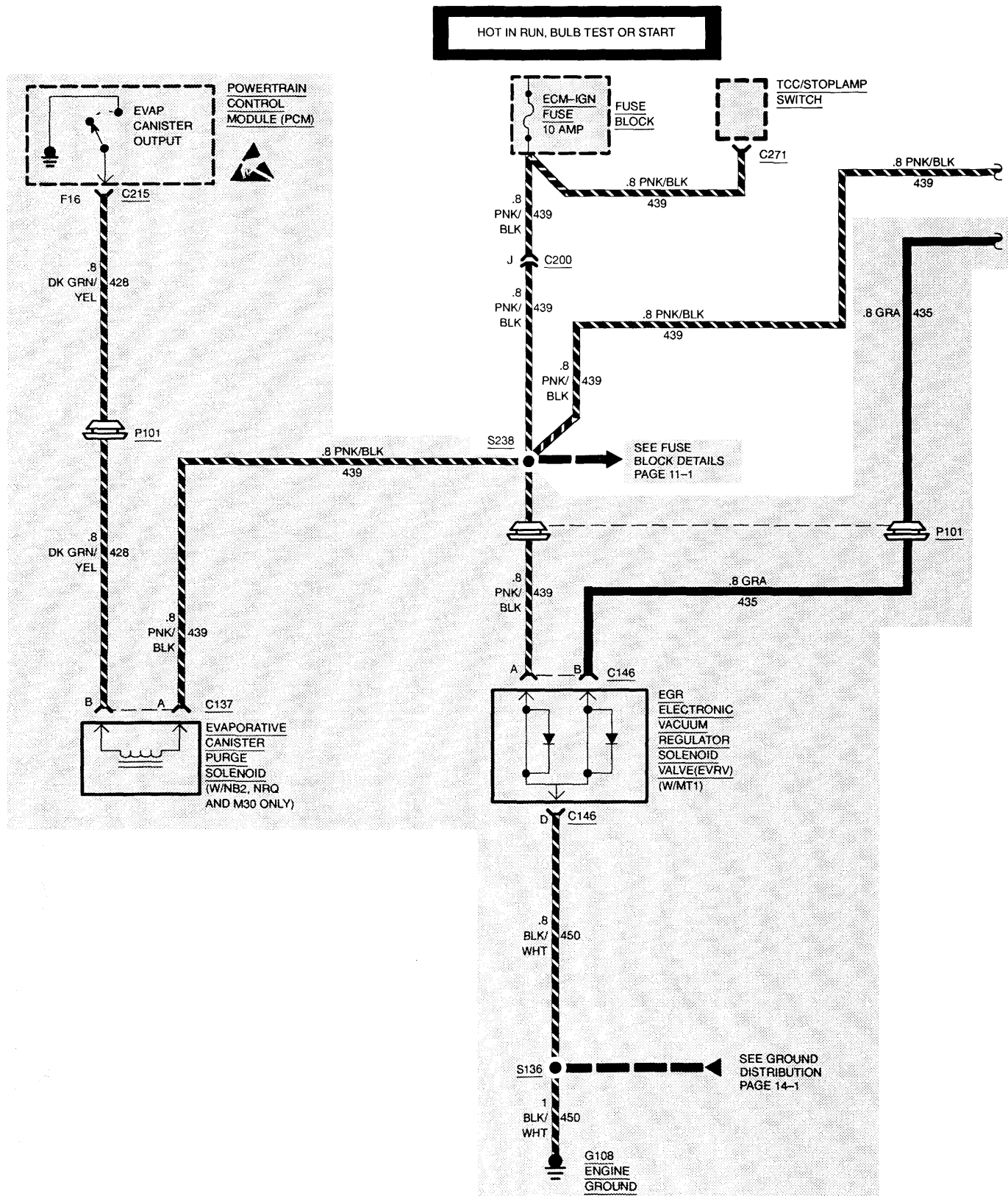


# ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K 8A-23-5

## W/AUTOMATIC AND HD AUTOMATIC TRANSMISSIONS



**8A-23-6 ENGINE CONTROLS 5.7L HD (350 CID) V8 VIN K**  
**W/AUTOMATIC AND HD AUTOMATIC TRANSMISSION**

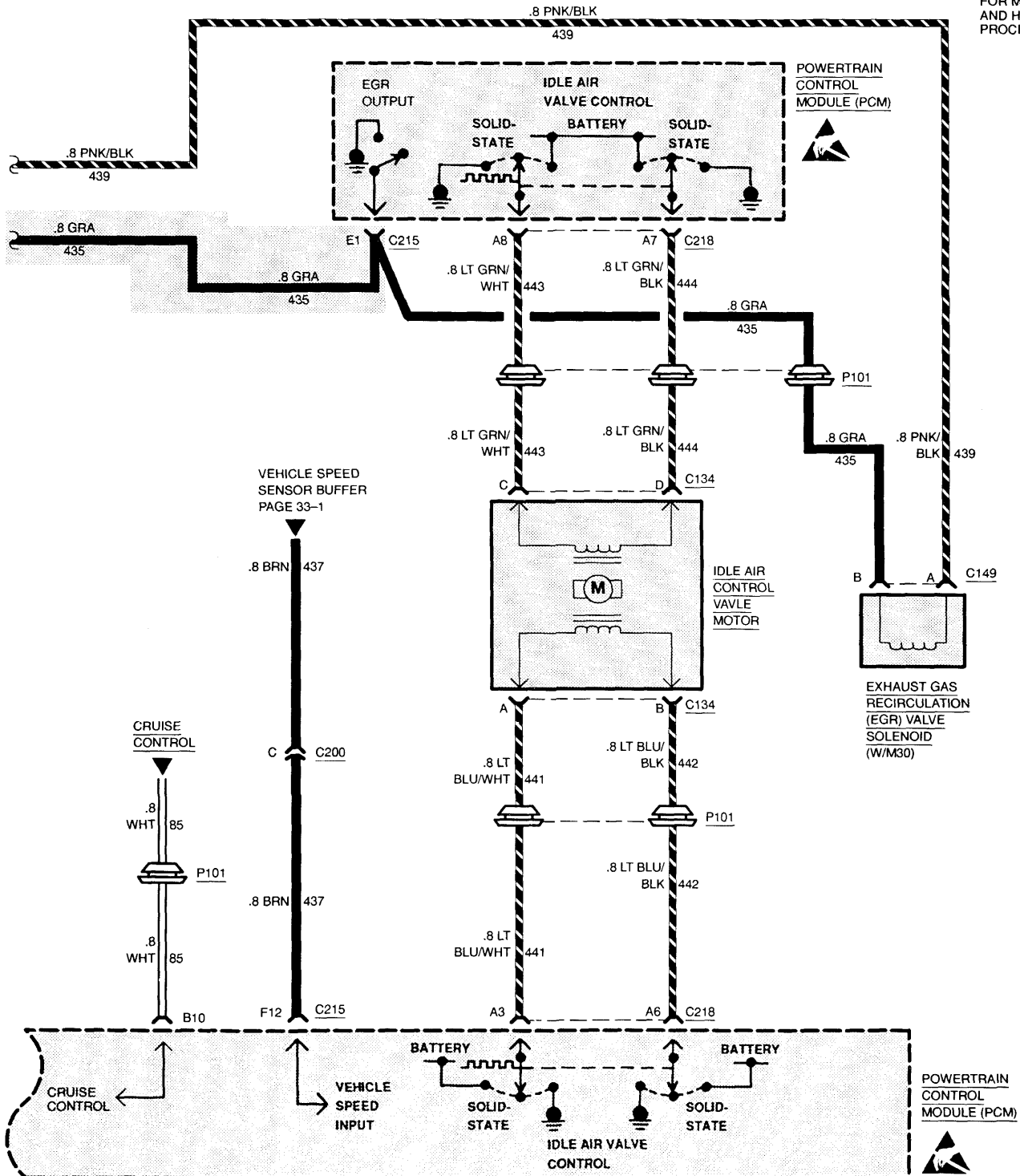


# ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K 8A-23-7

## W/AUTOMATIC AND HD AUTOMATIC TRANSMISSION



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

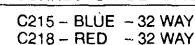
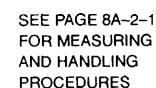


### PCM CONNECTOR IDENTIFICATION

C215 - BLUE - 32 WAY  
C218 - RED - 32 WAY



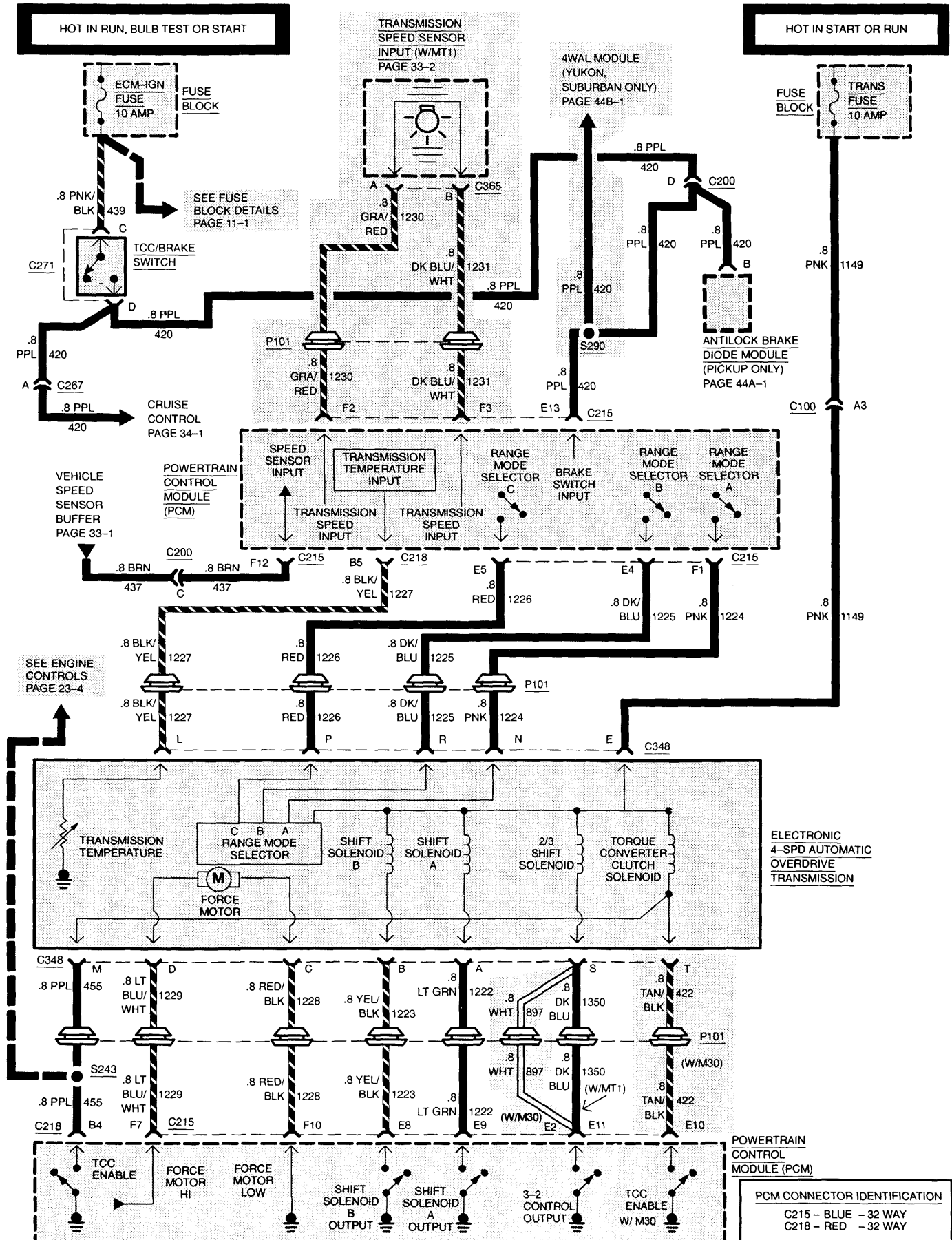
## W/AUTOMATIC AND HD AUTOMATIC TRANSMISSION



C218 - RED - 32 WAY

# ENGINE CONTROLS 5.7L, 5.7L HD (350 CID) V8 VIN K 8A-23-9

## W/AUTOMATIC OR HD AUTOMATIC TRANSMISSION

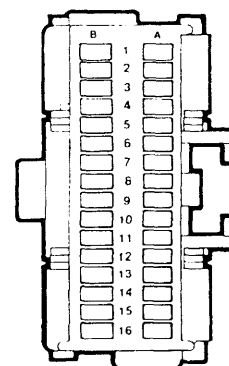


# 8A-23-10 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

## POWERTRAIN CONTROL MODULE – 5.7L HD (350 CID) ENGINE W/HD AUTO TRANSMISSION (32-PIN RED)

| CIRCUIT NO. | WIRE SIZE | COLOR       | CAVITY | DESCRIPTION                          |
|-------------|-----------|-------------|--------|--------------------------------------|
| 450         | 1.0       | BLK/WHT     | A1     | SYSTEM GROUND                        |
| 551         | 1.0       | TAN/WHT     | A2     | SYSTEM GROUND                        |
| 441         | .8        | LT BLU/WHT  | A3     | STEPPER COIL A HIGH                  |
| 430         | .8        | PPL/WHT     | A4     | DISTRIBUTOR REF HIGH                 |
| 453         | .8        | BLK/RED     | A5     | DISTRIBUTOR REF LOW                  |
| 442         | .8        | LT BLU/BLK  | A6     | STEPPER COIL A LOW                   |
| 444         | .8        | LT GRN/ BLK | A7     | STEPPER COIL B LOW                   |
| 443         | .8        | LT GRN/WHT  | A8     | STEPPER COIL B HIGH                  |
| 468         | .8        | DK GRN      | A9     | LOW SIDE INJ B                       |
| 412         | .8        | PPL         | A10    | OXYGEN SENSOR HIGH                   |
|             |           |             | A11    | NOT USED                             |
| 413         | .8        | TAN         | A12    | OXYGEN SENSOR LOW                    |
|             |           |             | A13    | NOT USED                             |
| 451         | .8        | WHT/BLK     | A14    | DLC                                  |
| 417         | .8        | DK BLU      | A15    | TRHOTTLE POSITION SENSOR             |
| 467         | .8        | DK BLU      | A16    | LOW SIDE INJ A                       |
|             |           |             | B1     | NOT USED                             |
| 424         | .8        | TAN/BLK     | B2     | IGNITION BYPASS                      |
| 452         | .8        | BLK         | B3     | 5V RETURN B                          |
| 455         | .8        | PPL         | B4     | 5V SYSTEM RETURN A                   |
| 1227        | .8        | BLK/YEL     | B5     | PCM TO TRANS TEMP SENSOR             |
|             |           |             | B6     | NOT USED                             |
|             |           |             | B7     | NOT USED                             |
| 410         | .8        | YEL         | B8     | ENGINE COOLANT TEMPERATURE<br>SENSOR |
|             |           |             | B9     | NOT USED                             |
| 85          | .8        | WHT         | B10    | CRUS IND REG CNTRLD GRD              |
|             |           |             | B11    | NOT USED                             |
| 120         | 1.0       | GRA         | B12    | ELEC FUEL PUMP – INPUT               |
| 432         | .8        | LT GRN      | B13    | MANIFOLD ABSOLUTE PRESSURE<br>SENSOR |
|             |           |             | B14    | NOT USED                             |
| 496         | .8        | DK BLU      | B15    | KNOCK SENSOR                         |
|             |           |             | B16    | NOT USED                             |

**C218  
RED**

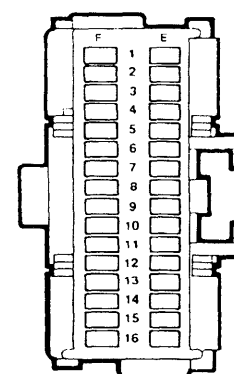


# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-23-11

## POWERTRAIN CONTROL MODULE – 5.7L HD, 5.7L (350 CID) ENGINE W/HD AUTOMATIC TRANSMISSION (32-PIN BLUE)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                                       |
|-------------|-----------|------------|--------|---------------------------------------------------|
| *435        | .8        | GRA        | E1     | EGR ELECTRONIC VACUUM<br>REGULATOR SOLENOID VALVE |
| ●435        | .8        | GRA        | E1     | EXHAUST GAS RECIRCULATION<br>(EGR) VALVE SOLENOID |
| ●897        | .8        | WHT        | E2     | TRANS SHIFT 2/3 SOL                               |
|             |           |            | E3     | NOT USED                                          |
| 1225        | .8        | DK BLU     | E4     | PCM TRANS RANGE MODE B                            |
| 1226        | .8        | RED        | E5     | PCM TRANS RANGE MODE C                            |
| 419         | .8        | BRN/WHT    | E6     | MALFUNCTION INDICATOR LAMP                        |
|             |           |            | E7     | NOT USED                                          |
| 1223        | .8        | YEL/BLK    | E8     | PCM TRANS SHIFT SOL B                             |
| 1222        | .8        | LT GRN     | E9     | PCM TRANS SHIFT SOL A                             |
| 422         | .8        | TAN/BLK    | E10    | TORQUE CONVERTER CLUTCH                           |
| *1350       | .8        | DK BLU     | E11    | 2/3 SHIFT SOLENOID                                |
| 59          | .8        | DK GRN     | E12    | AIR CONDITIONING                                  |
| 420         | .8        | PPL        | E13    | BRAKE SW TO PCM                                   |
| 474         | .8        | GRA        | E14    | 5V REF VOLTAGE                                    |
| 439         | .8        | PNK/BLK    | E15    | 12V IGNITION FUSED                                |
| 440         | 1.0       | ORN        | E16    | 12 BATTERY FUSED                                  |
| 1224        | .8        | PNK        | F1     | PCM TRANS RANGE MODE A                            |
|             |           |            | F2     | NOT USED                                          |
|             |           |            | F3     | NOT USED                                          |
|             |           |            | F4     | NOT USED                                          |
|             |           |            | F5     | NOT USED                                          |
| 465         | .8        | DK GRN/WHT | F6     | FUEL PUMP RELAY DRIVE                             |
| 1229        | .8        | LT BLU/WHT | F7     | PCM TRANS FORCE MTR LOW                           |
| 1493        | .8        | DK BLU     | F8     | SHIFT PERFORMANCE SELECT<br>SWITCH INPUT          |
| 1061        | .8        | ORN/BLK    | F9     | DLC SERIAL DATA                                   |
| 1228        | .8        | RED/BLK    | F10    | PCM TRANS FORCE MOTOR<br>HIGH                     |
| 423         | .8        | WHT        | F11    | IGNITION CONTROL (IC)                             |
| 1697        | .8        | BRN/WHT    | F12    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL             |
| 437         | .8        | BRN        | F13    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL             |
| 416         | .8        | GRA        | F14    | 5V SENSOR REF                                     |
| □439        | .8        | PNK/BLK    | F15    | 12V IGNITION FUSED                                |
| ●428        | .8        | DK GRN/YEL | F16    | EVAPORATIVE CANISTER PURGE<br>CONTROL             |

C215  
BLUE



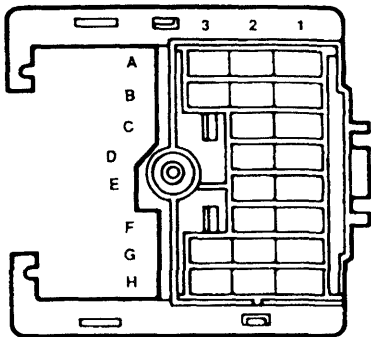
\* W/HD 5.7L ENGINE AND HD AUTOMATIC TRANSMISSION

● W/LD AUTOMATIC TRANSMISSION

□ SUBURBAN, YUKON ONLY

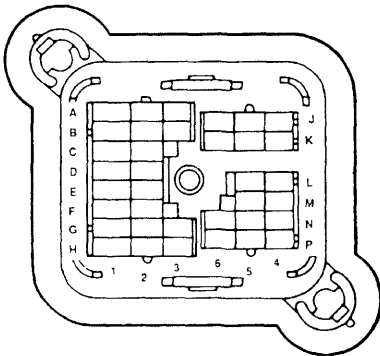
8A-23-12 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

12020183



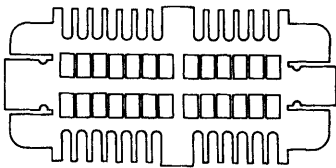
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



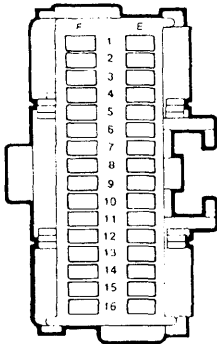
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12089908



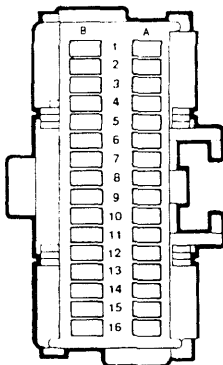
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12110115



**BLUE**  
Metri-Pack 280  
**C215**  
PCM

12110113



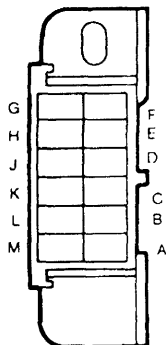
**RED**  
Metri-Pack 280  
**C218**  
PCM

12020403



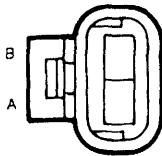
**BLACK**  
**C100A**  
MAP Sensor

12020043



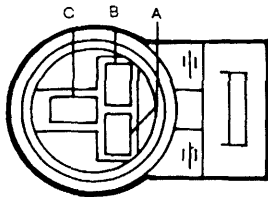
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

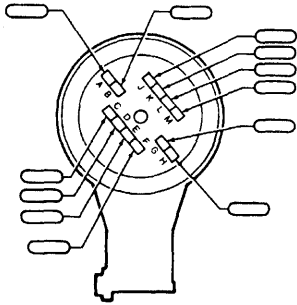
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**BLACK**  
Metri-Pack 150  
**C119**  
TP Sensor

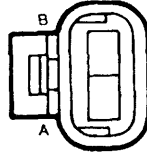
# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-23-13

12084690



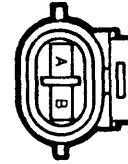
**C348**  
Transmission

12078084



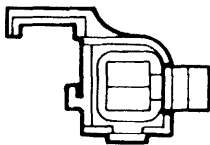
**BLACK**  
Metri-Pack 150  
**C143**  
Engine Coolant Temperature  
Sensor

12052643



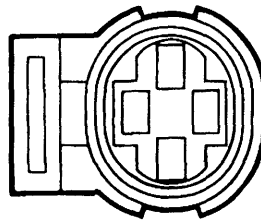
**RED**  
Metri-Pack 150  
**C137**  
Evaporative Cansiter Purge  
Solenoid

12040705



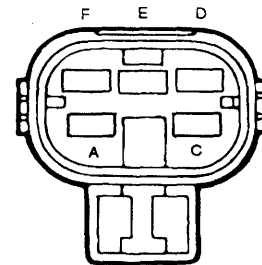
**GRAY**  
Metri-Pack 280  
**C111**  
Ignition Coil

12065401



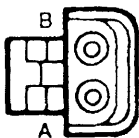
**GRAY**  
Metri-Pack 150  
**C167**  
Fuel Pump Oil Pressure Switch

12052287



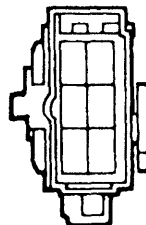
**BLACK**  
Metri-Pack  
**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack  
**C106A**  
Fuse to Fuel Pump and Sender

12020099



**C101**  
Bulkhead - Rear Lamps

12015791



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

# 8A-23-14 ENGINE CONTROLS 5.7L (350 CID) V8 VIN K

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12015791



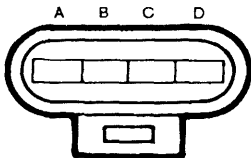
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



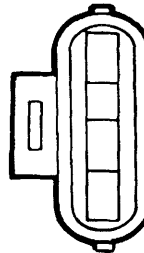
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



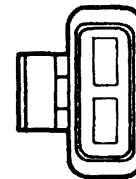
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12047950



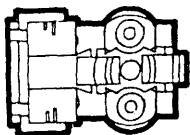
**BLACK**  
Metri-Pack 150  
**C149**  
EGR Valve Solenoid

12066681



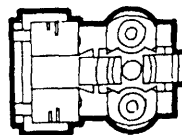
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



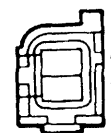
**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

12040706



**C145**  
Ignition Coil

# ENGINE CONTROLS 5.7L (350 CID) V8 VIN K 8A-23-15

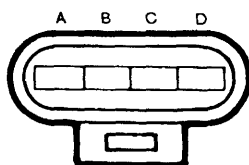
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GRAY

**C144**  
Knock Sensor

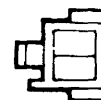
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BLACK  
Metri-Pack 150

**C113**  
Distributor

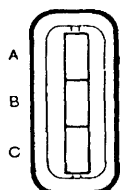
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BLACK  
Metri-Pack 280

**C271**  
TCC/Brake Switch

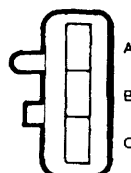
12047782



BLACK  
Metri-Pack 150

**C267**  
TCC/Brake Switch to Cruise  
Control Module

12047781



BLACK  
Metri-Pack 150

**C267**  
Cruise Control to TCC/Brake  
Switch

02984528



BLACK  
56 Series  
**C104A**  
Tachometer Test Lead

12052641



BLACK  
Metri-Pack 150  
**C147**  
EGR Electronic Vacuum  
Regulator Solenoid Valve

12020600



BLACK  
Metri-Pack 280  
**C365**  
Vehicle Speed Sensor

12015375



GRAY  
**C199A**  
Knock Sensor



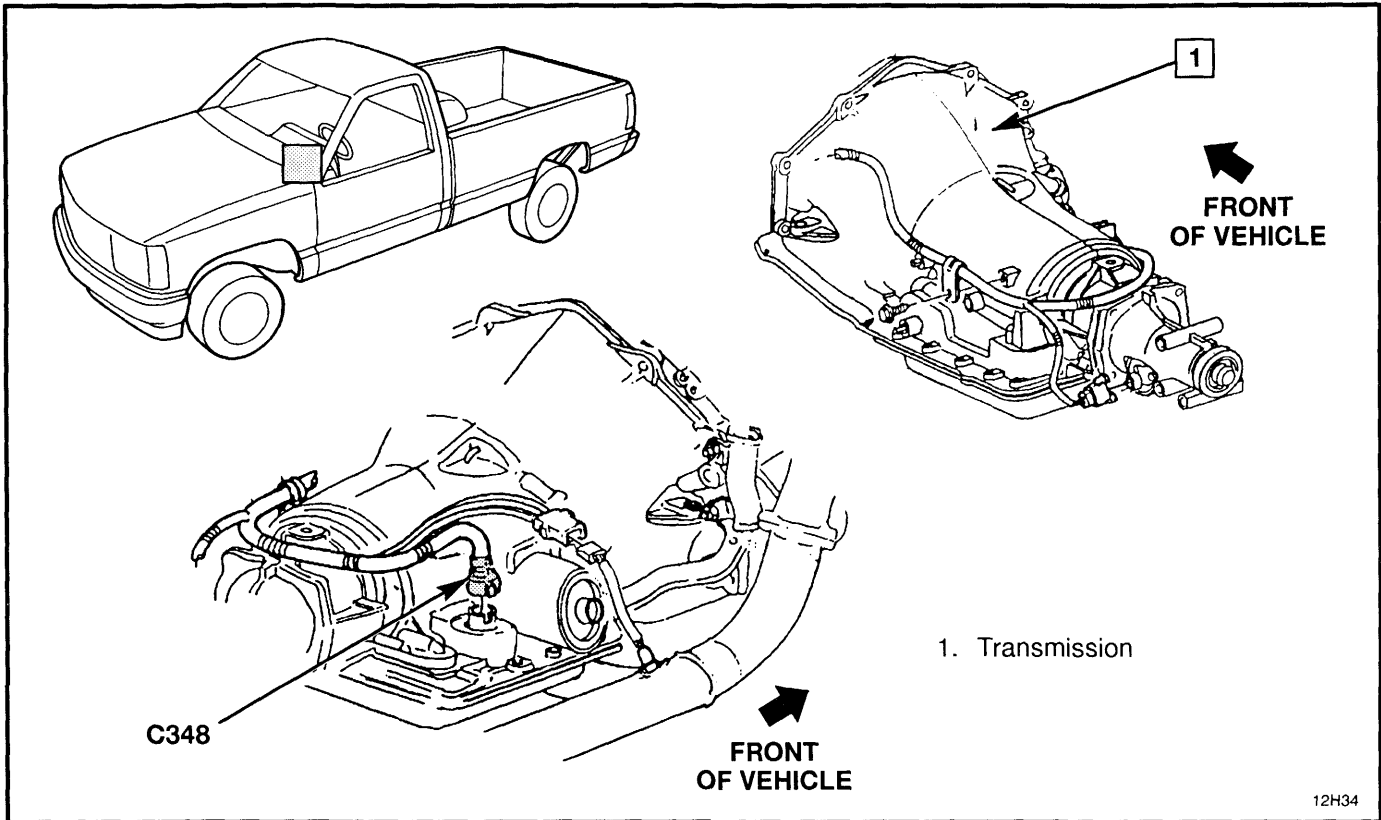


Figure 1 — Transmission Wiring, Electronic 4-Speed — Automatic W/Overdrive

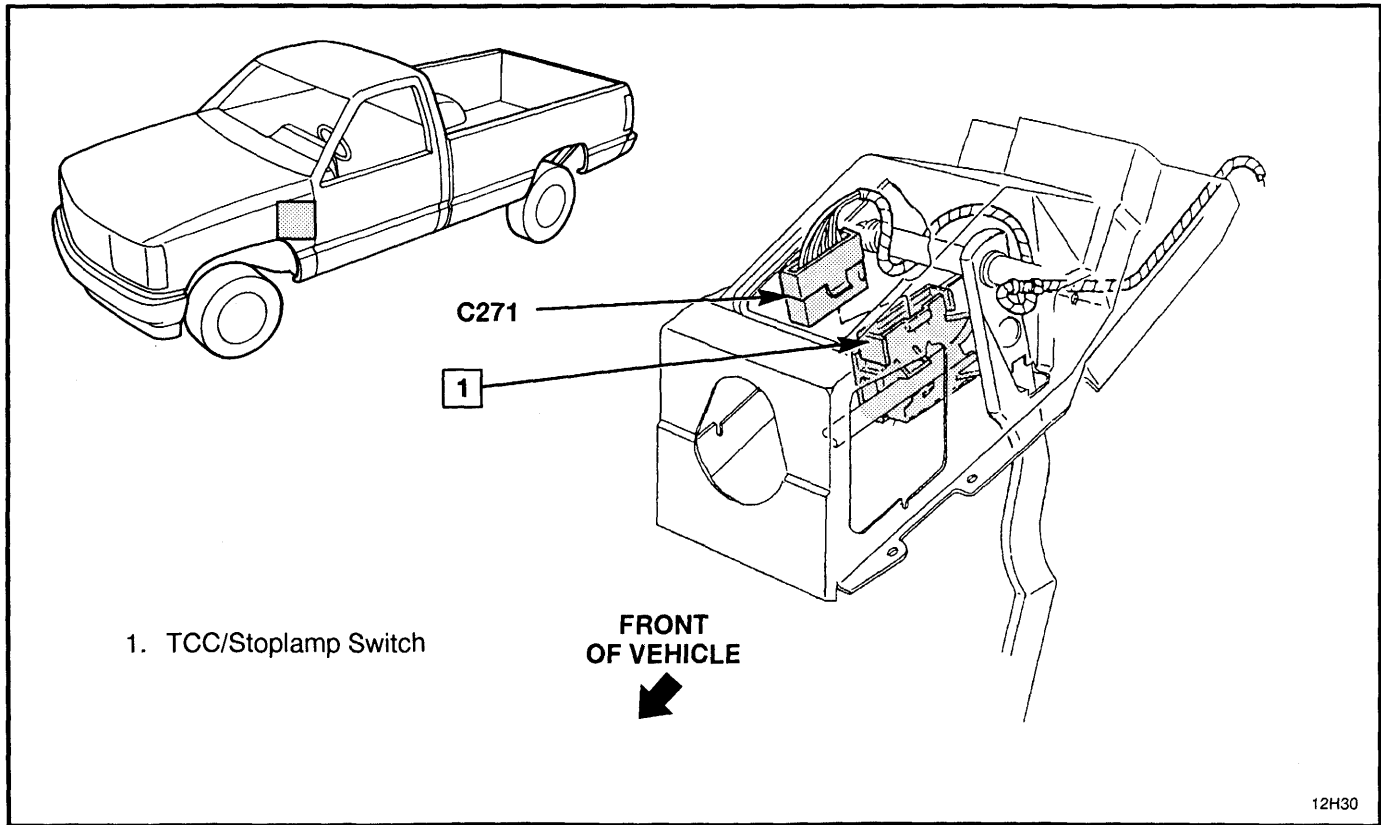


Figure 2 — TCC/Stoplamp Switch

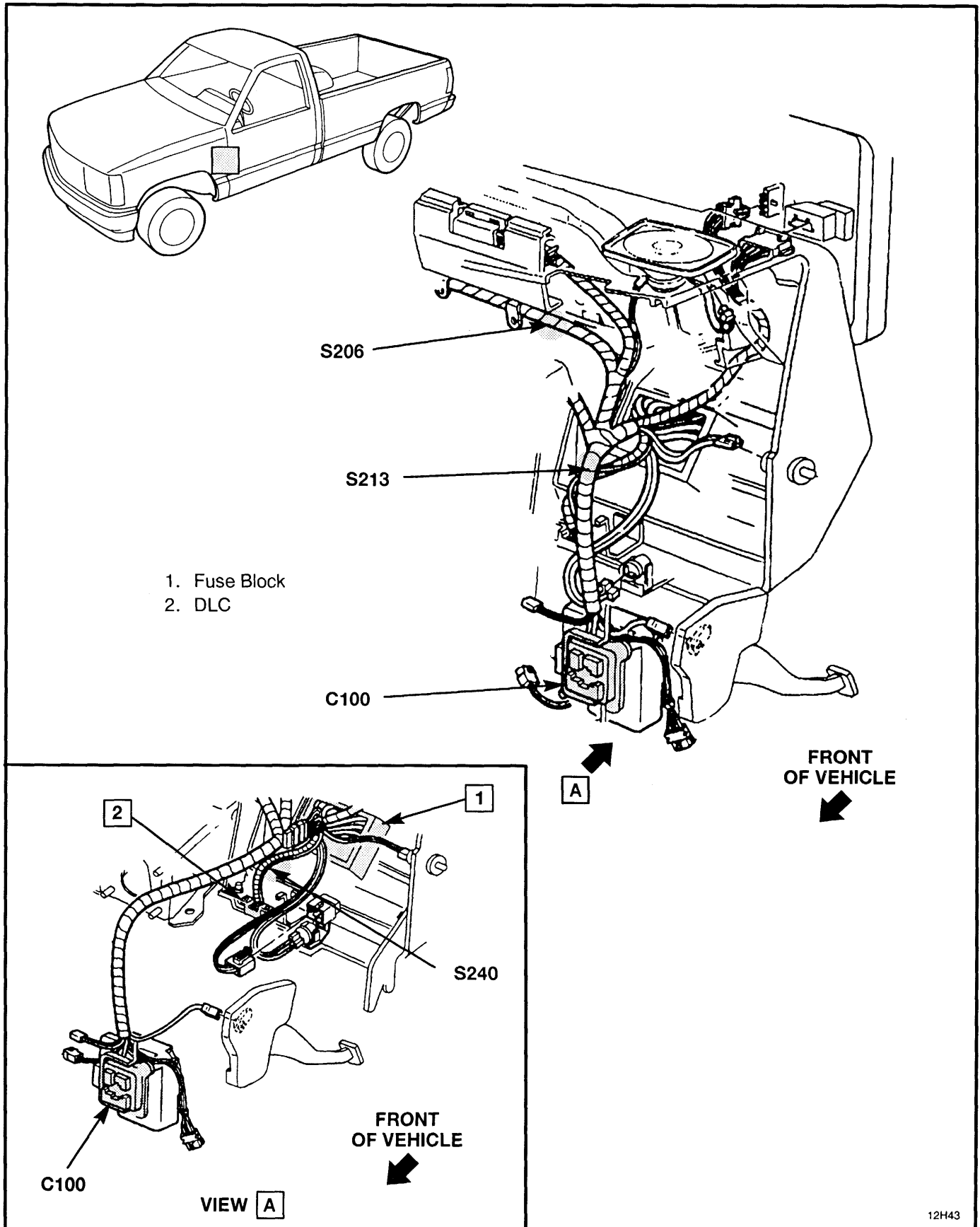


Figure 3 — LH Side of Instrument Panel

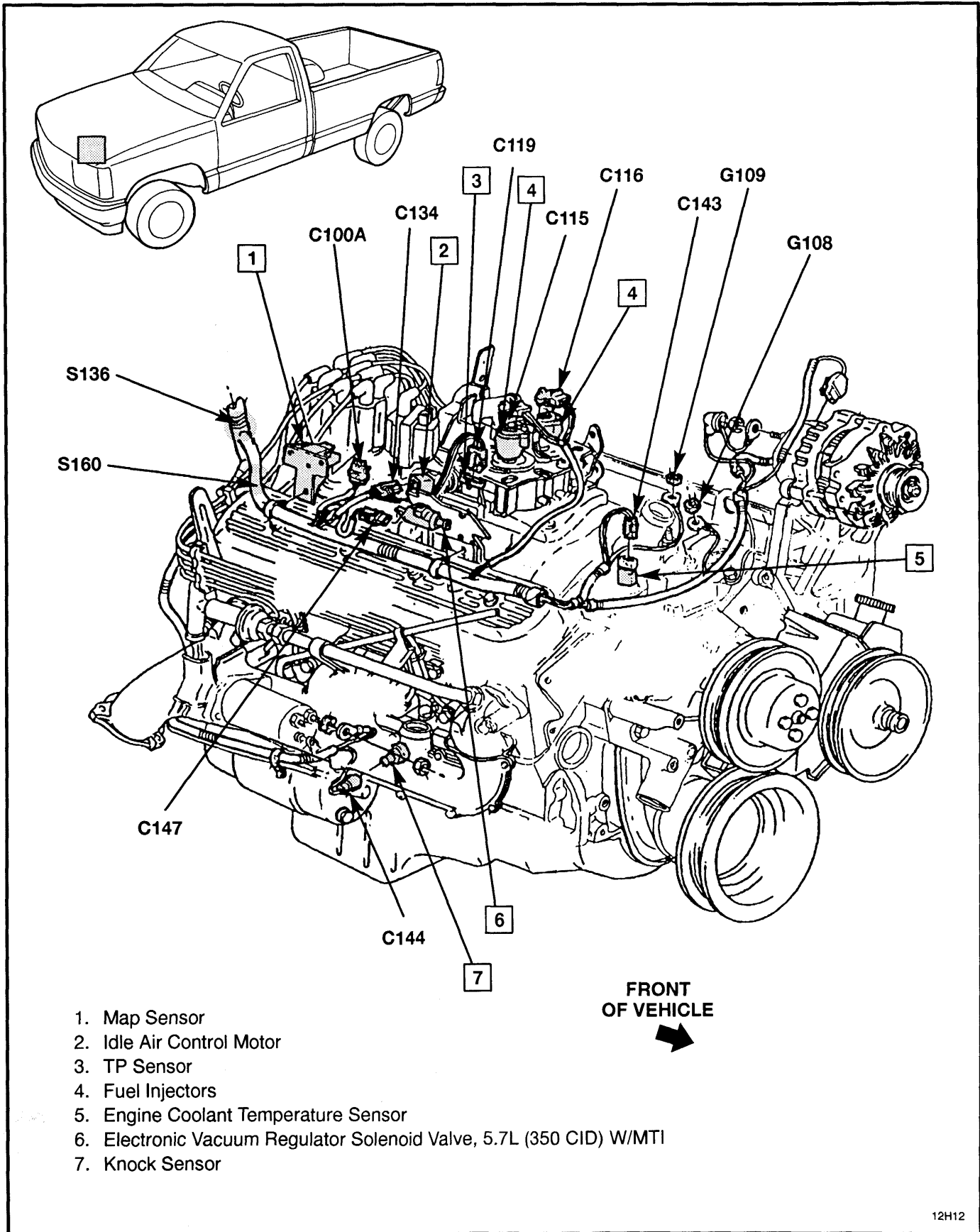
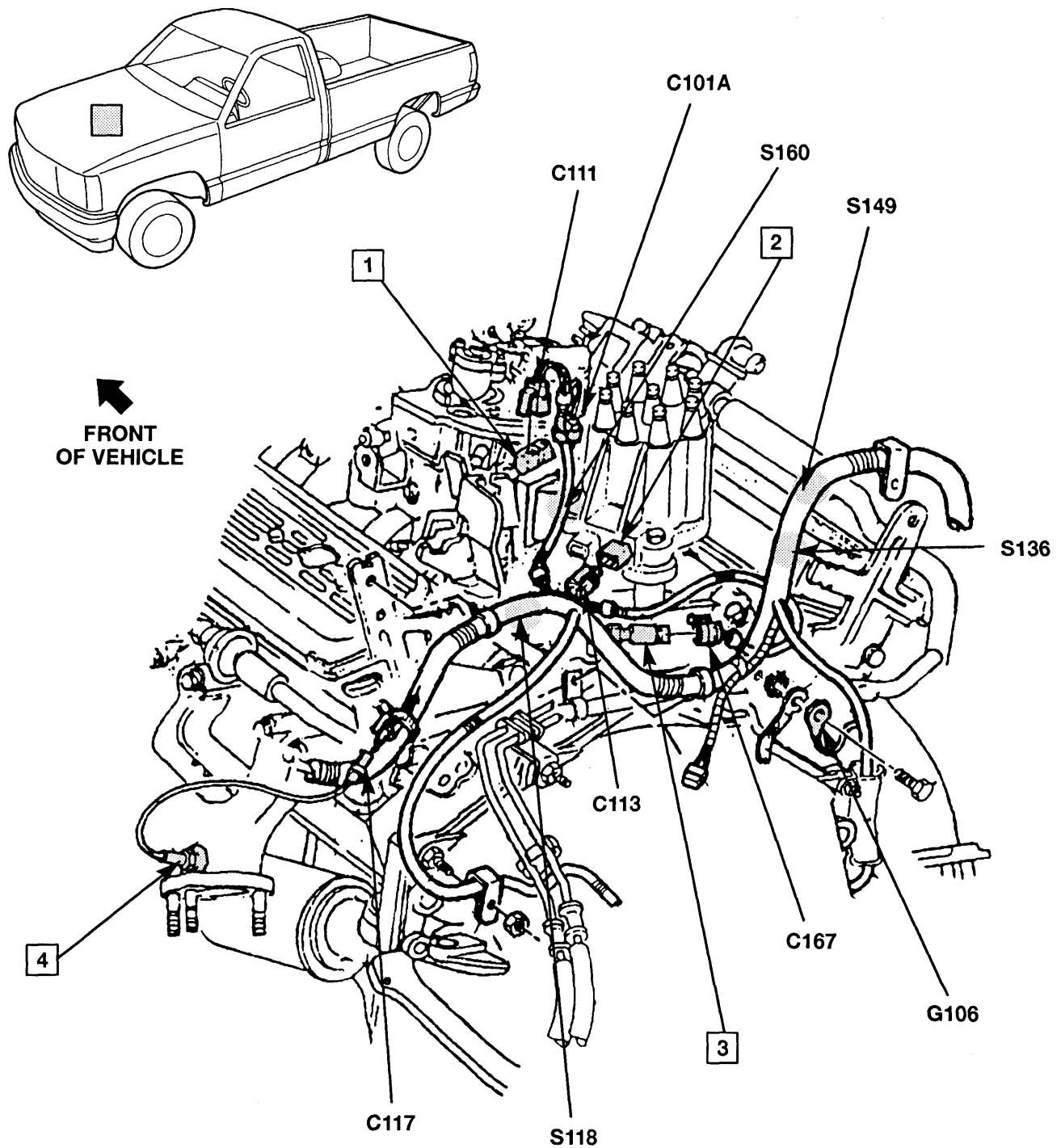


Figure 4 — RH Side of Engine, 5.7L (350 CID) Engine — Gasoline



1. Ignition Coil
2. Distributor Ignition Control Module
3. Fuel Pump Oil Pressure Switch and Sender
4. Oxygen Sensor

Figure 5 — 5.7L Engine Wiring Rear

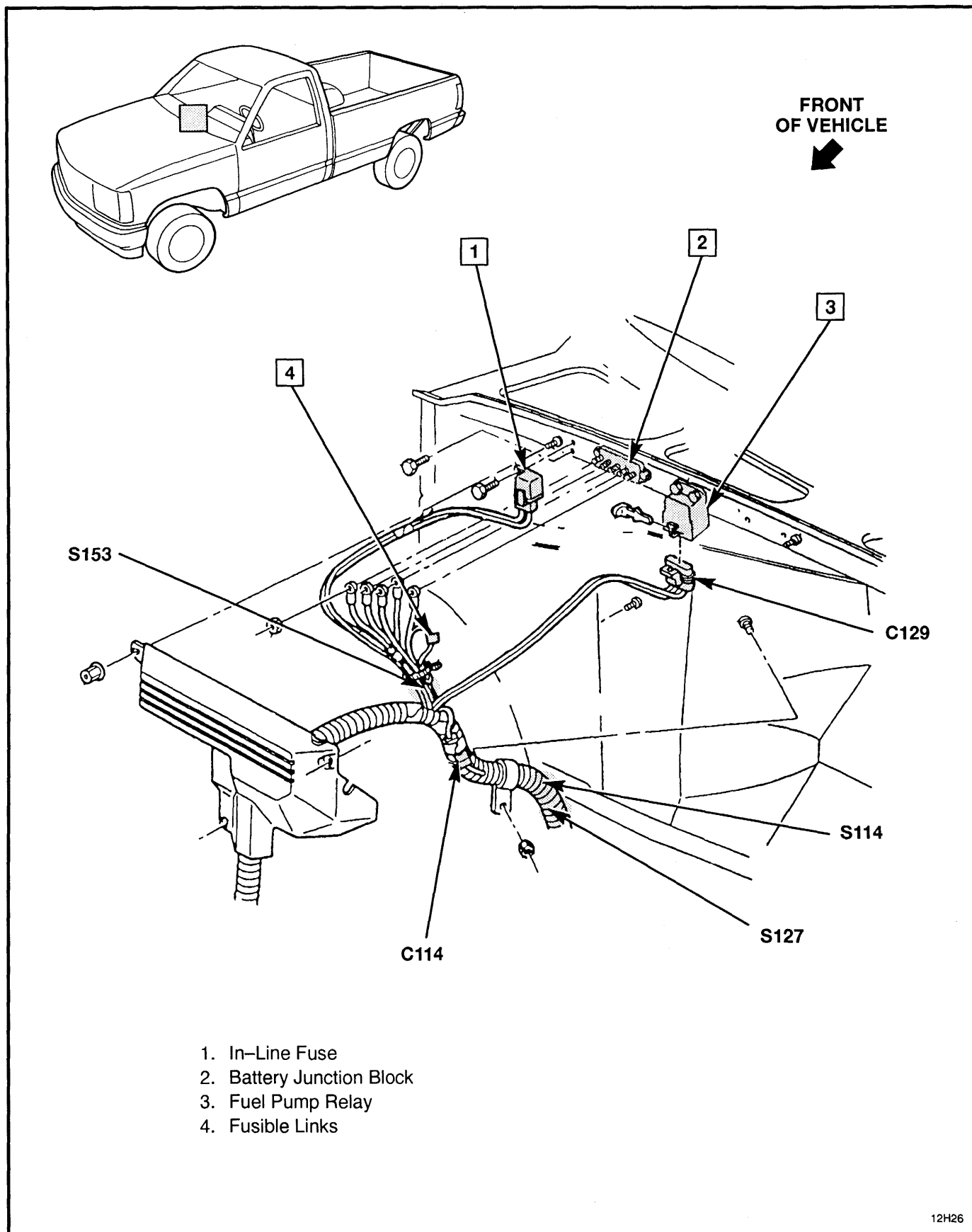


Figure 6 — Battery Junction Block and Relay Wiring

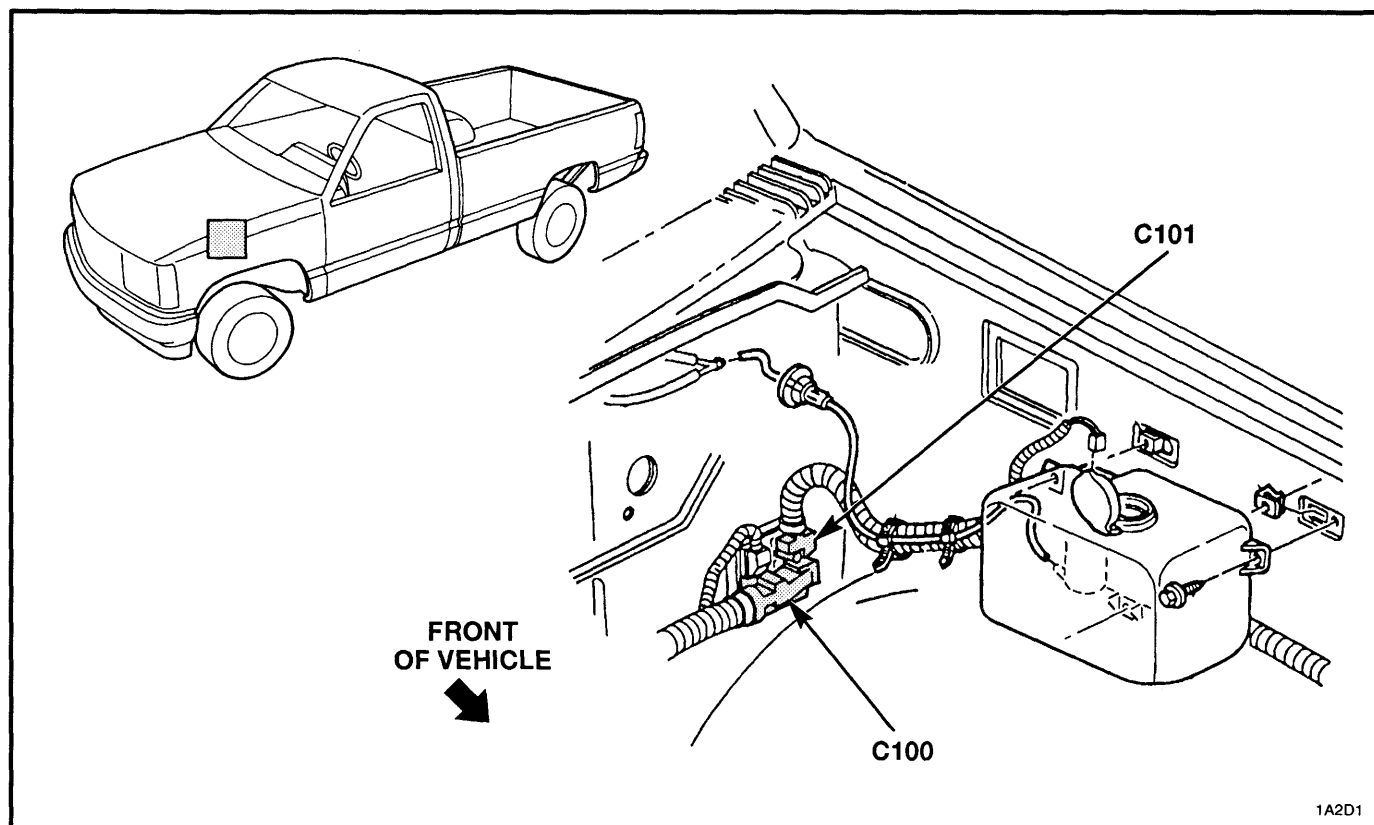


Figure 7 — LH Cowl Wiring

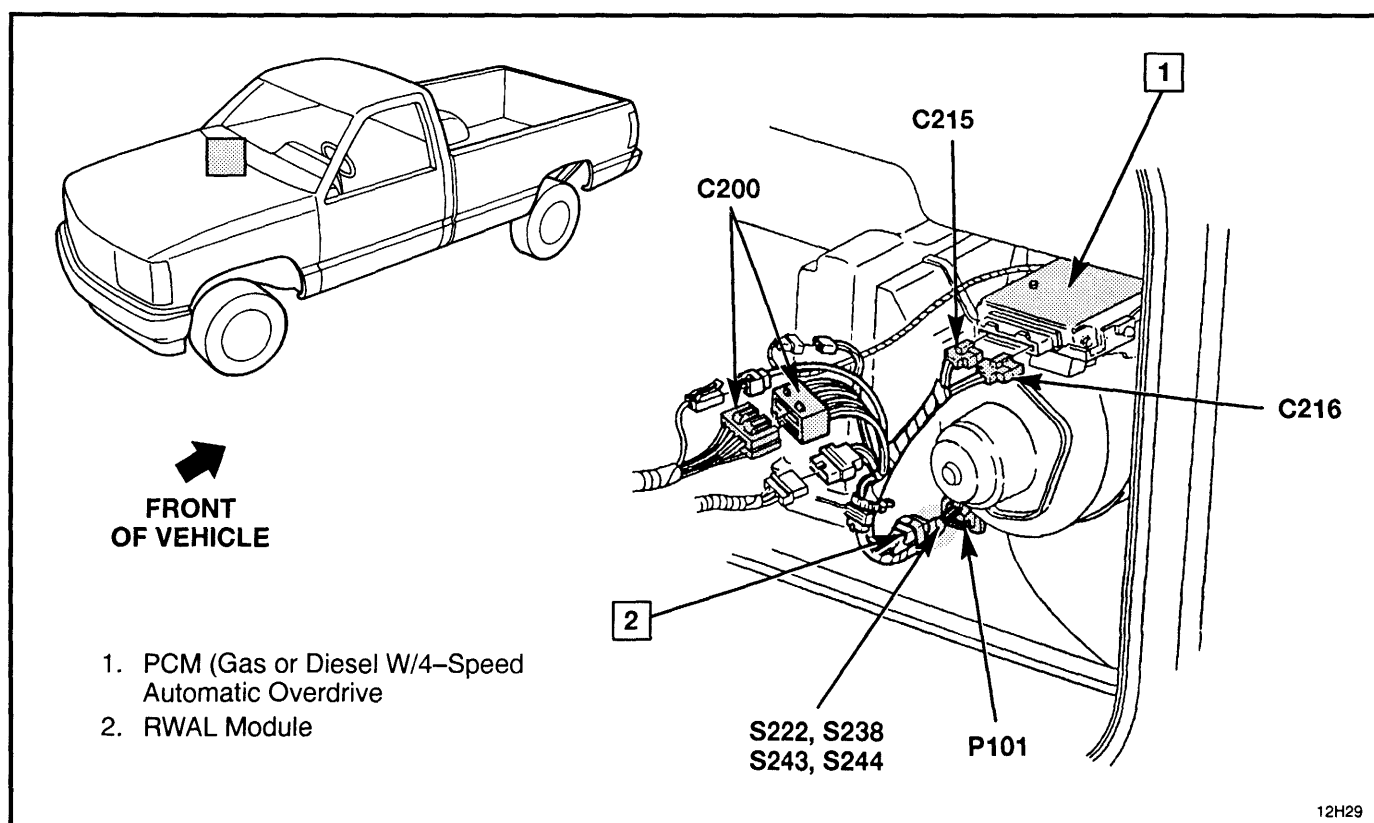
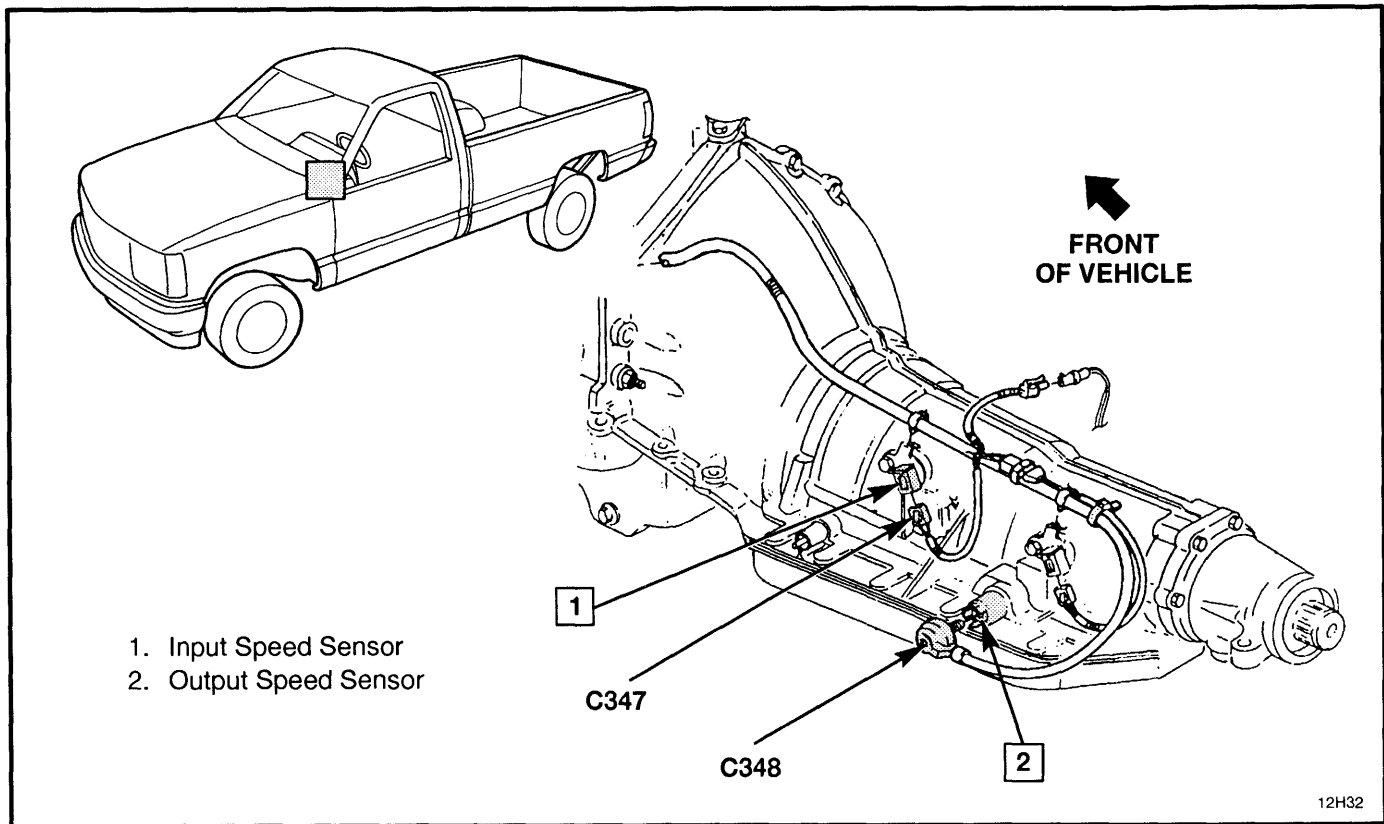


Figure 8 — Behind RH Side of I/P



**Figure 9 — Transmission Wiring**

**COMPONENT LOCATION**

**Page — Figure**

|                                                              |                                                            |           |   |
|--------------------------------------------------------------|------------------------------------------------------------|-----------|---|
| Battery Junction Block .....                                 | RH rear engine compartment, at cowl .....                  | 24-16     | 2 |
| Distributor Ignition Control Module ..                       | Center rear of engine .....                                | 24-18     | 4 |
| DLC .....                                                    | Below LH side of I/P .....                                 | 24-15     | 1 |
| EGR Linear Exhaust Gas<br>Recirculation Solenoid Valve ..... | Top of engine RH side .....                                | 24-17     | 3 |
| Engine Coolant Temperature<br>Sensor .....                   | RH top front of engine .....                               | 24-17     | 3 |
| Evaporative Canister Purge Control<br>Solenoid .....         | RH side of engine .....                                    | 24-17     | 3 |
| Fuel Pump and Sender .....                                   | Inside fuel tank .....                                     | Not Shown |   |
| Fuel Pump Oil Pressure Switch<br>and Sender .....            | LH rear of engine, near exhaust manifold .....             | 24-17     | 3 |
| Fuel Pump Relay .....                                        | RH rear of engine compartment, near battery junction ..... | 24-16     | 2 |
| Fuse Block .....                                             | Lower LH side of I/P .....                                 | 24-15     | 1 |
| Idle Air Control Motor .....                                 | RH rear of TBI unit .....                                  | 24-17     | 3 |
| Ignition Coil .....                                          | Center rear of engine .....                                | 24-17     | 3 |
| Instrument Cluster .....                                     | LH side of I/P .....                                       | 24-15     | 1 |
| Knock Sensor .....                                           | RH side of engine, below exhaust manifold .....            | 24-17     | 3 |
| MAP Sensor .....                                             | RH rear top of engine .....                                | 24-17     | 3 |
| Oxygen Sensor .....                                          | In LH exhaust manifold .....                               | Not Shown |   |
| PCM .....                                                    | Under RH end of I/P .....                                  | 24-19     | 5 |
| TCC Stoplamp Switch .....                                    | Top of brake pedal .....                                   | 24-19     | 6 |
| Throttle Actuator Solenoid .....                             | At throttle body unit .....                                | 24-17     | 3 |
| Throttle Body Fuel Injector #1 .....                         | Top of throttle body unit .....                            | 24-17     | 3 |
| Throttle Body Fuel Injector #2 .....                         | Top of throttle body unit .....                            | 24-17     | 3 |
| TP Sensor .....                                              | RH side of TBI .....                                       | 24-17     | 3 |
| Transmission Input Speed Sensor ..                           | LH side of transmission .....                              | 24-20     | 8 |

**CONNECTORS:**

|             |                                                          |           |   |
|-------------|----------------------------------------------------------|-----------|---|
| C100 .....  | At bulkhead connector .....                              | 24-15     | 1 |
| C101 .....  | At bulkhead connector C100 .....                         | 24-20     | 7 |
| C106A ..... | Near LH lower cowl (engine compartment) .....            | Not Shown |   |
| C114 .....  | Center of cowl, under battery junction block cover ..... | Not Shown |   |
| C200 .....  | Under RH side of I/P, near blower motor .....            | 24-19     | 5 |

**GROMMETS:**

|            |                                          |       |   |
|------------|------------------------------------------|-------|---|
| P101 ..... | RH lower cowl (engine compartment) ..... | 24-17 | 3 |
|------------|------------------------------------------|-------|---|

**GROUND:**

|            |                              |       |   |
|------------|------------------------------|-------|---|
| G108 ..... | LH top front of engine ..... | 24-17 | 3 |
| G109 ..... | LH top front of engine ..... | 24-17 | 3 |

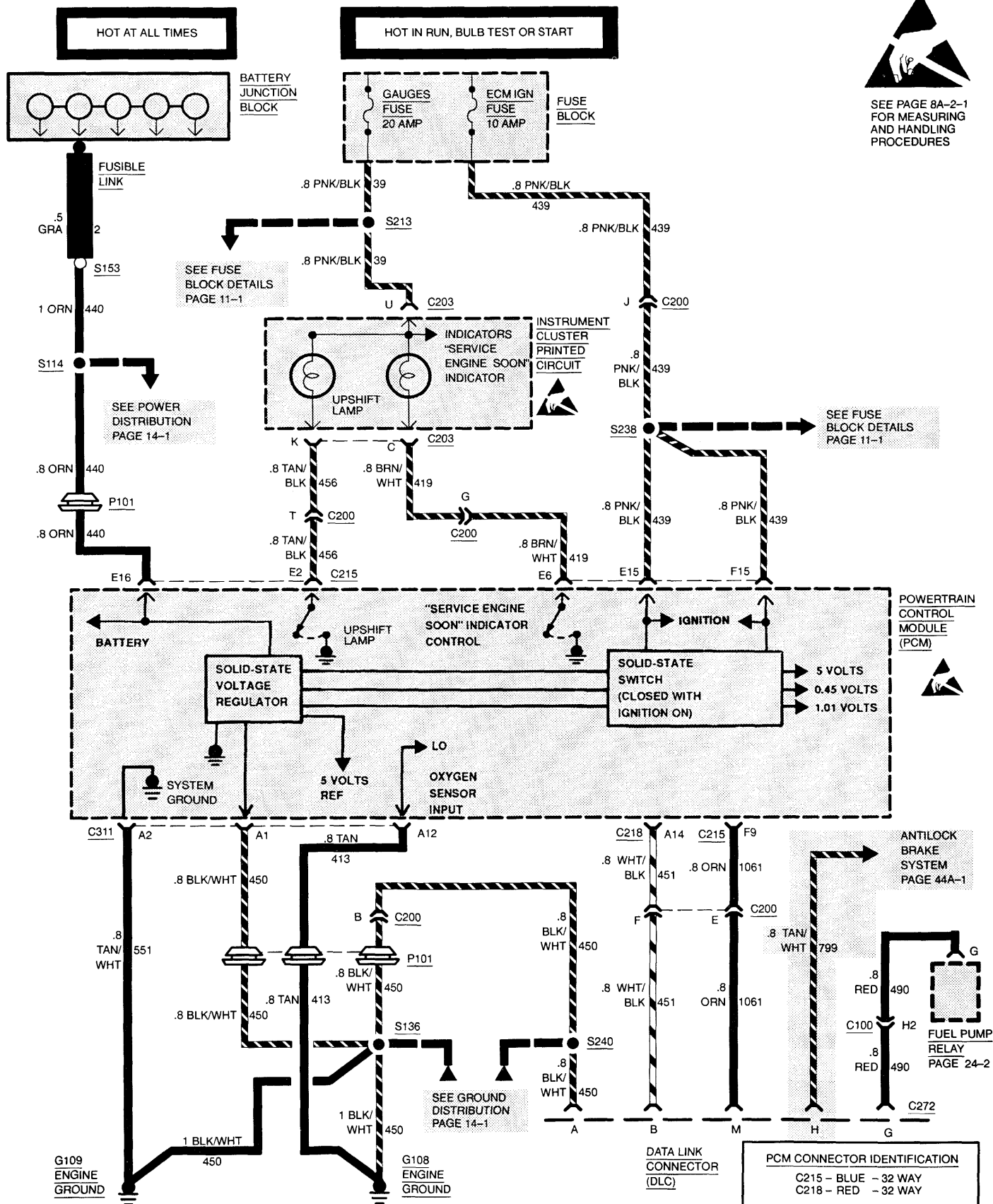
**SPLICES:**

|             |                                                            |           |   |
|-------------|------------------------------------------------------------|-----------|---|
| S114 .....  | RH rear engine compartment, near A/C accumulator .....     | 24-16     | 2 |
| S119 .....  | Engine harness, near cowl LH rear engine compartment ..... | 24-18     | 4 |
| S127 .....  | Near P101, RH cowl .....                                   | 24-16     | 2 |
| S136 .....  | Rear of engine compartment, near center .....              | 24-18     | 4 |
| S149 .....  | Near battery junction block .....                          | Not Shown |   |
| S153 .....  | Center of cowl, below battery junction block .....         | 24-16     | 2 |
| S160 .....  | Upper rear of engine .....                                 | 24-17     | 3 |
| S206 .....  | Behind LH side of I/P .....                                | Not Shown |   |
| S213 .....  | Under LH side of I/P .....                                 | 24-15     | 1 |
| S222 .....  | Behind RH side of I/P, above blower case .....             | 24-19     | 5 |
| S238 .....  | Engine harness, near PCM .....                             | 24-19     | 5 |
| S240 .....  | Behind LH side of I/P .....                                | 24-15     | 1 |
| S243 .....  | Engine harness, near P101 .....                            | 24-19     | 5 |
| S244 .....  | Behind RH side of I/P, above blower case .....             | 24-19     | 5 |
| S286A ..... | Behind RH side of I/P, above blower case .....             | 24-19     | 5 |



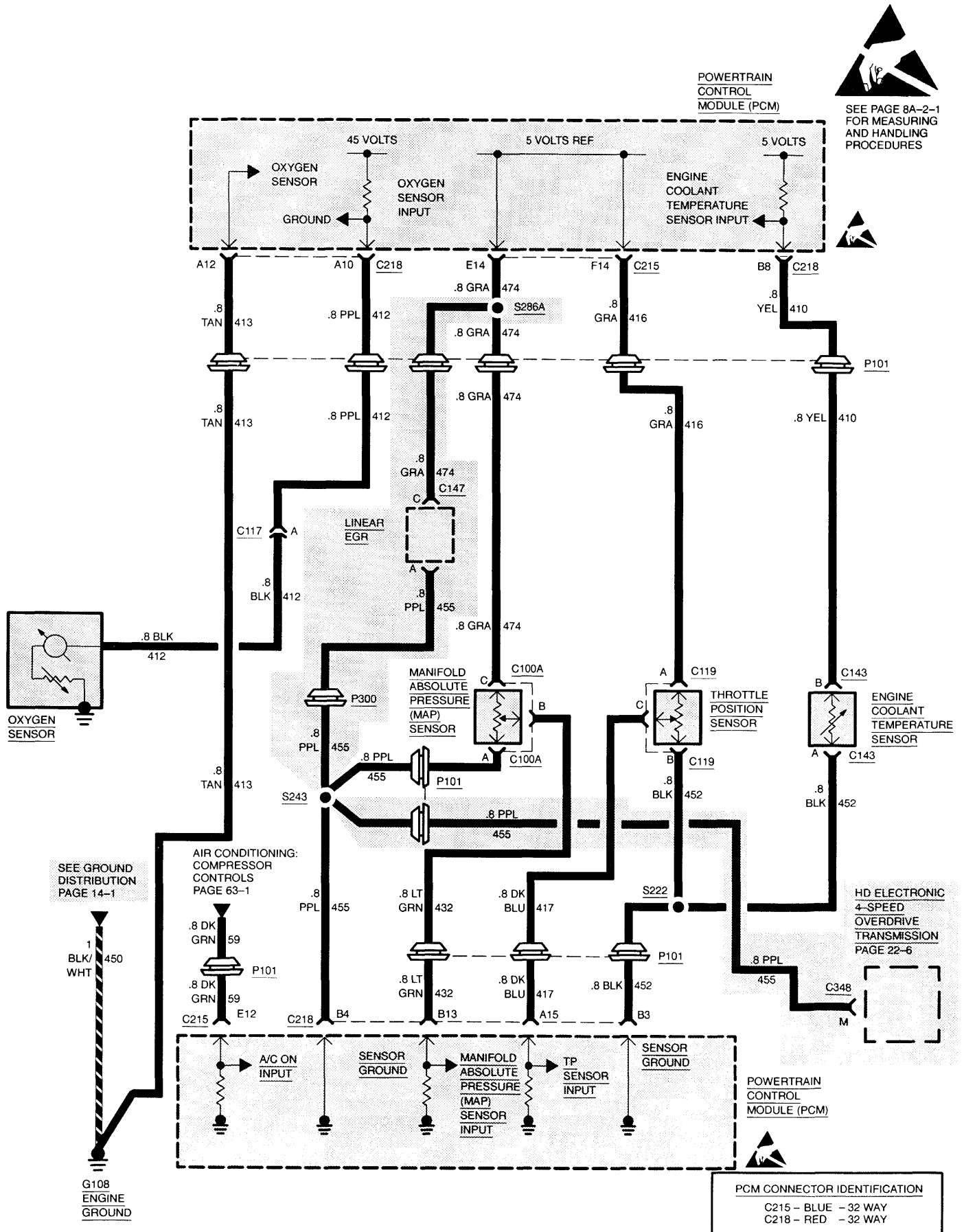
# 8A-24-2 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

## W/MANUAL AND AUTOMATIC TRANSMISSION



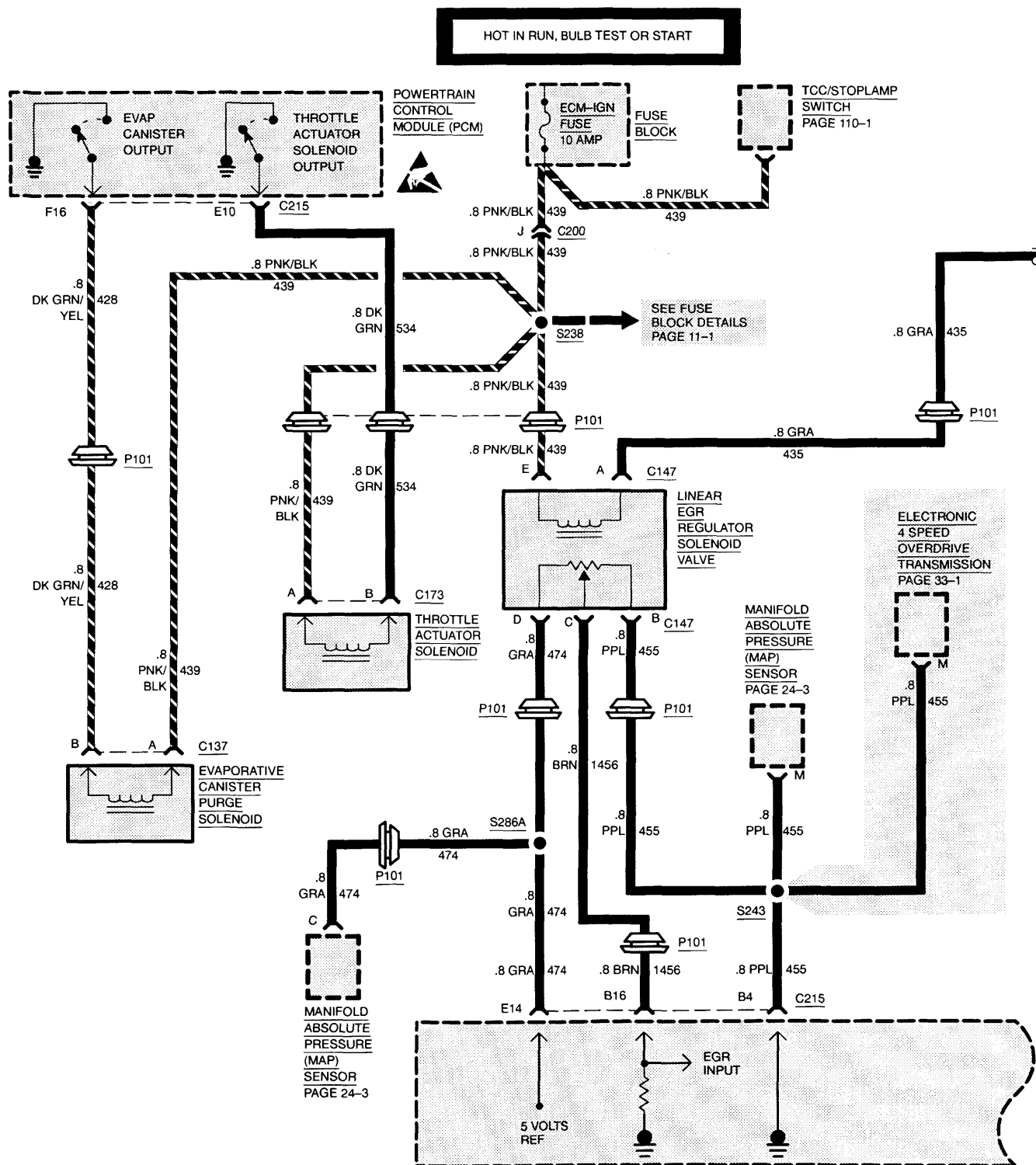
# ENGINE CONTROLS 7.4L (454 CID) V8 VIN N 8A-24-3

## W/MANUAL AND AUTOMATIC TRANSMISSION



# 8A-24-4 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

## W/MANUAL AND AUTOMATIC TRANSMISSION



**Wiring Diagram: Idle Air Control (IAC) System**

**Legend:**

- POWERTRAIN CONTROL MODULE (PCM):** The central control unit.
- IDLE AIR VALVE CONTROL:** The control unit for the IAC valve.
- IDLE AIR VALVE MOTOR:** The motor that actuates the IAC valve.
- VEHICLE SPEED SENSOR BUFFER:** The buffer for the vehicle speed sensor signal.

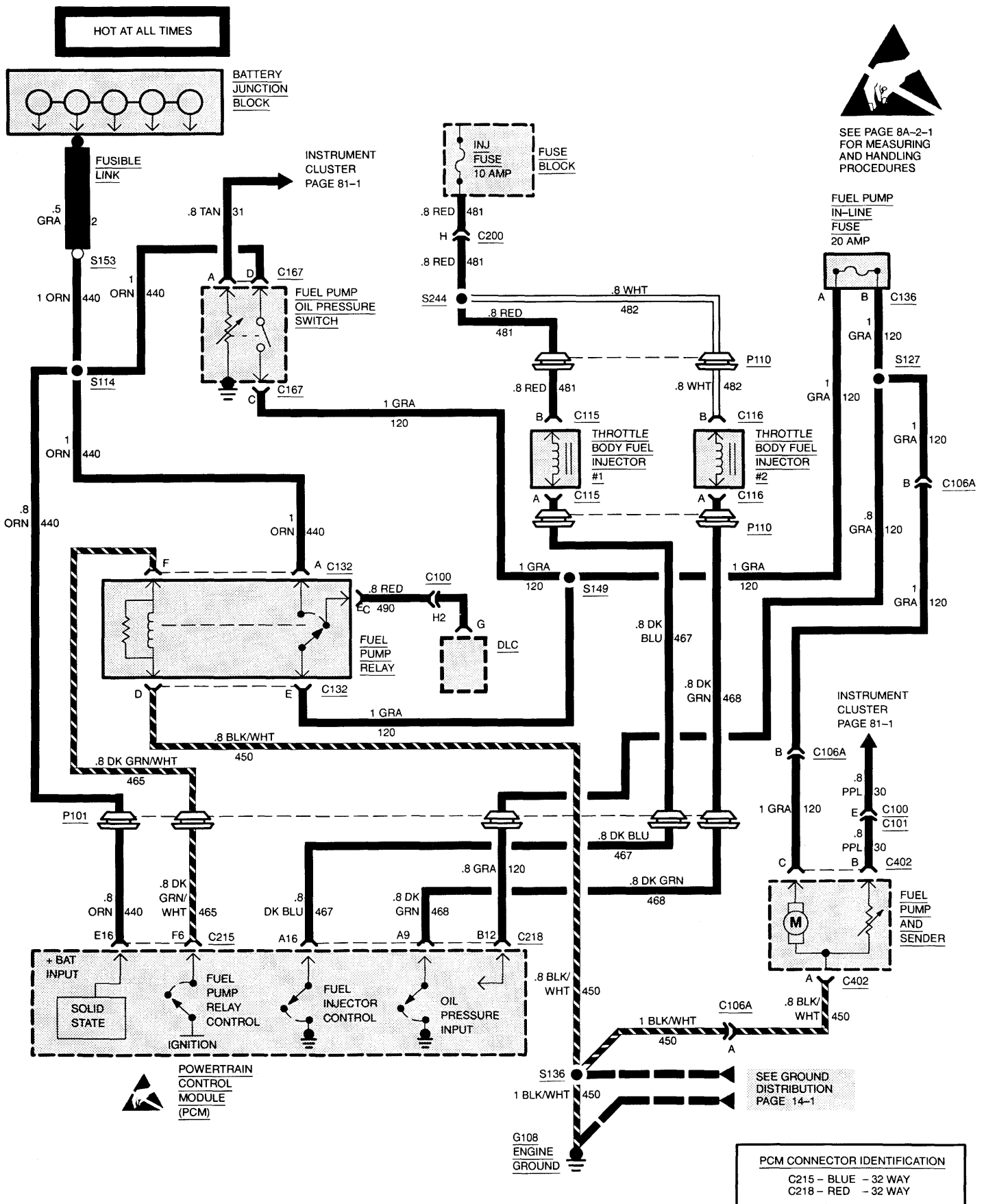
**Wiring Details:**

- PCM to IAC Valve Control:**
  - A7 (C218):** .8 LT GRN/ BLK (444) - Solid-State Relay.
  - A8 (C215):** .8 LT GRN/ WHT (443) - Solid-State Relay.
  - BATTERY:** Connected to the IAC Valve Control.
- IAC Valve Control to IAC Valve Motor:**
  - A6 (C218):** .8 LT BLU/ BLK (442) - Solid-State Relay.
  - A3 (C215):** .8 LT BLU/ WHT (441) - Solid-State Relay.
  - BATTERY:** Connected to the IAC Valve Motor.
- Vehicle Speed Sensor Buffer to PCM:**
  - F12 (C215):** .8 BRN (437) - Vehicle Speed Input.
- EGR Output:** Connected to the PCM via a solid-state relay.

C215 - BLUE - 32 WAY  
C218 - RED - 32 WAY

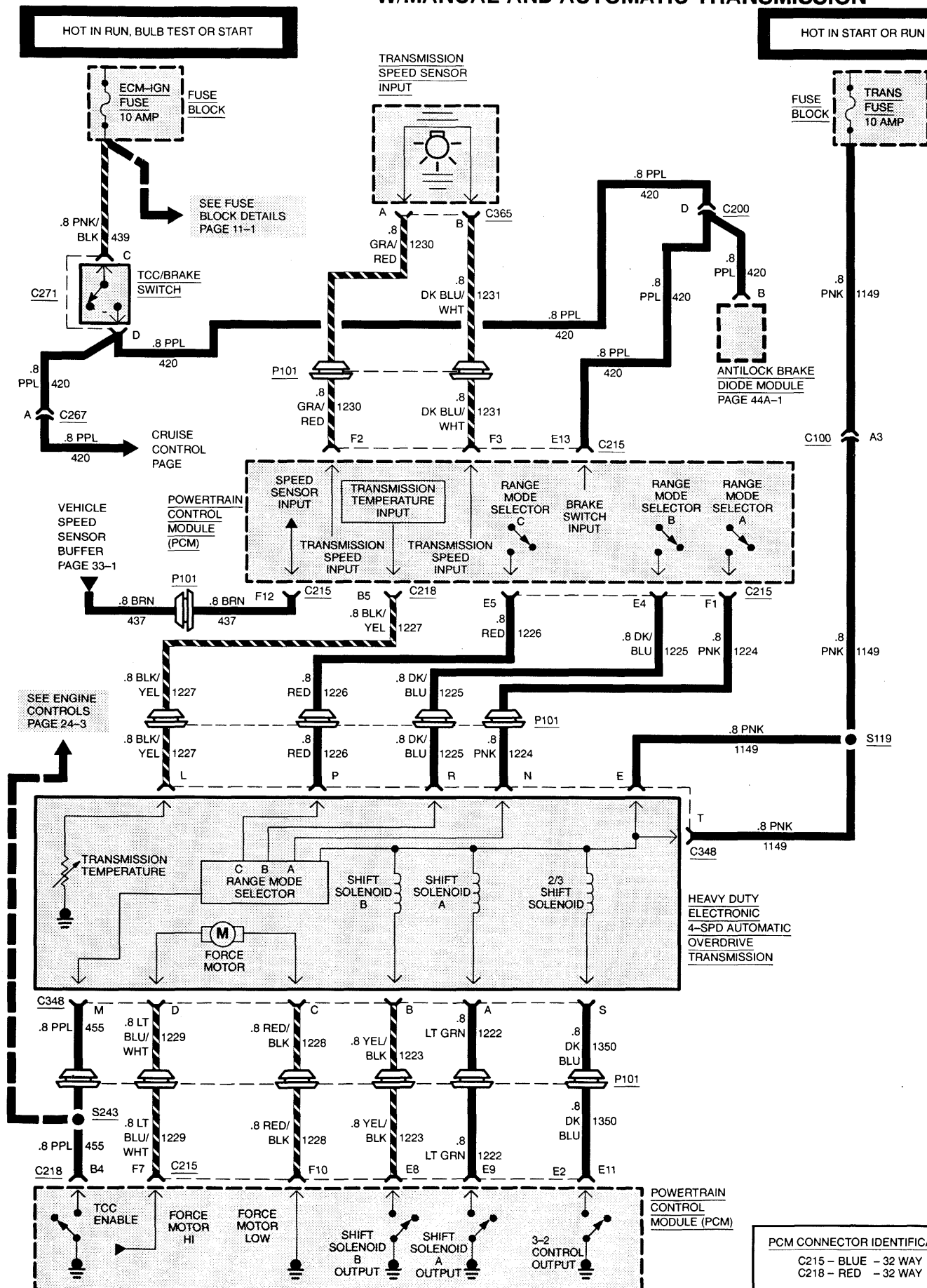
# 8A-24-6 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

## W/MANUAL AND AUTOMATIC TRANSMISSIONS



# ENGINE CONTROLS 7.4L (454 CID) V8 VIN N 8A-24-7

## W/MANUAL AND AUTOMATIC TRANSMISSION



## W/MANUAL AND AUTOMATIC TRANSMISSION



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

SEE POWER  
DISTRIBUTION  
PAGE 11-1

KNOCK  
SENSOR

TACHOMETER,  
I/P CLUSTER  
PAGE 81-1

## PCM CONNECTOR IDENTIFICATION

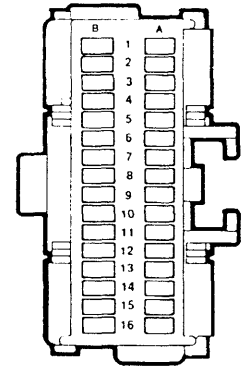
C215 - BLUE - 32 WAY  
C218 - RED - 32 WAY

# ENGINE CONTROLS 7.4L (454 CID) V8 VIN N 8A-24-9

## POWERTRAIN CONTROL MODULE – 7.4L (454 CID) ENGINE (32-Pin Red) W/MANUAL OR HD AUTOMATIC TRANSMISSION

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                       |
|-------------|-----------|------------|--------|-----------------------------------|
| 450         | 1.0       | BLK/WHT    | A1     | SYSTEM GRD                        |
| 551         | 1.0       | TAN/WHT    | A2     | SYSTEM GRD                        |
| 441         | .8        | LT BLU/WHT | A3     | STEPPER COIL A HIGH               |
| 430         | .8        | PPL/WHT    | A4     | DISTRIBUTOR REF HIGH              |
| 453         | .8        | BLK/RED    | A5     | DISTRIBUTOR REF LOW               |
| 442         | .8        | LT BLU/BLK | A6     | STEPPER COIL A LOW                |
| 444         | .8        | LT GRN/BLK | A7     | STEPPER COIL B LOW                |
| 443         | .8        | LT GRN/WHT | A8     | STEPPER COIL B HIGH               |
| 468         | .8        | DK GRN     | A9     | LOW SIDE INJ B                    |
| 412         | .8        | PPL        | A10    | OXYGEN SENSOR HIGH                |
|             |           |            | A11    | NOT USED                          |
| 413         | .8        | TAN        | A12    | OXYGEN SENSOR HIGH                |
|             |           |            | A13    | NOT USED                          |
| 451         | .8        | WHT/BLK    | A14    | DLC                               |
| 417         | .8        | DK BLU     | A15    | THROTTLE POSITION SENSOR          |
| 467         | .8        | DK BLU     | A16    | LOW SIDE INJ A                    |
|             |           |            | B1     | NOT USED                          |
| 424         | .8        | TAN/BLK    | B2     | IGNITION BYPASS                   |
| 452         | .8        | BLK        | B3     | 5V RETURN B                       |
| 455         | .8        | PPL        | B4     | 5V SYSTEM RETURN A                |
| ●1227       | .8        | BLK/YEL    | B5     | PCM TO TRANS TEMP SENSOR          |
|             |           |            | B6     | NOT USED                          |
|             |           |            | B7     | NOT USED                          |
| 410         | .8        | YEL        | B8     | ENGINE COOLANT TEMPERATURE SENSOR |
|             |           |            | B9     | NOT USED                          |
|             |           |            | B10    | NOT USED                          |
|             |           |            | B11    | NOT USED                          |
| 120         | 1.0       | GRA        | B12    | ELEC FUEL PUMP INPUT              |
| 432         | .8        | LT GRN     | B13    | MANIFOLD ABSOLUTE PRESSURE SENSOR |
|             |           |            | B14    | NOT USED                          |
| 496         | .8        | DK BLU     | B15    | KNOCK SENSOR                      |
| 1456        | .8        | BRN        | B16    | LINEAR EGR POSITION INPUT         |

**C218  
RED**



● W/AUTOMATIC TRANSMISSION

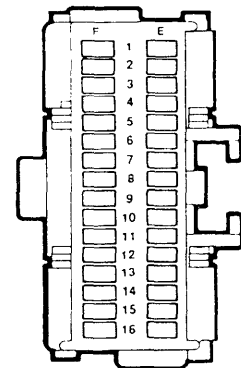


# 8A-24-10 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

## POWERTRAIN CONTROL MODULE – 7.4L (454 CID) ENGINE W/MANUAL OR HD AUTOMATIC TRANSMISSION (32-PIN BLUE)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                              |
|-------------|-----------|------------|--------|------------------------------------------|
| 435         | .8        | GRA        | E1     | LINEAR EGR OUTPUT                        |
| ●897        | .8        | WHT        | E2     | TRANS SHIFT 2/3 SOL                      |
| □456        | .8        | TAN/BLK    | E2     | UPSHIFT LAMP                             |
|             |           |            | E3     | NOT USED                                 |
| ●1225       | .8        | DK BLU     | E4     | PCM TRANS RANGE MODE B                   |
| ●1226       | .8        | RED        | E5     | PCM TRANS RANGE MODE C                   |
| 419         | .8        | BRN/WHT    | E6     | MALFUNCTION INDICATOR LAMP               |
|             |           |            | E7     | NOT USED                                 |
| ●1223       | .8        | YEL/BLK    | E8     | PCM TRANS SHIFT SOL B                    |
| ●1222       | .8        | LT GRN     | E9     | PCM TRANS SHIFT SOL A                    |
| 534         | .8        | DK GRN     | E10    | THROTTLE ACTUATOR SOLENOID<br>OUTPUT     |
|             |           |            | E11    | NOT USED                                 |
| 59          | .8        | DK GRN     | E12    | AIR CONDITIONING                         |
| 420         | .8        | PPL        | E13    | BRAKE SW TO PCM                          |
| 474         | .8        | GRA        | E14    | 5V REF VOLTAGE                           |
| 439         | .8        | PNK/BLK    | E15    | 12V IGNITION FUSED                       |
| 440         | 1.0       | ORN        | E16    | 12 BATTERY FUSED                         |
| ●1224       | .8        | PNK        | F1     | PCM TRANS RANGE MODE A                   |
| ●1230       | .8        | GRA/RED    | F2     | TRANSMISSION SPEED SENSOR<br>INPUT       |
| ●1231       | .8        | DK BLU/WHT | F3     | TRANSMISSION SPEED SENSOR<br>INPUT       |
|             |           |            | F4     | NOT USED                                 |
|             |           |            | F5     | NOT USED                                 |
| 465         | .8        | DK GRN/WHT | F6     | FUEL PUMP RELAY DRIVE                    |
| ●1229       | .8        | LT BLU/WHT | F7     | PCM TRANS FORCE MTR LOW                  |
| ●1493       | .8        | DK BLU     | F8     | SHIFT PERFORMANCE SELECT<br>SWITCH INPUT |
| 1061        | .8        | ORN/BLK    | F9     | DLC SERIAL DATA                          |
| ●1228       | .8        | RED/BLK    | F10    | PCM TRANS FORCE MOTOR<br>HIGH            |
| 423         | .8        | WHT        | F11    | IGNITION CONTROL (IC)                    |
| 437         | .8        | BRN        | F12    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL    |
| 1716        | .8        | DK BLU     | F13    | VEHICLE SPEED SENSOR<br>BUFFER SIGNAL    |
| 416         | .8        | GRA        | F14    | 5V SENSOR REF                            |
| 439         | .8        | PNK/BLK    | F15    | 12V IGN FUSED                            |
| 428         | .8        | DK GRN/YEL | F16    | EVAPORATIVE CANISTER PURGE<br>CONTROL    |

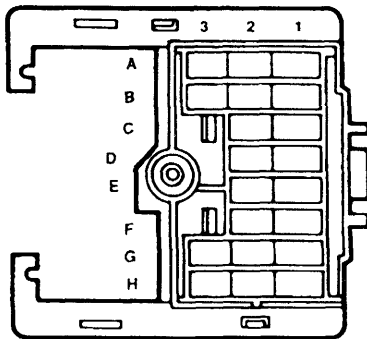
**C215  
BLUE**



- W/AUTOMATIC TRANSMISSION
- W/MANUAL TRANSMISSION

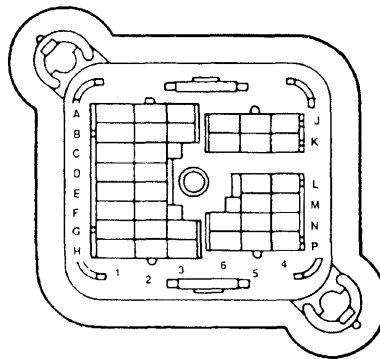
# ENGINE CONTROLS 7.4L (454 CID) V8 VIN N 8A-24-11

12020183



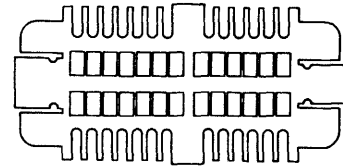
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



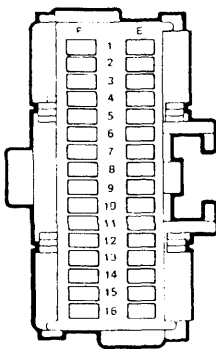
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



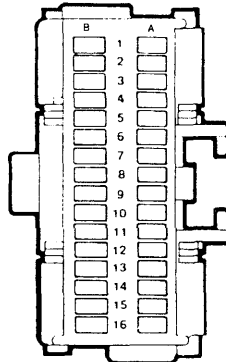
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12110115



**BLUE**  
Metri-Pack 280  
**C215**  
PCM

12110113



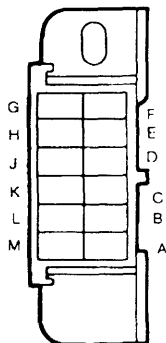
**RED**  
Metri-Pack 280  
**C218**  
PCM

12020403



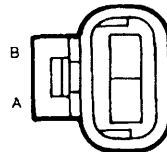
**BLACK**  
**C100A**  
MAP Sensor

12020043



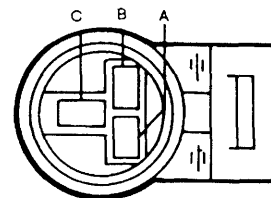
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12040753



**BLACK**  
Metri-Pack 150  
**C194**  
Distributor

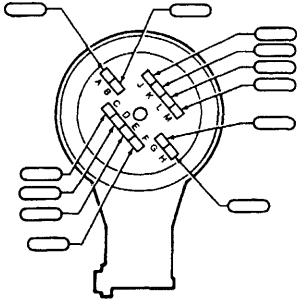
12078090



**BLACK**  
Metri-Pack 150  
**C119**  
TP Sensor

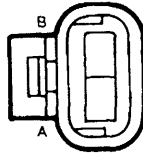
# 8A-24-12 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

12084690



**C348**  
**Transmission**

12078084



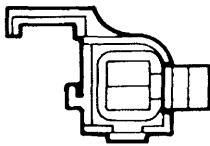
**BLACK**  
Metri-Pack 150  
**C143**  
**Engine Coolant Temperature**  
**Sensor**

12052643



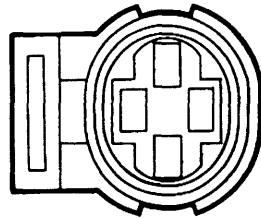
**RED**  
Metri-Pack 150  
**C137**  
**Evaporative Cansiter Purge**  
**Solenoid**

12040705



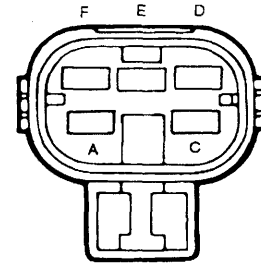
**GRAY**  
Metri-Pack 280  
**C111**  
**Ignition Coil**

12065401



**GRAY**  
Metri-Pack 150  
**C167**  
**Fuel Pump Oil Pressure Switch**

12052287



**BLACK**  
Metri-Pack  
**C132**  
**Fuel Pump Relay**

12052641



**BLACK**  
Metri-Pack 150  
**C173**  
**Throttle Actuator Solenoid**

12015792



**BLACK**  
Weather Pack  
**C106A**  
**Fuse to Fuel Pump and Sender**

12015791



**BLACK**  
Weather Pack  
**C114**  
**Set Timing Connector**

# ENGINE CONTROLS 7.4L (454 CID) V8 VIN N 8A-24-13

12010996



**BLACK**  
Weather Pack  
**C114**  
Set Timing Connector

12015791



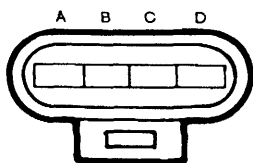
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12010996



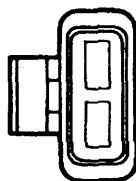
**BLACK**  
Weather Pack  
**C117**  
Oxygen Sensor

12040754



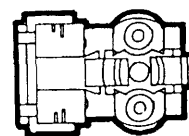
**BLACK**  
Metri-Pack 150  
**C134**  
Idle Air Control Valve

12066681



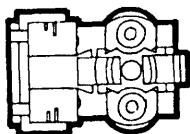
**BLACK**  
Metri-Pack 630  
**C136**  
Fuel Pump In-Line Fuse

12020549



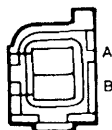
**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #1

12020549



**NATURAL**  
Pin Grip  
**C115**  
Throttle Body Fuel Injector #2

12040706



**C145**  
Ignition Coil

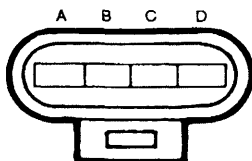
12015375



**GRAY**  
**C144**  
Knock Sensor

# 8A-24-14 ENGINE CONTROLS 7.4L (454 CID) V8 VIN N

12040754



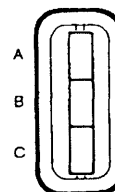
**BLACK**  
Metri-Pack 150  
**C113**  
Distributor

12033709



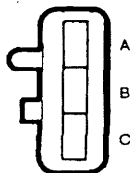
**BLACK**  
Metri-Pack 280  
**C271**  
TCC/Brake Switch

12047782



**BLACK**  
Metri-Pack 150  
**C267**  
TCC/Brake Switch to Cruise  
Control Module

12047781



**BLACK**  
Metri-Pack 150  
**C267**  
Cruise Control to TCC/Brake  
Switch

02984528



**BLACK**  
56 Series  
**C104A**  
Tachometer Test Lead

12020600



**BLACK**  
Metri-Pack 280  
**C365**  
Vehicle Speed Sensor

12015375



**GRAY**  
**C199A**  
Knock Sensor



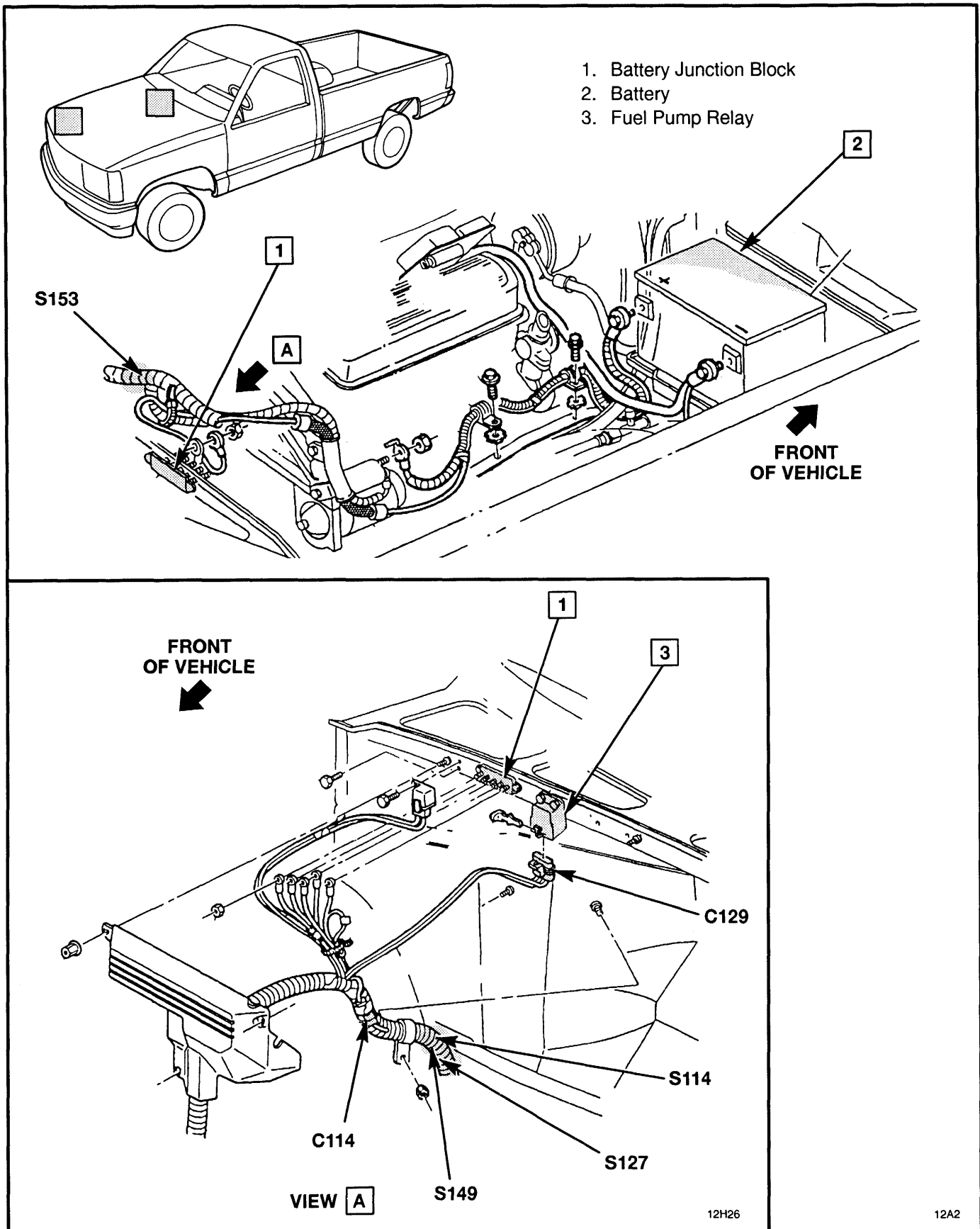


Figure 2 — Battery Wiring, Fuel Pump Relay and Battery Junction Block

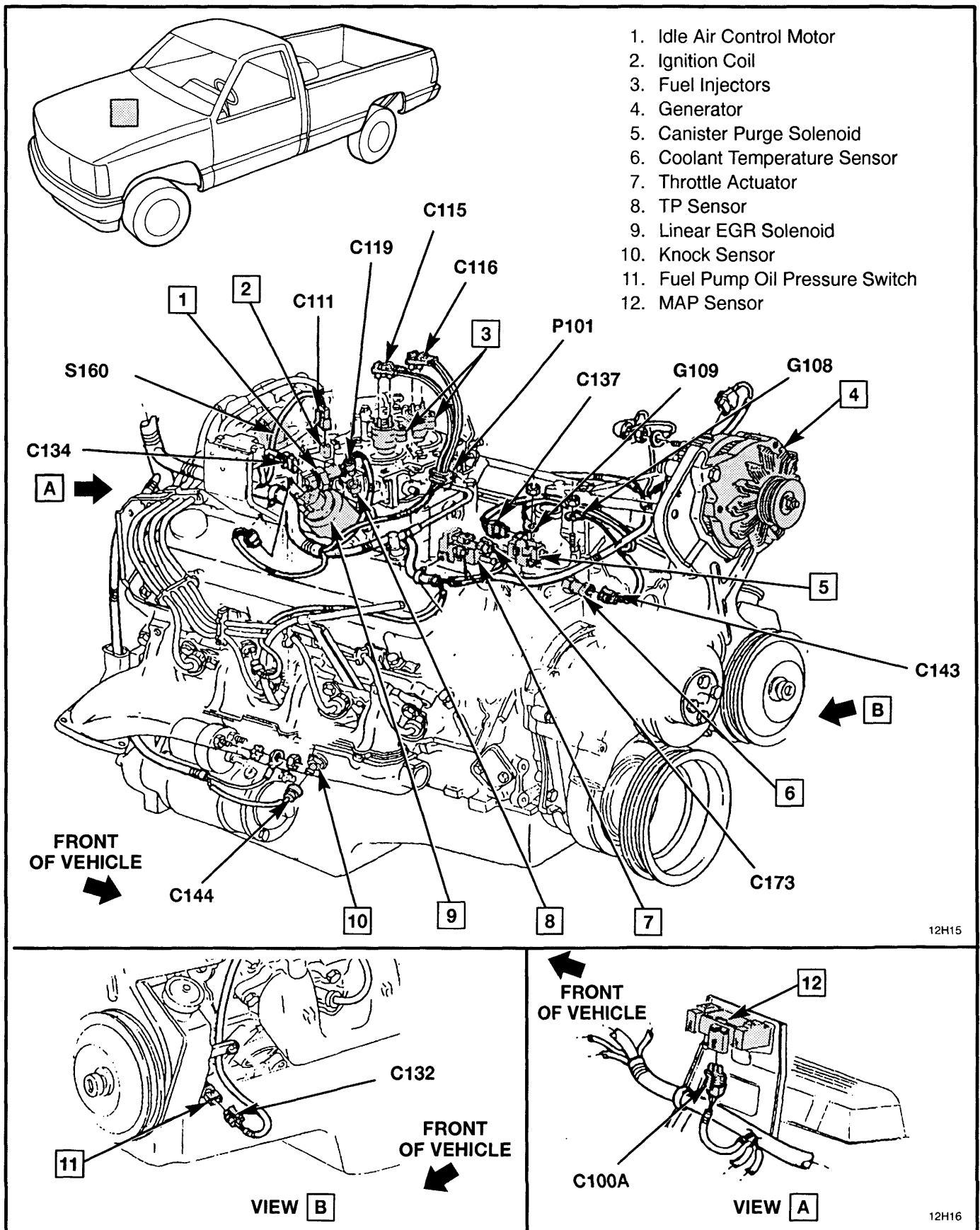


Figure 3 — 7.4L Engine, RH Side



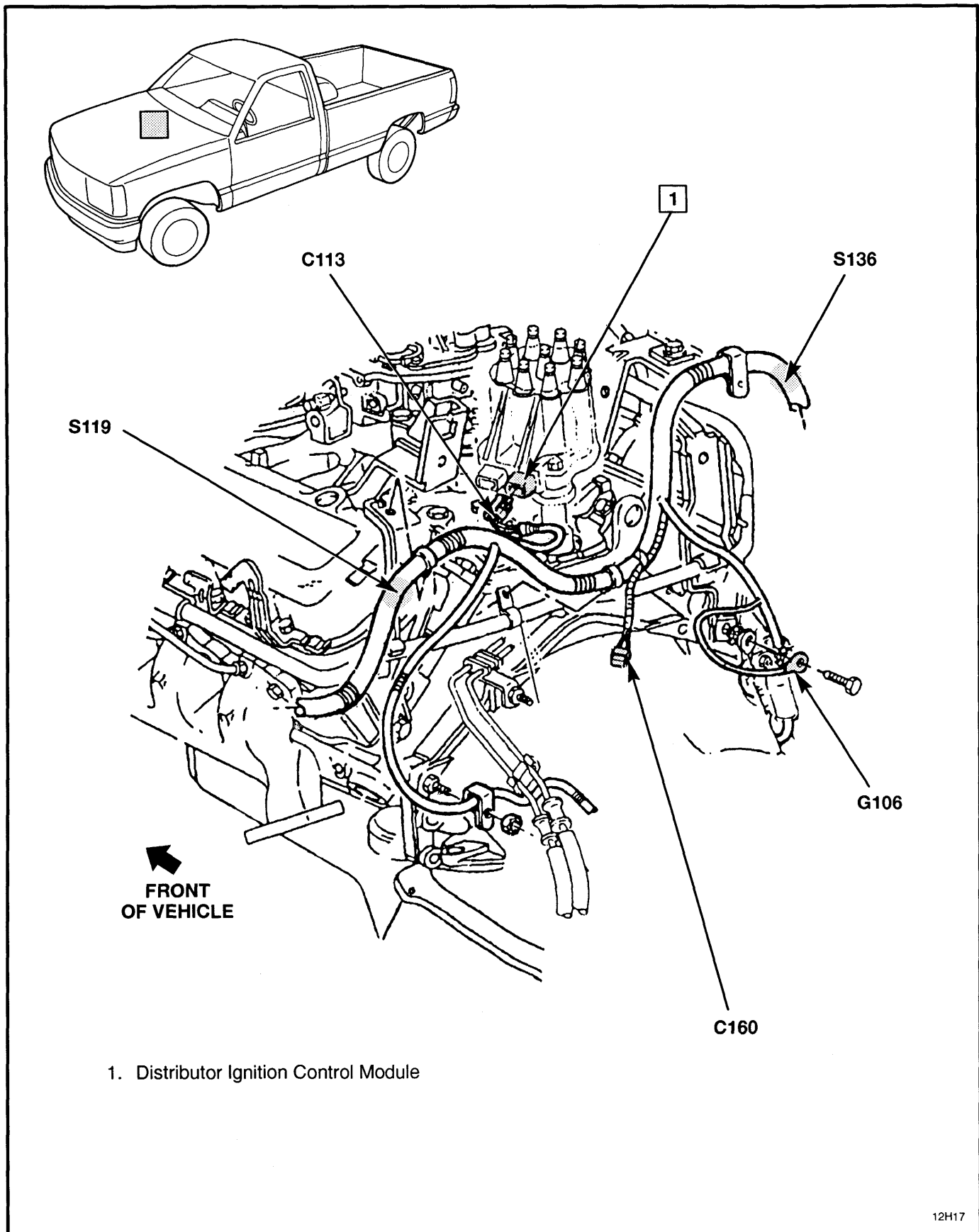


Figure 4 — 7.4L Engine, Rear

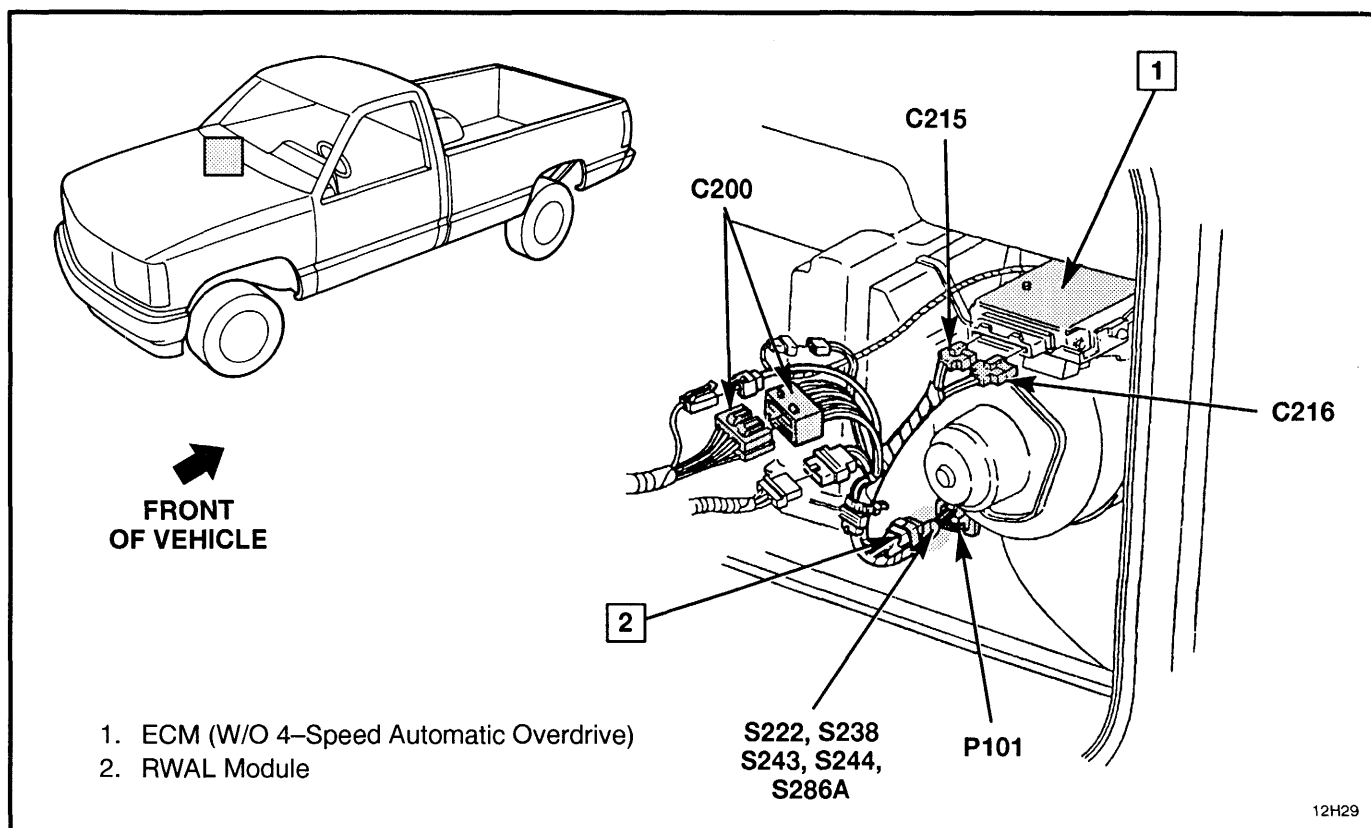


Figure 5 — ECM/PCM Wiring

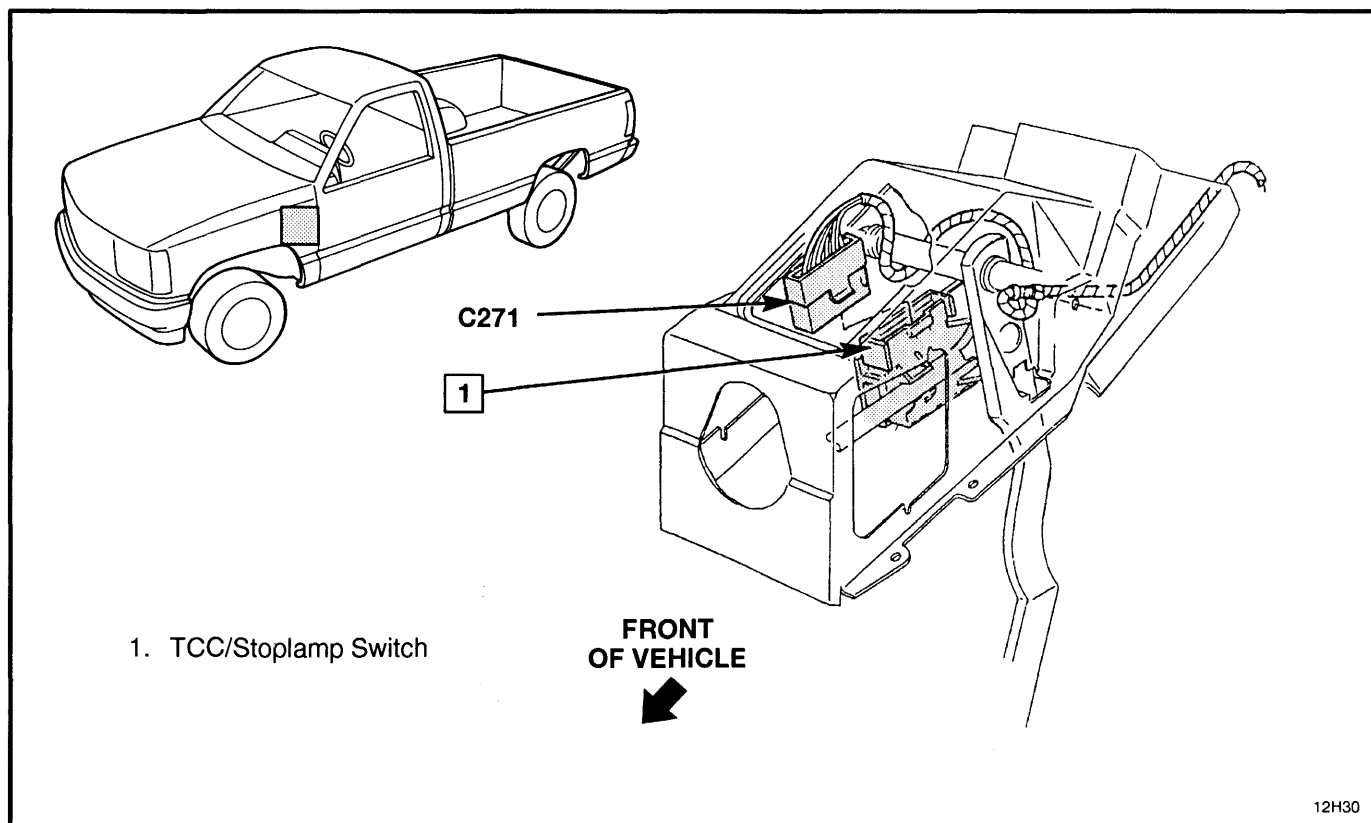


Figure 6 — TCC/Stoplamp Switch

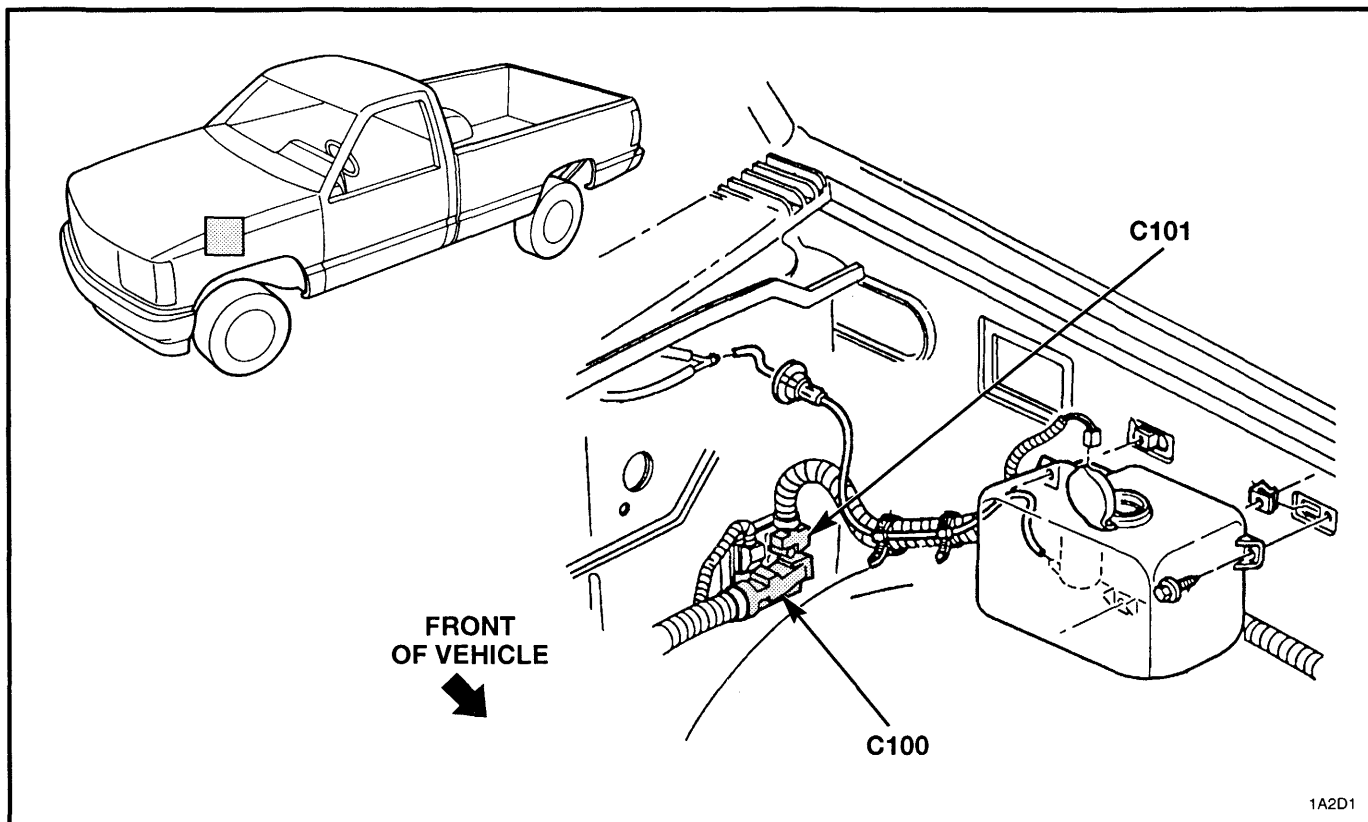


Figure 7 — Cowl Wiring, LH Side

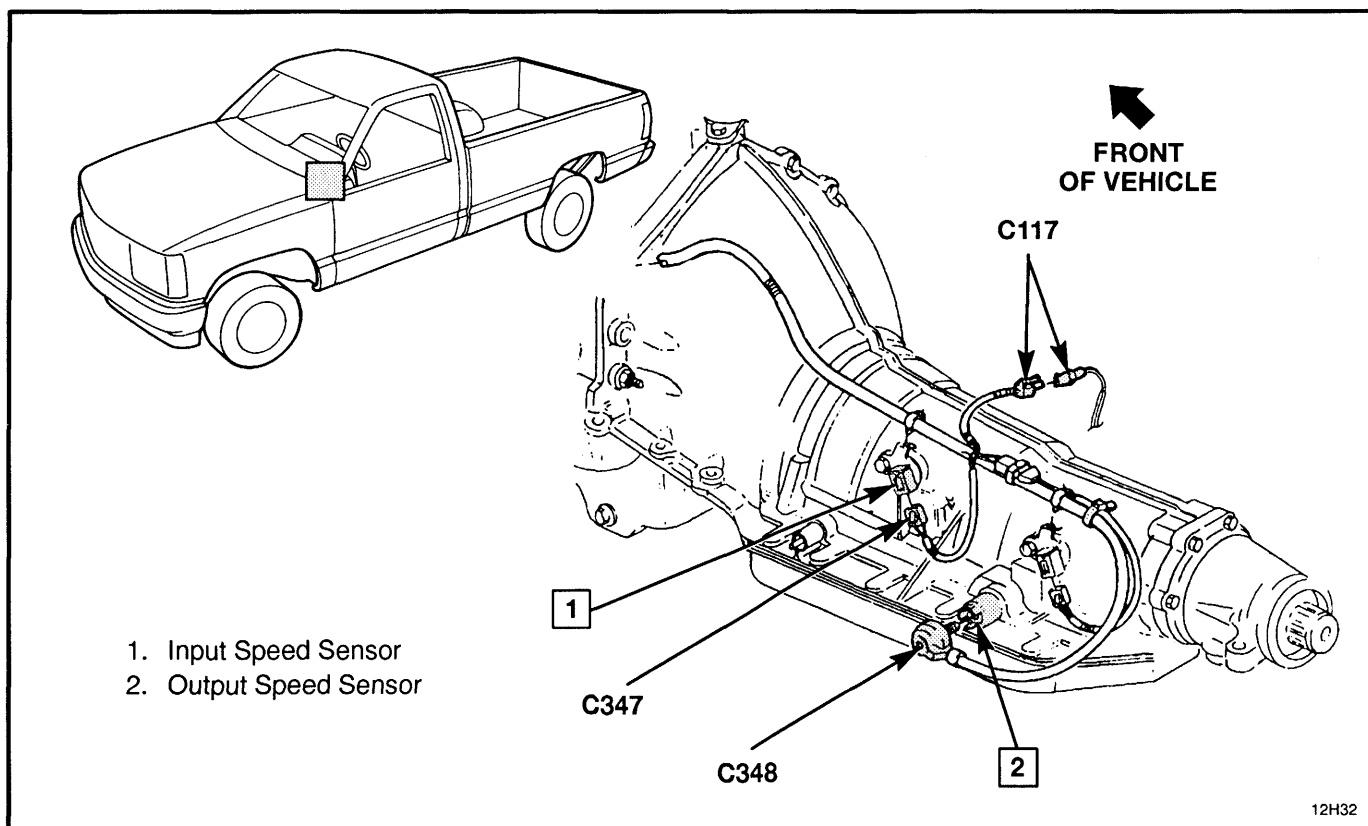


Figure 8 — Transmission Wiring

# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-1

## COMPONENT LOCATION

## Page — Figure

|                                 |                                    |           |   |
|---------------------------------|------------------------------------|-----------|---|
| Barometric Pressure Sensor      | Upper LH side of cowl              | 25-20     | 4 |
| Battery                         | At front of vehicle                | Not Shown |   |
| Battery Junction Block          | RH rear engine compartment at cowl | 25-20     | 1 |
| Clutch Pedal Position Switch    | On clutch pedal support bracket    | Not Shown |   |
| Crank Sensor                    | Inside electronic injection pump   | Not Shown |   |
| DLC                             | Under LH side of I/P               | 25-22     | 6 |
| Fuel Pump Oil Pressure Switch   | Upper rear of engine               | 25-18     | 2 |
| Fuel Pump Relay                 | RH upper cowl                      | 25-21     | 5 |
| Fuel Pump and Sender            | In fuel tank                       | Not Shown |   |
| EGR Solenoid (Pulse Width)      | LH rear top of engine              | 25-19     | 3 |
| EGR Vent Solenoid               | LH rear top of engine              | 25-19     | 3 |
| Electronic Accelerator Pedal    |                                    |           |   |
| Actuator                        | Top of accelerator bracket         | Not Shown |   |
| Electronic Injection Pump       | Top front of engine                | Not Shown |   |
| Engine Coolant Temperature      |                                    |           |   |
| Sensor                          | RH rear front of engine            | 25-19     | 3 |
| Fuel Heater                     | Top rear of engine                 | 25-17     | 1 |
| Fuse Block                      | Under LH side of I/P               | 25-22     | 6 |
| Glow Plug Controller            | RH rear top of engine              | 25-19     | 3 |
| Intake Manifold Air Temperature |                                    |           |   |
| Sensor                          | At front of engine                 | Not Shown |   |
| I/P Cluster                     | LH side of I/P                     | Not Shown |   |
| MAP Sensor                      | LH rear engine compartment at cowl | Not Shown |   |
| Powertrain Control Module (PCM) | Under RH end of I/P                | 25-23     | 8 |
| TCC/Brake Switch                | On brake pedal support bracket     | Not Shown |   |
| TP Sensor                       | Top RH side of engine              | Not Shown |   |
| Transfer Case Switch            | Side of transfer case              | Not Shown |   |

## CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C100  | At bulkhead connector                   | 25-20     | 4 |
| C101  | At bulkhead connector                   | Not Shown |   |
| C106A | LH side of cowl near bulkhead connector | 25-20     | 4 |
| C160  | Center rear of engine                   | Not Shown |   |
| C160A | Top front of engine                     | Not Shown |   |
| C174  | Top front of engine                     | Not Shown |   |
| C200  | Under RH side of I/P, near blower motor | 25-23     | 8 |

## GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 25-20 | 4 |
|------|------------------------------------|-------|---|

## GROUND:

|      |                       |       |   |
|------|-----------------------|-------|---|
| G106 | Top RH rear of engine | 25-17 | 1 |
| G108 | Top RH rear of engine | 25-17 | 1 |

## SPLICES:

|      |                                         |           |   |
|------|-----------------------------------------|-----------|---|
| S100 | At RH battery                           | Not Shown |   |
| S108 | Upper RH side of engine                 | 25-17     | 1 |
| S109 | Upper LH side of engine                 | 25-17     | 1 |
| S113 | Engine compartment                      | 25-18     | 2 |
| S118 | Rear of engine                          | 25-18     | 2 |
| S136 | Rear of engine compartment, near center | 25-18     | 2 |
| S137 | Near fuel pump relay                    | 25-20     | 4 |
| S145 | At glow plug controller                 | 25-19     | 3 |
| S146 | At glow plug controller                 | 25-19     | 3 |
| S153 | Near battery junction block             | 25-21     | 5 |

## 8A-25-2 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

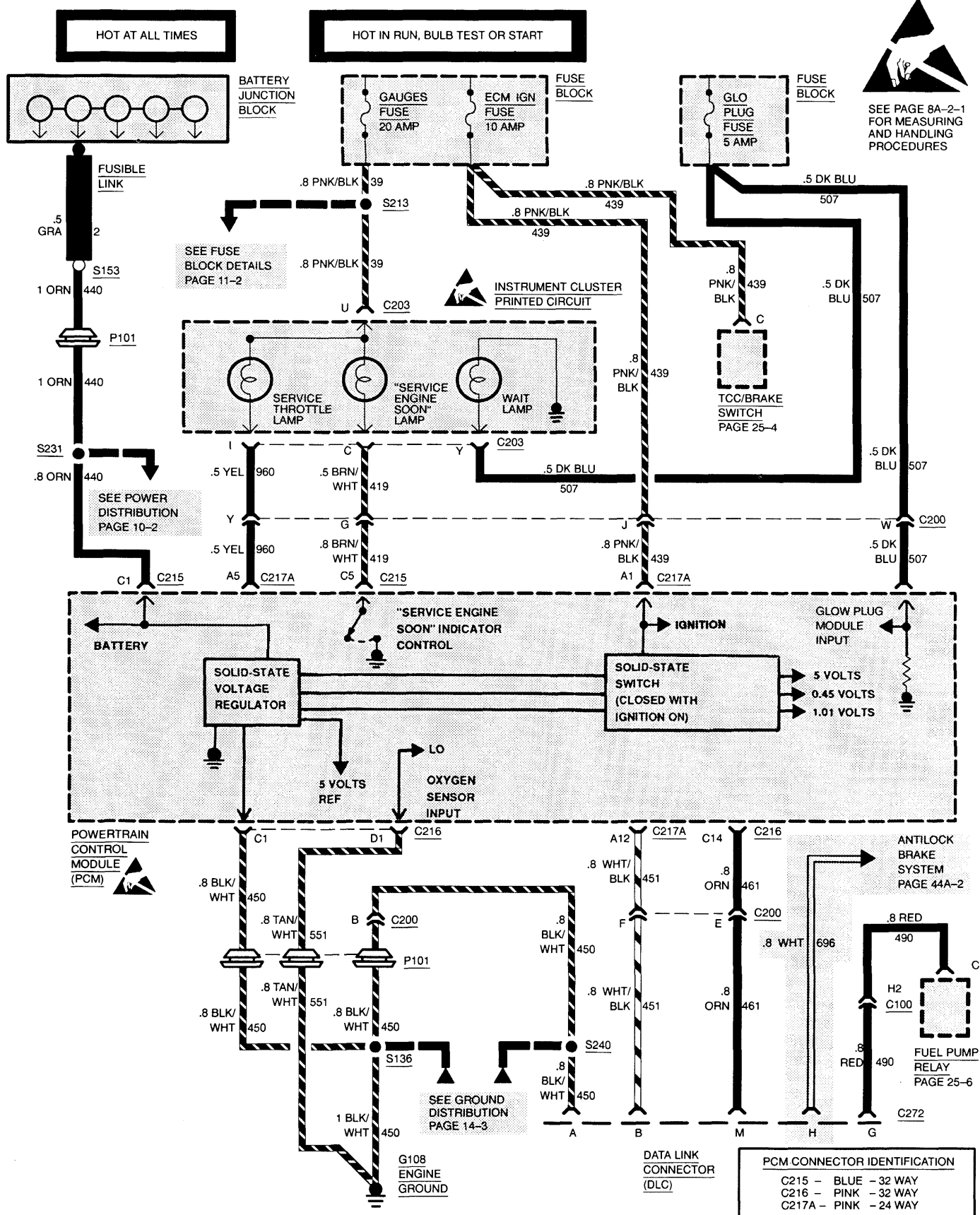
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### COMPONENT LOCATION

Page — Figure

#### SPLICES (CONTINUED):

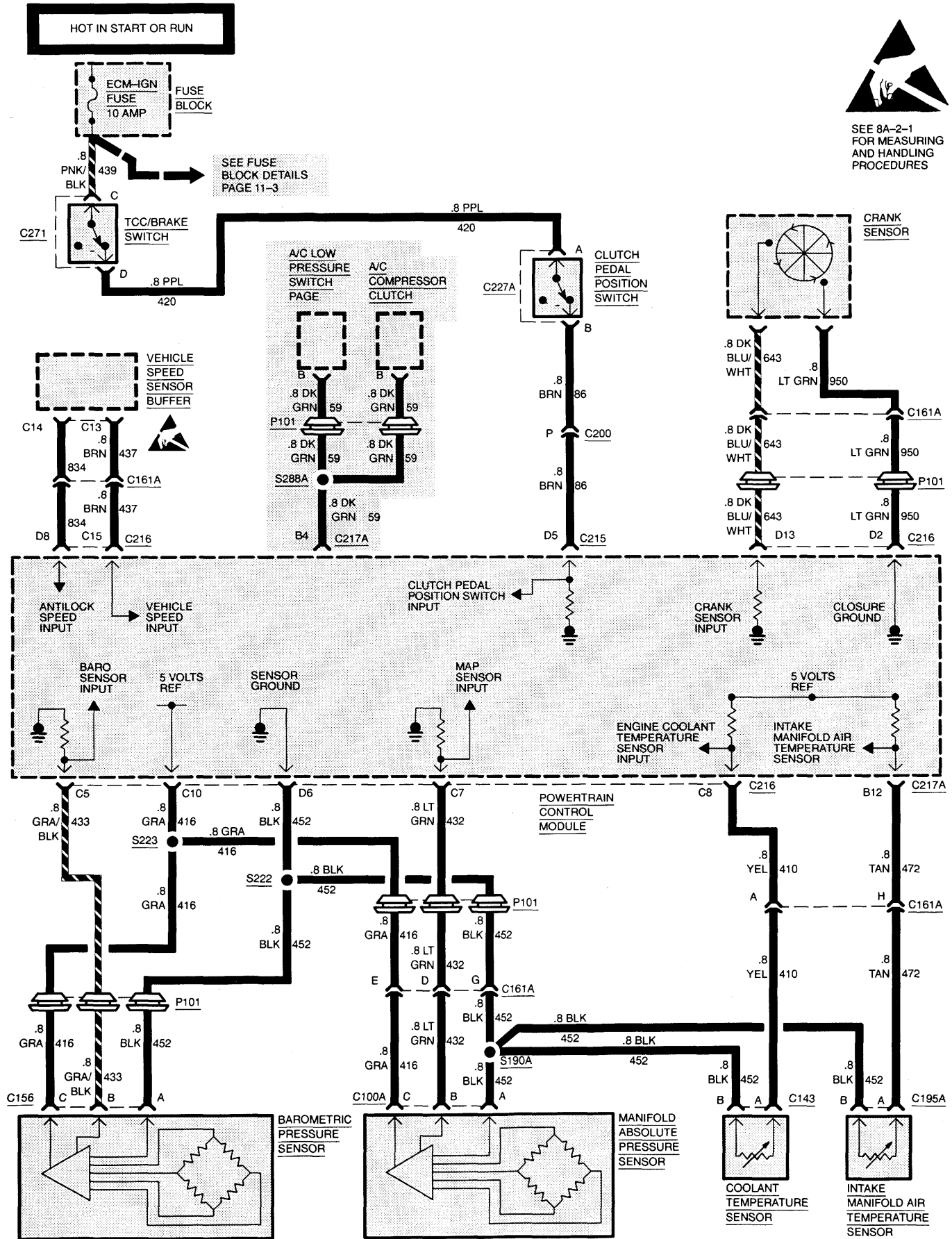
|                        |                                                      |           |   |
|------------------------|------------------------------------------------------|-----------|---|
| S161                   | At battery junction block                            | 25-21     | 5 |
| S190A                  | Engine harness near cowl, LH rear engine compartment | Not Shown |   |
| S207                   | Under LH side of I/P                                 | 25-22     | 6 |
| S213                   | Under LH side of I/P                                 | 25-22     | 6 |
| S222                   | Near PCM, under RH side of I/P                       | 25-23     | 8 |
| S223                   | Near PCM, under RH side of I/P                       | 25-23     | 8 |
| S231                   | Engine harness, near PCM                             | 25-23     | 8 |
| S238                   | Engine harness, near PCM                             | 25-23     | 8 |
| S288A                  | Near PCM, under RH side of I/P                       | Not Shown |   |
| S290 (Suburban, Yukon) | Under LH side of I/P                                 | 25-23     | 8 |



# 8A-25-4 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P



SEE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

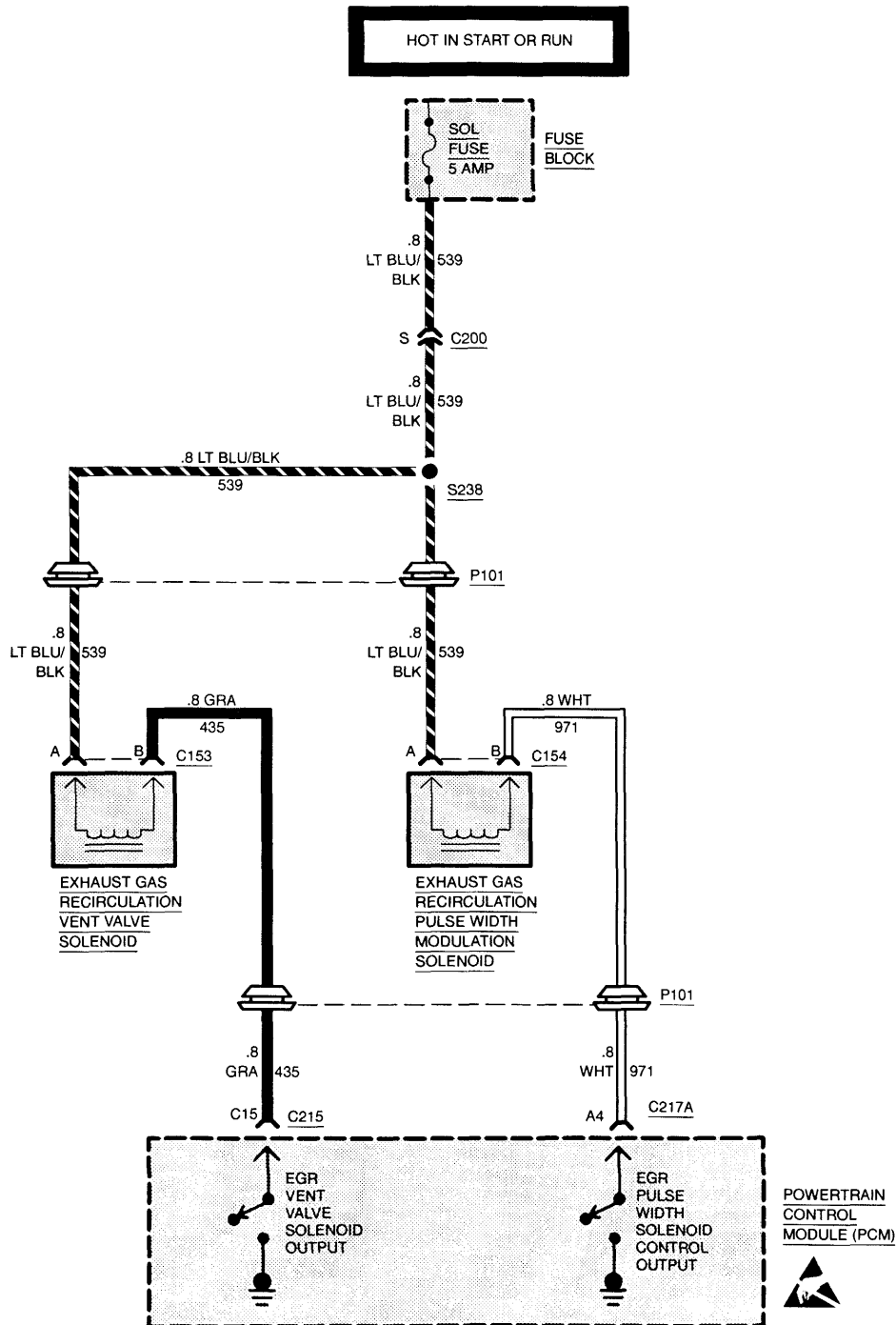


# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-5

## W/MANUAL OR AUTOMATIC TRANSMISSION



SEE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES

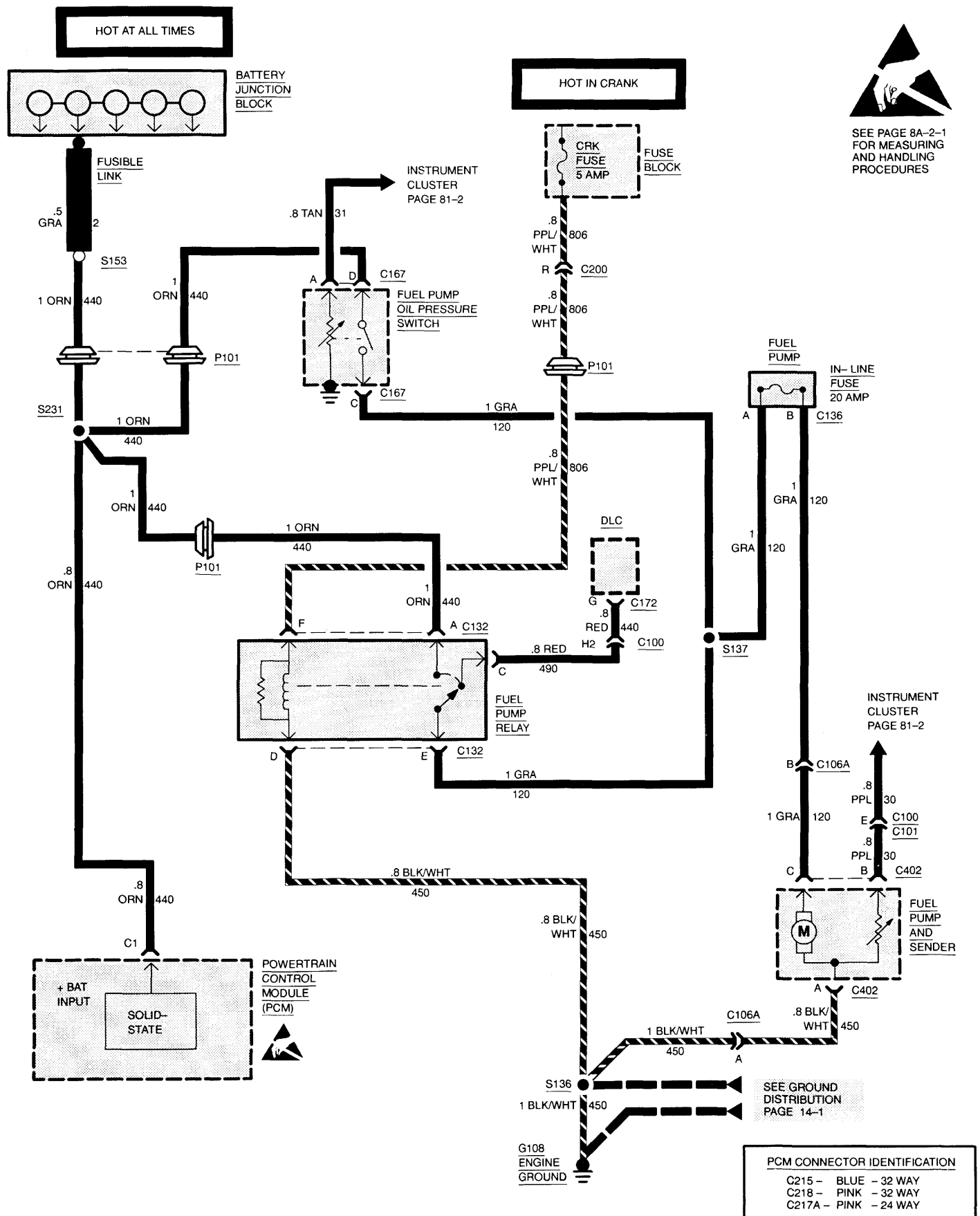


### PCM CONNECTOR IDENTIFICATION

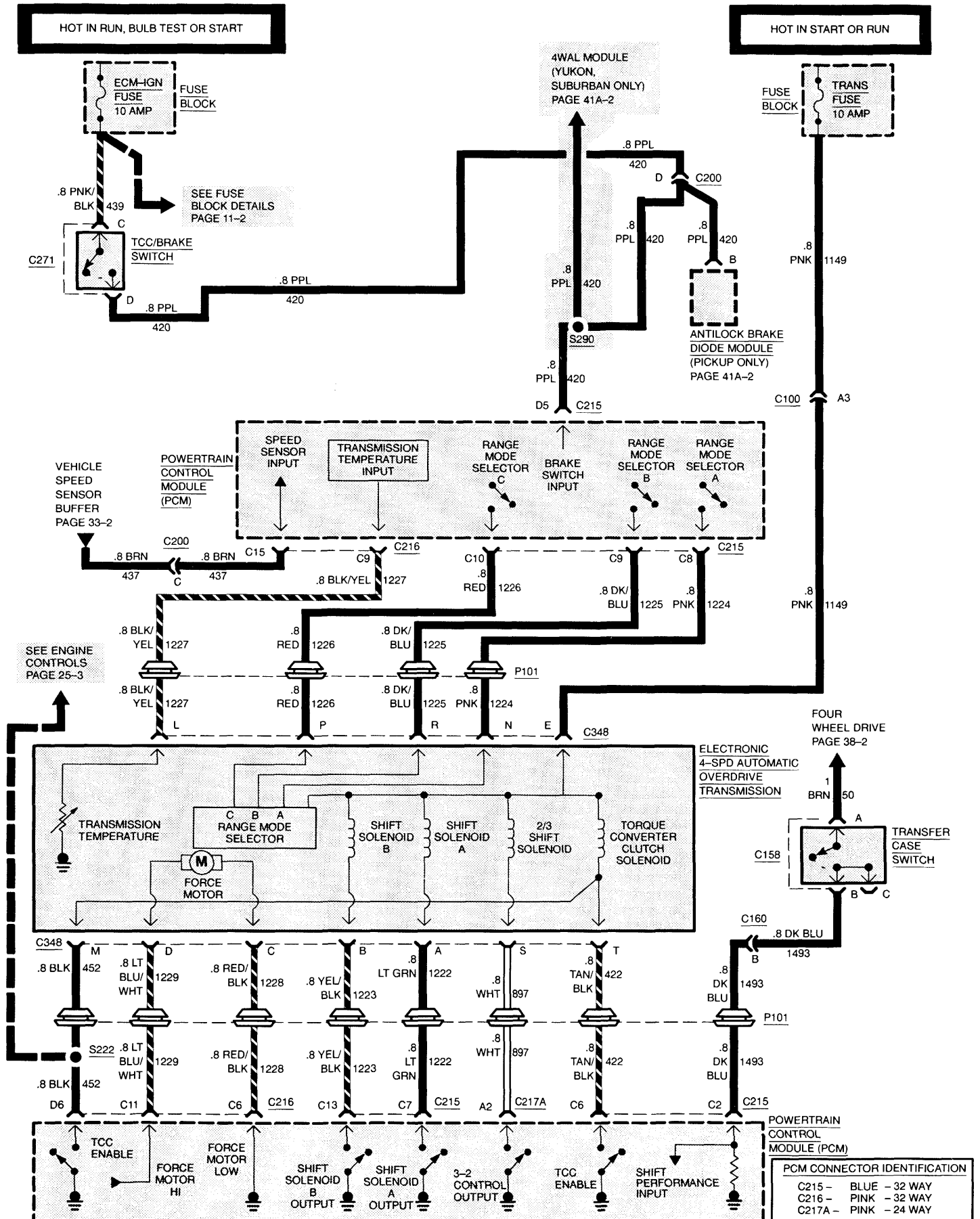
C215 - BLUE - 32 WAY  
C216 - PINK - 32 WAY  
C217A - PINK - 24 WAY



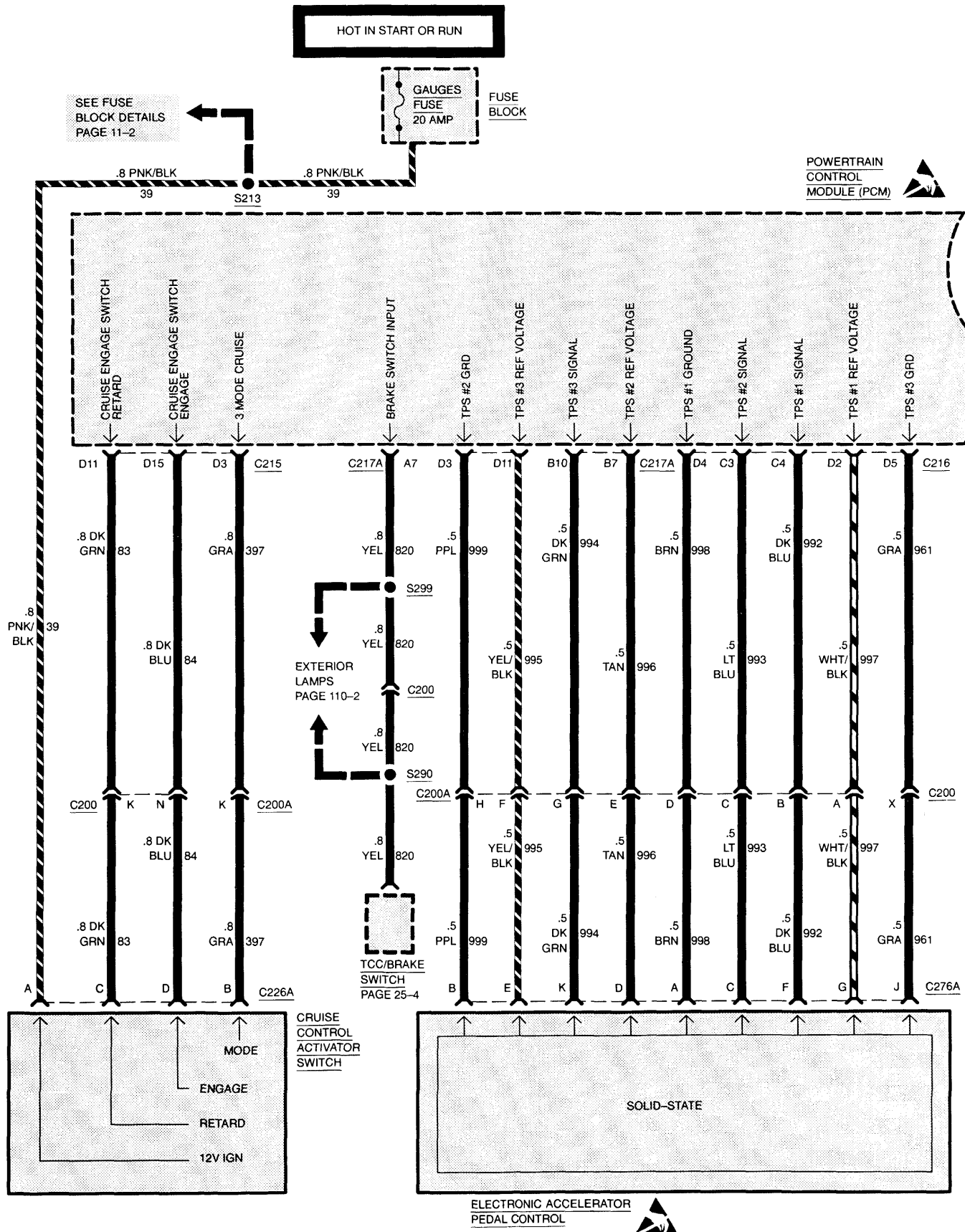
# 8A-25-6 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P (FUEL PUMP CONTROLS)



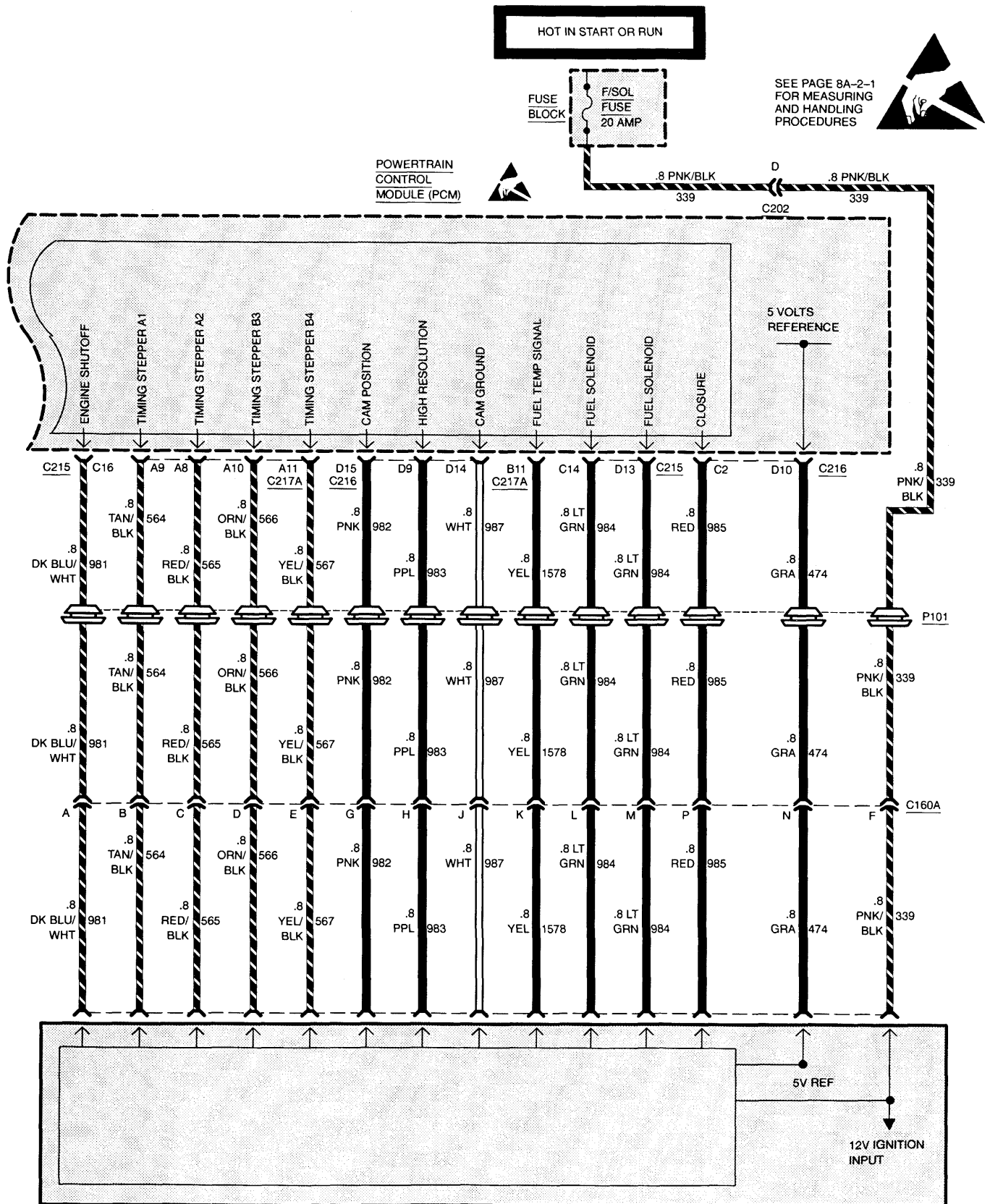
# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-7 (W/AUTOMATIC TRANSMISSION)



# 8A-25-8 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P



# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-9

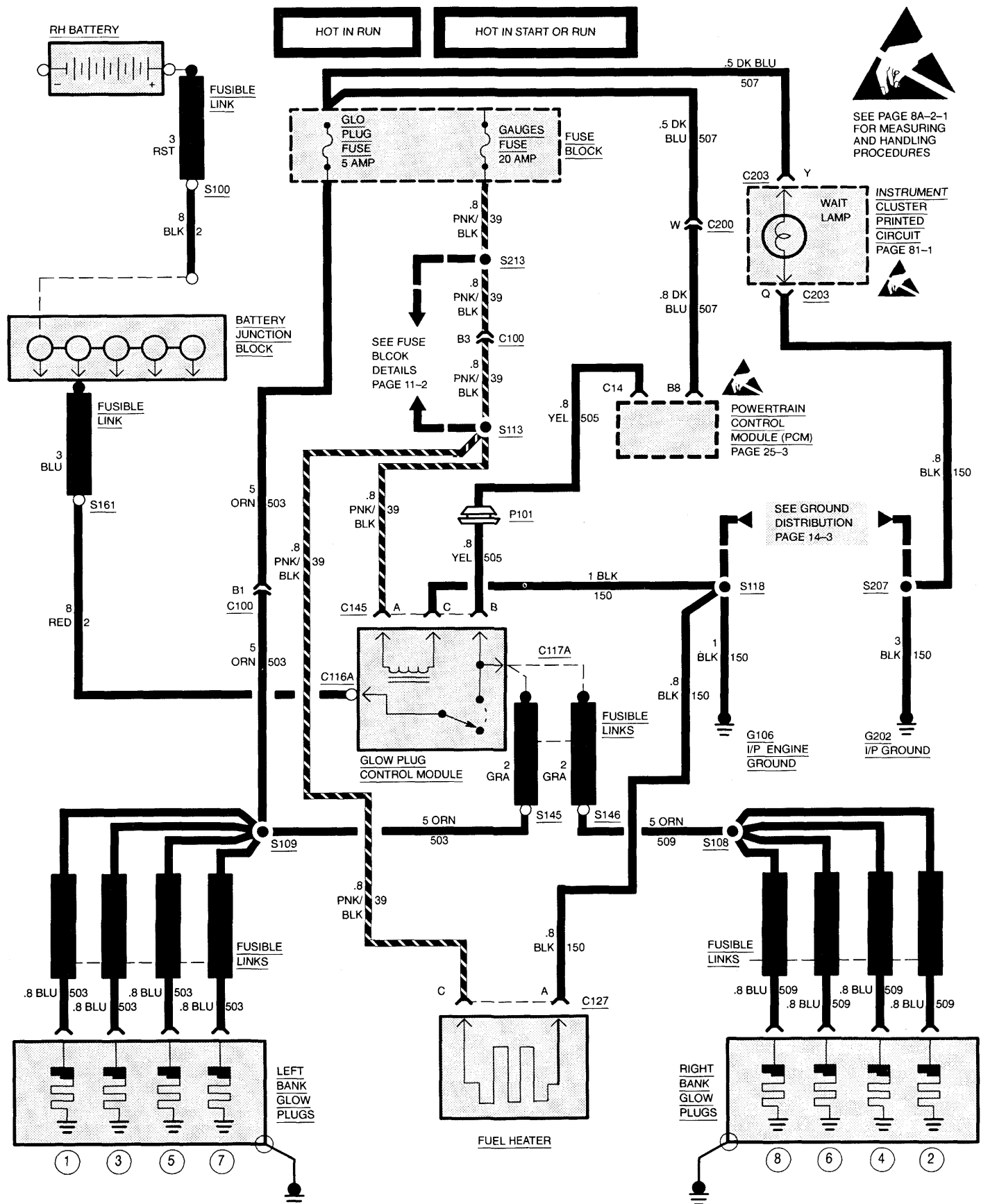


ELECTRONIC  
INJECTION PUMP

| PCM CONNECTOR IDENTIFICATION |        |        |
|------------------------------|--------|--------|
| C215 -                       | BLUE - | 32 WAY |
| C216 -                       | PINK - | 32 WAY |
| C217A -                      | PINK - | 24 WAY |

# 8A-25-10 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

## GLOW PLUG SYSTEM



# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-11

## POWERTRAIN CONTROL MODULE — 6.5L DIESEL ENGINE

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                       |
|-------------|-----------|------------|--------|-----------------------------------|
| 440         | .8        | ORN        | C1     | 12V + BATTERY                     |
| *1493       | .8        | DK BLU     | C2     | 4WD INPUT                         |
|             |           |            | C3     | NOT USED                          |
|             |           |            | C4     | NOT USED                          |
| 419         | .8        | BRN/WHT    | C5     | "SERVICE ENGINE SOON" LAMP OUTPUT |
| ▲422        | .8        | TAN/BLK    | C6     | TORQUE CONVERTER CLUTCH           |
| *1222       | .8        | LT GRN     | C7     | TRANS SHIFT SOLENOID A            |
| *1224       | .8        | PNK        | C8     | TRANS RANGE MODE A                |
| *1225       | .8        | DK BLU     | C9     | TRANS RANGE MODE B                |
| *1226       | .8        | RED        | C10    | TRANS RANGE MODE C                |
|             |           |            | C11    | NOT USED                          |
|             |           |            | C12    | NOT USED                          |
| *1223       | .8        | YEL/BLK    | C13    | TRANS SHIFT SOLENOID B            |
| 984         | .8        | LT GRN     | C14    | FUEL SOLENOID                     |
| 435         | .8        | GRA        | C15    | EGR SOLENOID                      |
| 981         | .8        | DK BLU/WHT | C16    | FUEL SHUTOFF                      |
|             |           |            | D1     | NOT USED                          |
| 997         | .5        | WHT/BLK    | D2     | REFERENCE VOLTAGE TPS 1           |
| 397         | .8        | GRA        | D3     | 3 MODE ELECTRONIC CRUISE CONTROL  |
|             |           |            | D4     | NOT USED                          |
| 420         | .8        | PPL        | D5     | BRAKE SWITCH INPUT                |
|             |           |            | D6     | NOT USED                          |
|             |           |            | D7     | NOT USED                          |
| 834         | .5        | BRN        | D8     | EBS CONTROL SIGNAL                |
|             |           |            | D9     | NOT USED                          |
|             |           |            | D10    | NOT USED                          |
| 83          | .8        | DK GRN     | D11    | CRUISE CONTROL SWITCH — RETARD    |
|             |           |            | D12    | NOT USED                          |
| 984         | .8        | LT GRN     | D13    | FUEL SOLENOID                     |
|             |           |            | D14    | NOT USED                          |
| 84          | .8        | DK BLU     | D15    | CRUISE CONTROL SWITCH — ENGAGE    |
|             |           |            | D16    | NOT USED                          |

\* W/AUTO TRANS ONLY

▲ W/M30 AUTO TRANS

# 8A-25-12 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

## POWERTRAIN CONTROL MODULE — 6.5L DIESEL ENGINE

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                              |
|-------------|-----------|------------|--------|------------------------------------------|
| 450         | .8        | BLK/WHT    | C1     | SYSTEM GROUND                            |
| 985         | .8        | RED        | C2     | CLOSURE SIGNAL                           |
| 993         | .5        | LT BLU     | C3     | TPS 2 SIGNAL                             |
| 992         | .5        | DK BLU     | C4     | TPS 1 SIGNAL                             |
| 433         | .8        | GRA/BLK    | C5     | BAROMETRIC PRESSURE SENSOR INPUT         |
| *1228       | .8        | RED/BLK    | C6     | TRANS FORCE MOTOR HIGH                   |
| 432         | .8        | LT GRN     | C7     | MANIFOLD ABSOLUTE PRESSURE SENSOR INPUT  |
| 410         | .8        | YEL        | C8     | COOLANT TEMPERATURE                      |
| *1227       | .8        | BLK/YEL    | C9     | TRANS TEMPERATURE INPUT                  |
| 416         | .8        | GRA        | C10    | +5 VOLT REFERENCE                        |
| *1229       | .8        | LT BLU/WHT | C11    | TRANS FORCE MOTOR LOW                    |
|             |           |            | C12    | NOT USED                                 |
| 505         | .8        | YEL        | C13    | GLOW PLUG RELAY                          |
| 1061        | .8        | ORN/BLK    | C14    | SERIAL DATA                              |
| 437         | .8        | BRN        | C15    | VEHICLE SPEED SENSOR INPUT               |
|             |           |            | C16    | NOT USED                                 |
| 551         | .8        | TAN/WHT    | D1     | ENGINE GROUND                            |
| 950         | .8        | LT GRN     | D2     | CLOSURE GROUND                           |
| 999         | .5        | PPL        | D3     | TPS 2 GROUND                             |
| 998         | .5        | BRN        | D4     | TPS 1 GROUND                             |
| 961         | .5        | GRA        | D5     | TPS 3 GROUND                             |
| 452         | .8        | BLK        | D6     | TRANS TEMPERATURE/PRESSURE REFERENCE LOW |
|             |           |            | D7     | NOT USED                                 |
| 1586        | .8        | BRN/WHT    | D8     | 2000 PULSE VEHICLE SPEED INPUT           |
| 983         | .8        | PPL        | D9     | TPS 2 SIGNAL                             |
| 474         | .8        | GRA        | D10    | +5 VOLT REFERENCE                        |
| 995         | .5        | YEL/BLK    | D11    | REFERENCE VOLTAGE TPS 3                  |
|             |           |            | D12    | NOT USED                                 |
| 643         | .8        | DK BLU/WHT | D13    | CRANK SENSOR                             |
| 987         | .8        | WHT        | D14    | CAM POSITION SENSOR GROUND               |
| 982         | .8        | PNK        | D15    | CAM POSITION SENSOR                      |
|             |           |            | D16    | NOT USED                                 |

\* W/AUTO TRANS ONLY

# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-13

## POWERTRAIN CONTROL MODULE — 6.5L DIESEL ENGINE

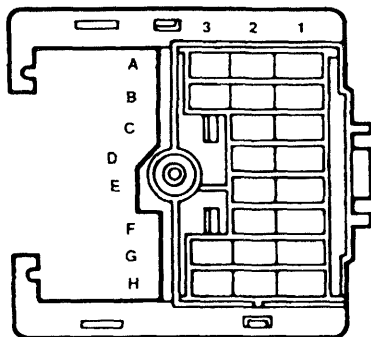
| CIRCUIT NO. | WIRE SIZE | COLOR   | CAVITY | DESCRIPTION                     |
|-------------|-----------|---------|--------|---------------------------------|
| 439         | .8        | PNK/BLK | A1     | 12V IGNITION (FUSED)            |
| ▲897        | .8        | WHT     | A2     | 3/2 SHIFT CONTROL OUTPUT        |
|             |           |         | A3     | NOT USED                        |
| 971         | .8        | WHT     | A4     | EGR VENT SOLENOID               |
| 960         | .5        | YEL     | A5     | "SERVICE THROTTLE" LAMP OUTPUT  |
|             |           |         | A6     | NOT USED                        |
| 820         | .8        | YEL     | A7     | CHMSL INPUT                     |
| 565         | .8        | RED/BLK | A8     | TIMING STEPPER A2               |
| 564         | .8        | TAN/BLK | A9     | TIMING STEPPER A1               |
| 566         | .8        | ORN/BLK | A10    | TIMING STEPPER B3               |
| 567         | .8        | YEL/BLK | A11    | TIMING STEPPER B4               |
| 451         | .8        | WHT/BLK | A12    | DIAGNOSTIC ENABLE               |
|             |           |         | B1     | NOT USED                        |
|             |           |         | B2     | NOT USED                        |
|             |           |         | B3     | NOT USED                        |
| 59          |           | DK GRN  | B4     | A/C ON INPUT                    |
|             |           |         | B5     | NOT USED                        |
|             |           |         | B6     | NOT USED                        |
| 996         | .5        | TAN     | B7     | REFERENCE VOLTAGE TPS 2         |
| 507         | .5        | DK BLU  | B8     | GLOW PLUG "WAIT" LAMP OUTPUT    |
|             |           |         | B9     | NOT USED                        |
| 994         | .5        | DK GRN  | B10    | TPS 3 SIGNAL INPUT              |
| 1578        | .8        | YEL     | B11    | FUEL TEMPERATURE INPUT          |
| 472         | .8        | TAN     | B12    | INTAKE MANIFOLD AIR TEMPERATURE |

▲ W/M30 AUTO TRANS ONLY



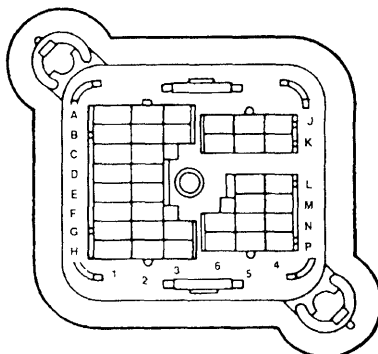
# 8A-25-14 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

12020183



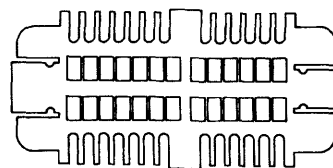
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



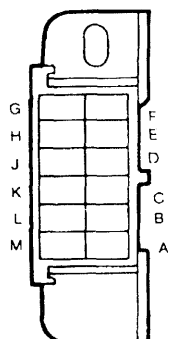
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



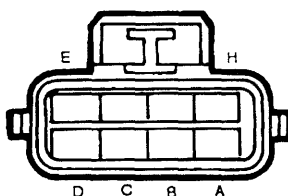
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12020043



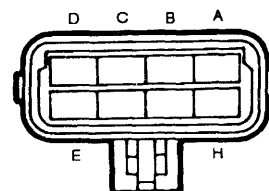
**BLACK**  
Metri-Pack 480  
**C272**  
Data Link Connector

12047937



**BLACK**  
Metri-Pack 150  
**C161A**  
In-Line PCM to Engine

12047931



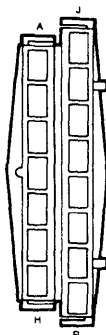
**BLACK**  
Metri-Pack 150  
**C161A**  
In-Line Engine to PCM

12041254



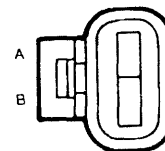
**C200**  
In-Line I/P to Bulkhead

12020213



**C200**  
In-Line Bulkhead to I/P

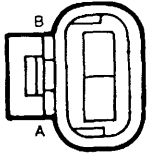
12084247



**GRAY**  
Metri-Pack 150  
**C195A**  
Intake Manifold Air Temperature  
Sensor

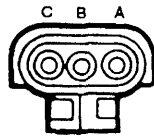
# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-15

12078084



**BLACK**  
Metri-Pack 150  
**C143**  
Coolant Temperature Sensor

12020403



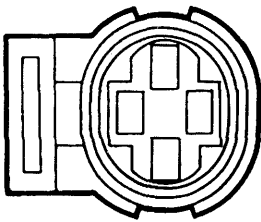
**BLACK**  
**C100A**  
MAP Sensor

12020403



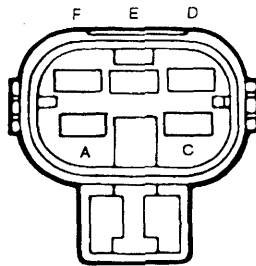
**BLACK**  
**C156**  
Barometric Pressure Sensor

12065401



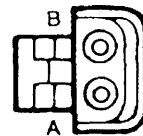
**GRAY**  
Metri-Pack 150  
**C167**  
Fuel Pump Oil Pressure Switch

12052287



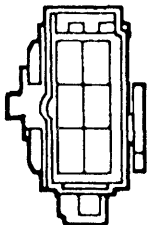
**BLACK**  
Metri-Pack  
**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack  
**C106A**  
In-Line Fuse to Fuel Pump and Sender

12020099



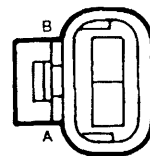
**C102**  
In-Line Fuel Pump to Bulkhead

12033709



**BLACK**  
Metri-Pack 280  
**C271**  
TCC/Brake Switch

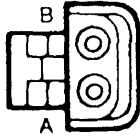
12078084



**BLACK**  
Metri-Pack 150  
**C365**  
Transmission Speed Sensor

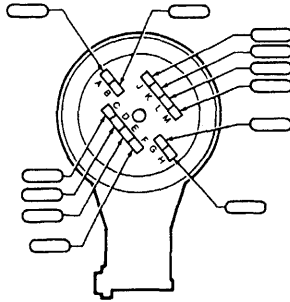
# 8A-25-16 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

12015792



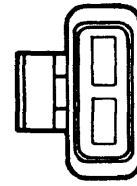
**BLACK**  
Weather Pack  
**C155A**  
Transfer Case Switch

12084690



**C348**  
Transmission

12066681

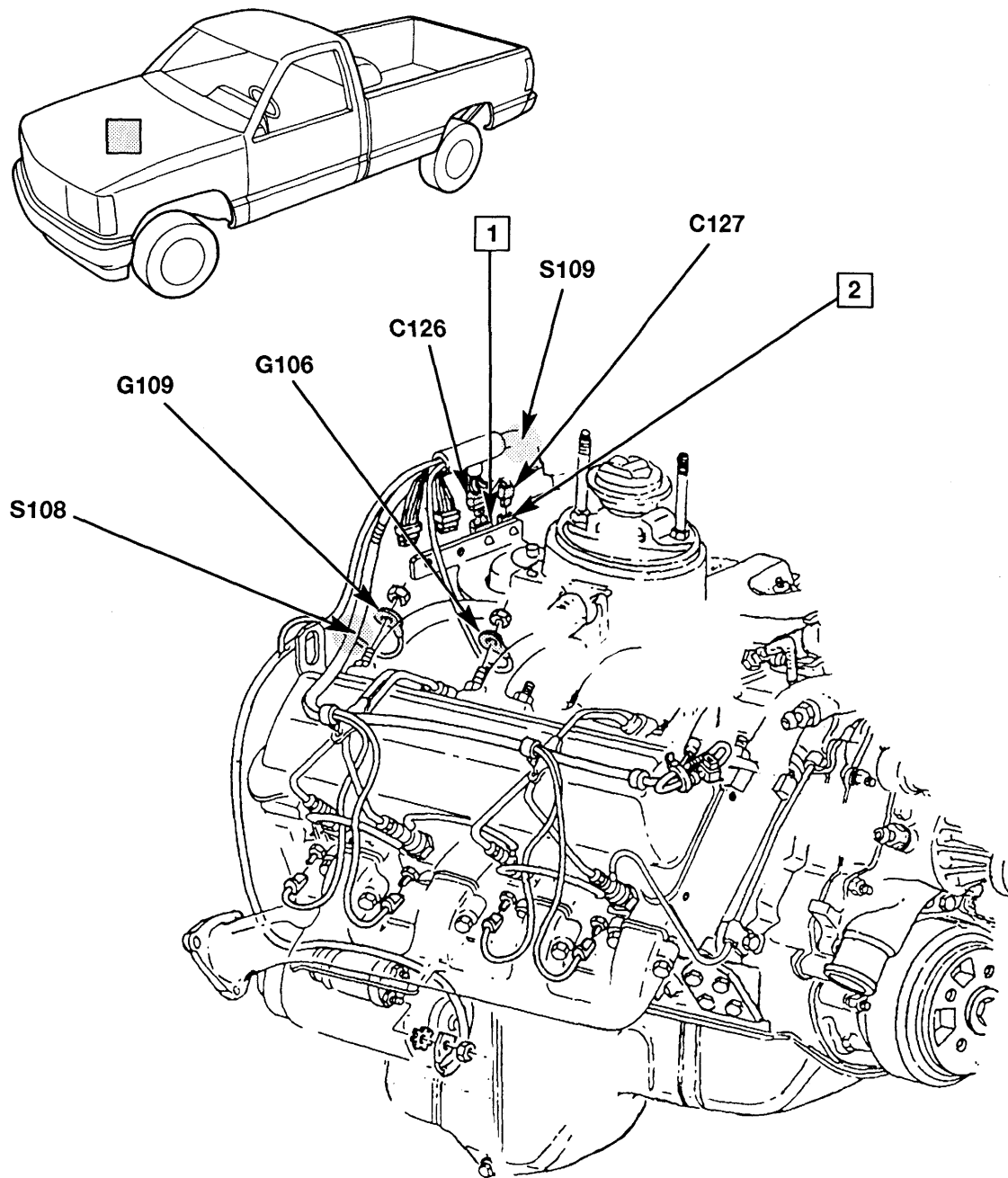


**BLACK**  
Metri-Pack 630  
**C130**  
Fuel Pump In-Line Fuse

12034417



**C227A**  
Clutch Pedal Position Switch



- 1. Fuel Heater
- 2. Water-In-Fuel Sensor

FRONT  
OF VEHICLE



Figure 1 — 6.5L Diesel Engine Wiring, RH Side

# 8A-25-18 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

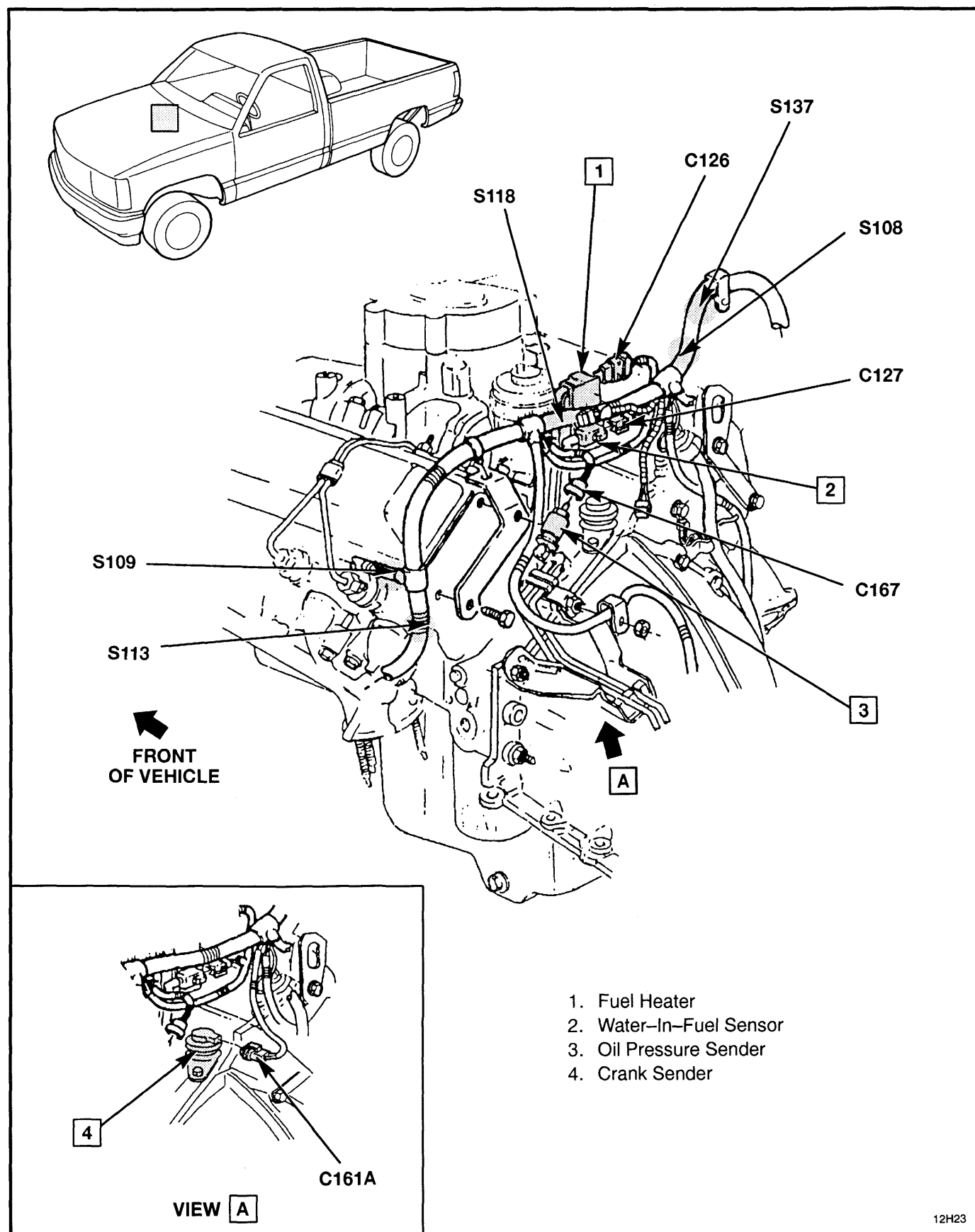


Figure 2 — 6.5L Diesel Engine Wiring, Rear

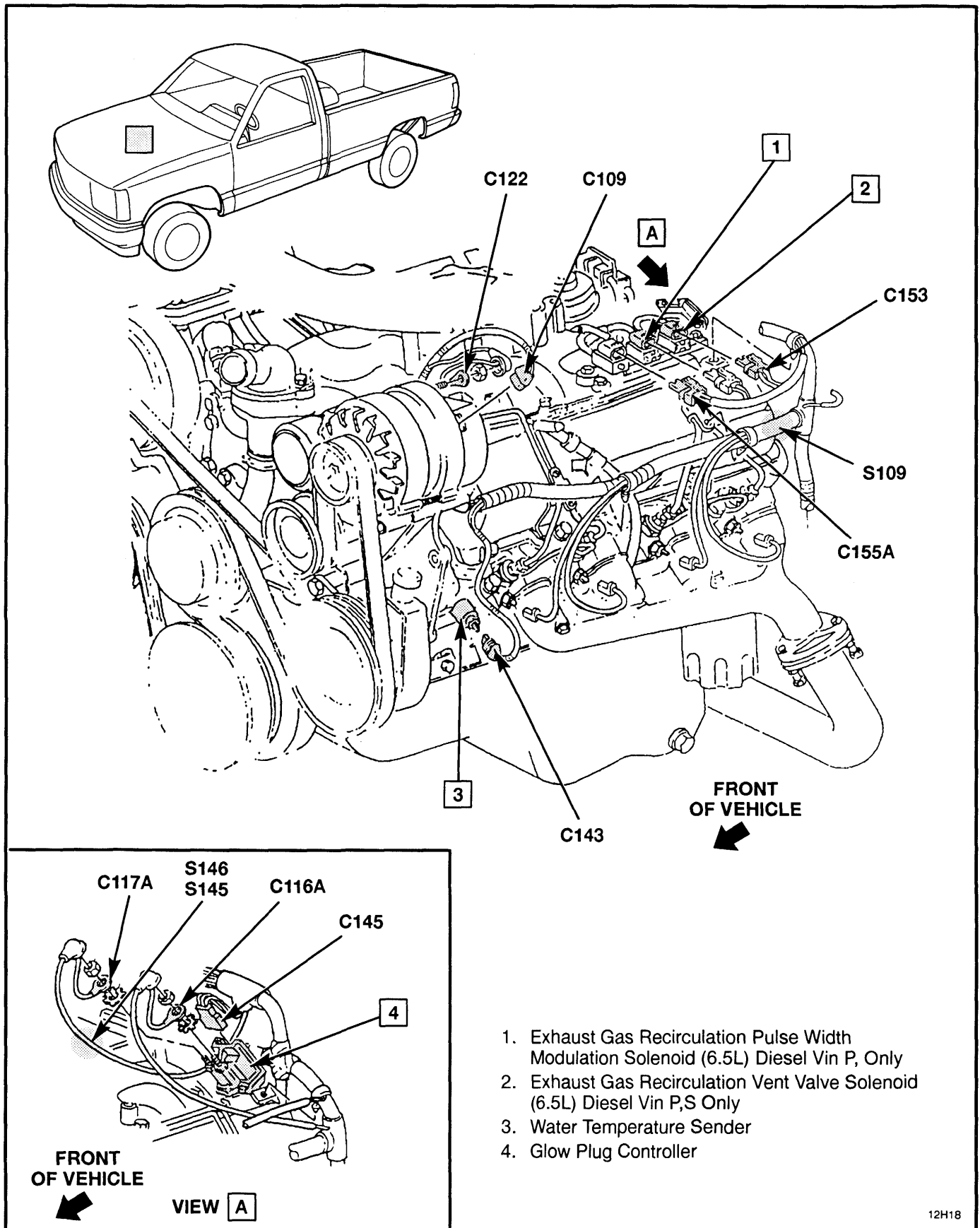


Figure 3 — 6.5L Diesel Engine Wiring, LH Side

# 8A-25-20 ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P

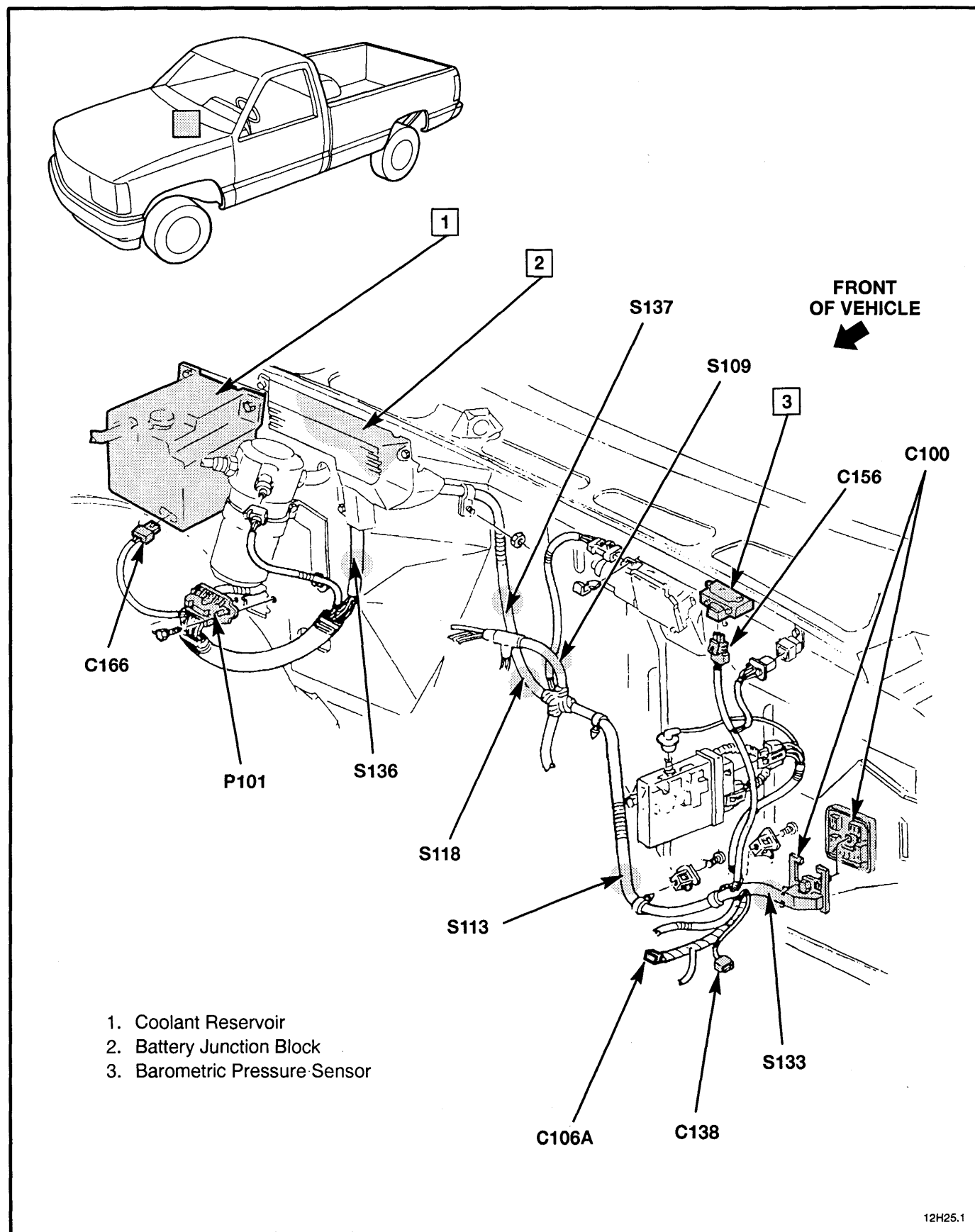


Figure 4 — Cowl Wiring, (6.5L) Diesel Engine

# ENGINE CONTROLS 6.5L (396 CID) V8 DIESEL VIN P 8A-25-21

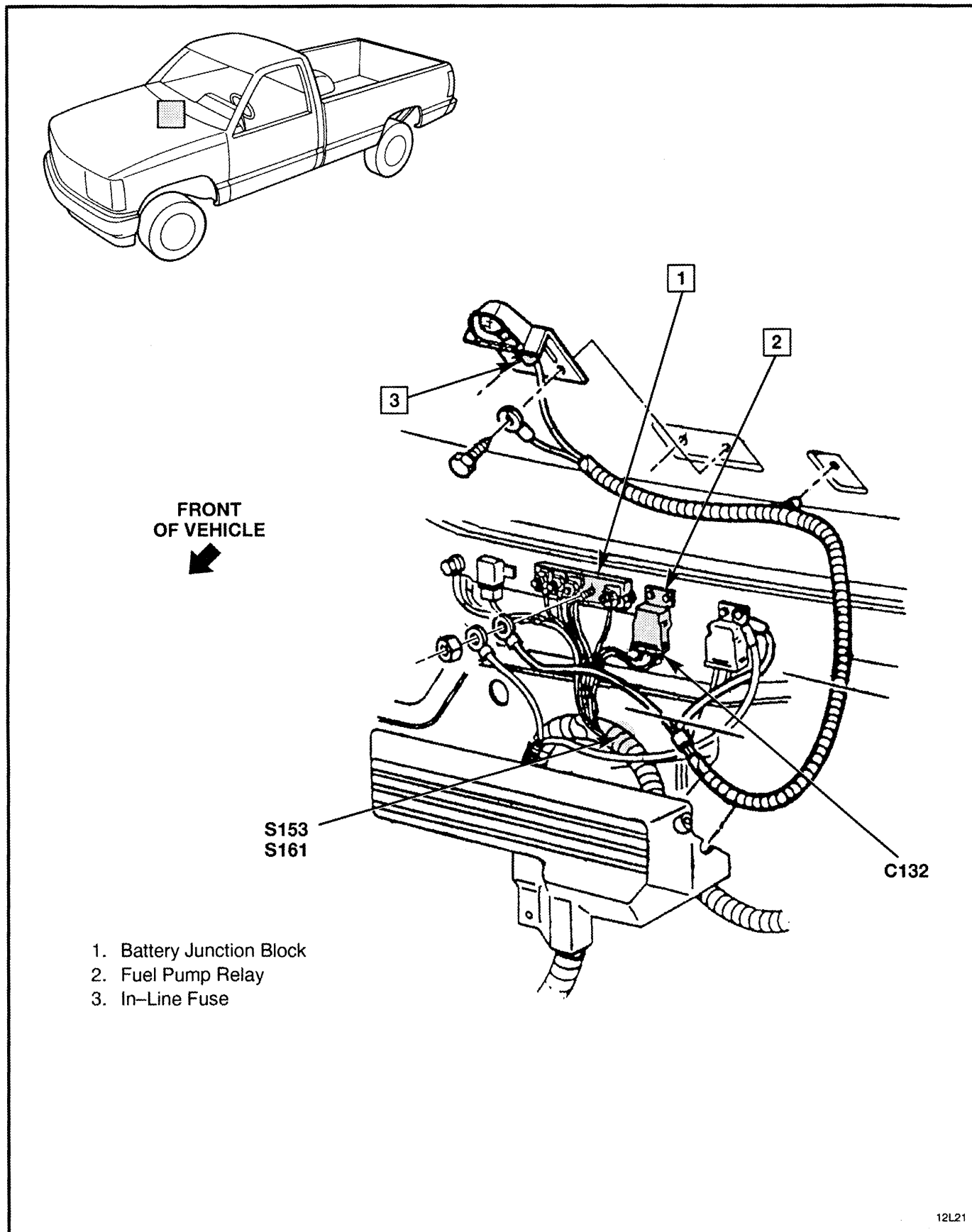


Figure 5 — Battery Junction Block Wiring



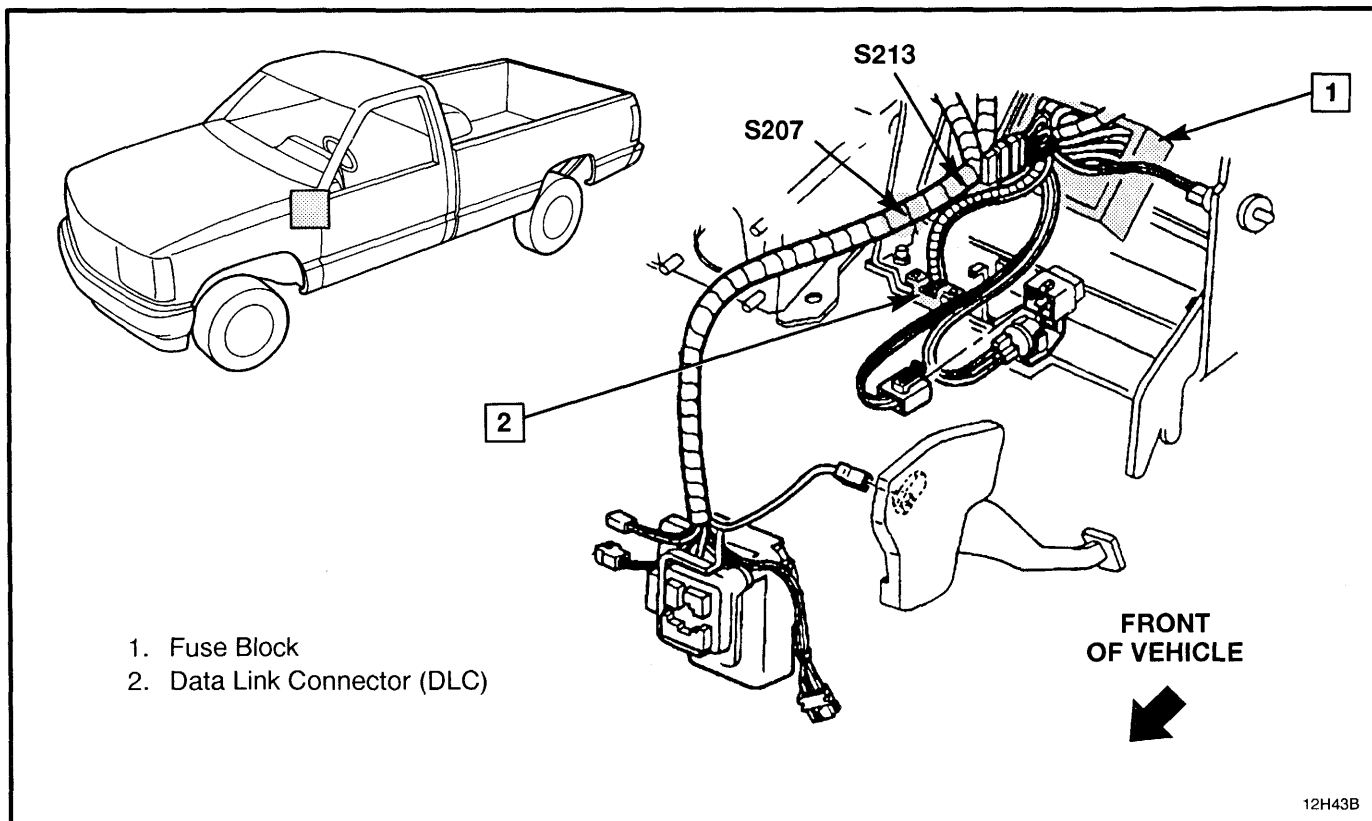


Figure 6 — Instrument Panel, LH Side

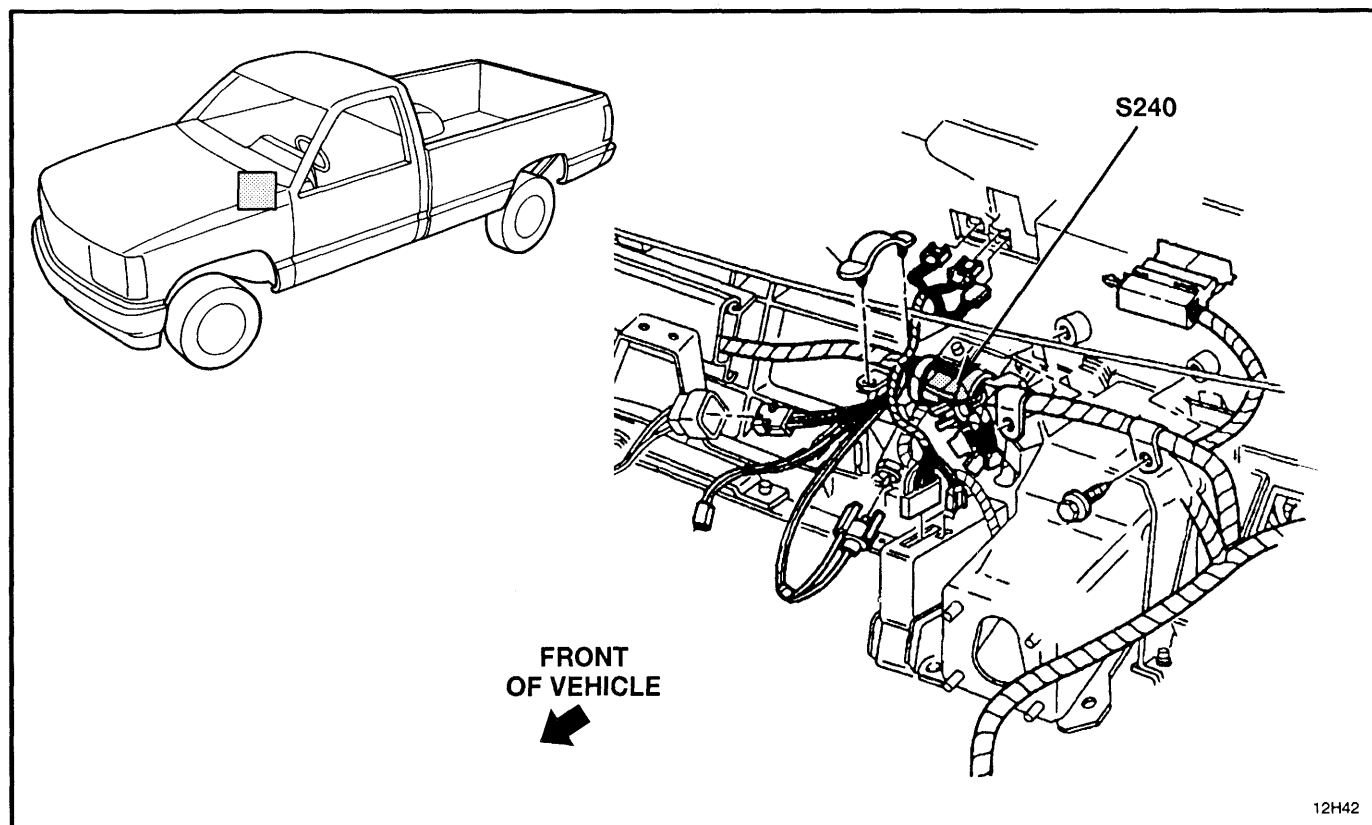


Figure 7 — Instrument Panel Wiring, RH Side

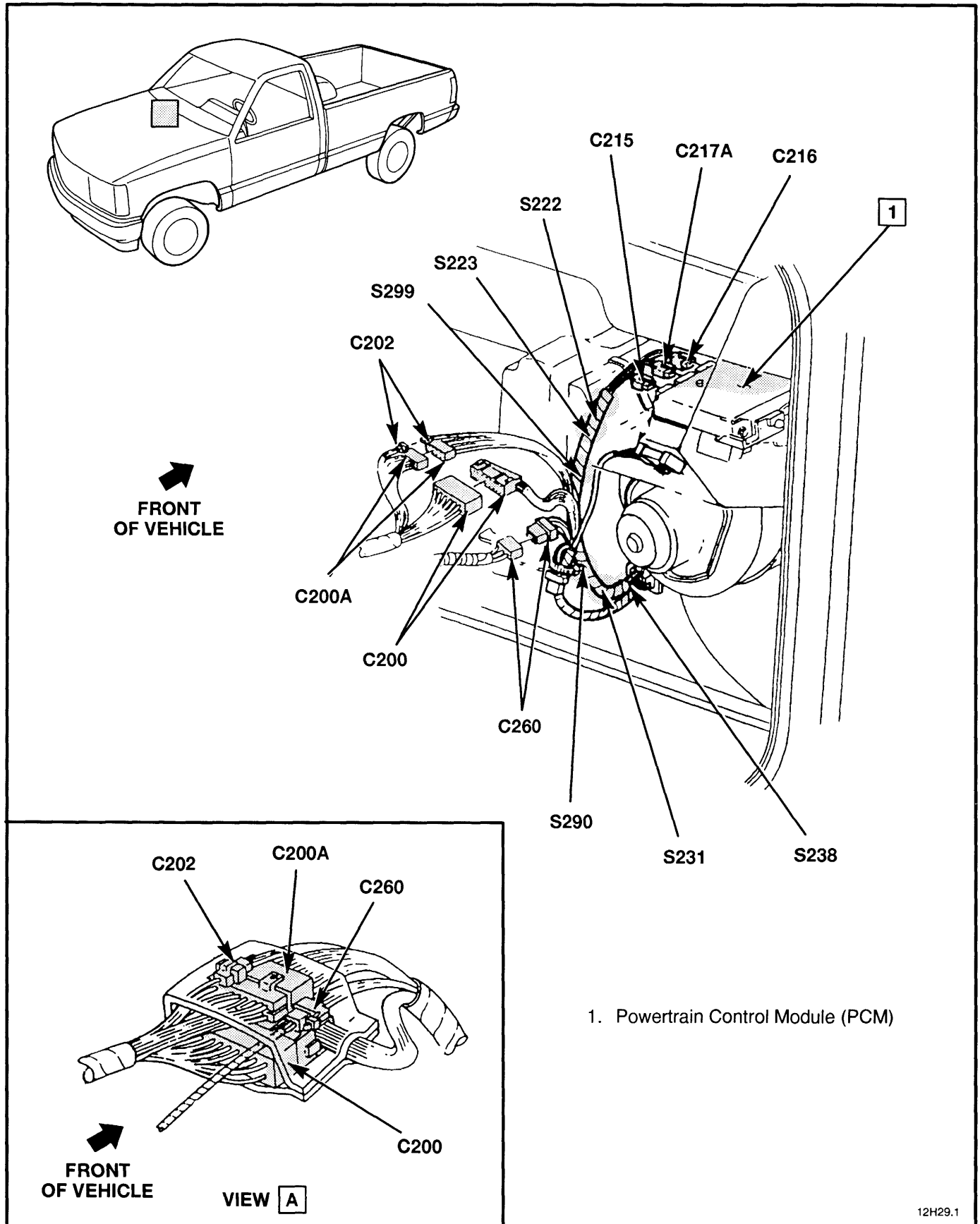


Figure 8 — PCM Wiring, Diesel Engines

**BLANK**

## COMPONENT LOCATION

Page — Figure

|                                 |                                    |           |   |
|---------------------------------|------------------------------------|-----------|---|
| Barometric Pressure Sensor      | Upper LH side of cowl              | 26-21     | 4 |
| Battery                         | At front of vehicle                | Not Shown |   |
| Battery Junction Block          | RH rear engine compartment at cowl | 26-21     | 4 |
| Clutch Pedal Position Switch    | On clutch pedal support bracket    | Not Shown |   |
| Crank Sensor                    | Inside electronic injection pump   | Not Shown |   |
| DLC                             | Under LH side of I/P               | 26-23     | 6 |
| Fuel Pump Oil Pressure Switch   | Upper rear of engine               | 26-19     | 2 |
| Fuel Pump Relay                 | RH upper cowl                      | 26-22     | 5 |
| Fuel Pump and Sender            | In fuel tank                       | Not Shown |   |
| EGR Solenoid (Pulse Width)      | LH rear top of engine              | 26-20     | 3 |
| EGR Vent Solenoid               | LH rear top of engine              | 26-20     | 3 |
| Electronic Accelerator Pedal    |                                    |           |   |
| Actuator                        | Top of accelerator bracket         | Not Shown |   |
| Electronic Injection Pump       | Top front of engine                | Not Shown |   |
| Engine Coolant Temperature      |                                    |           |   |
| Sensor                          | RH rear front of engine            | 26-20     | 3 |
| Fuel Heater                     | Top rear of engine                 | 26-18     | 1 |
| Fuse Block                      | Under LH side of I/P               | 26-23     | 6 |
| Glow Plug Controller            | RH rear top of engine              | 26-20     | 3 |
| Intake Manifold Air Temperature |                                    |           |   |
| Sensor                          | At front of engine                 | Not Shown |   |
| I/P Cluster                     | LH side of I/P                     | Not Shown |   |
| MAP Sensor                      | LH rear engine compartment at cowl | Not Shown |   |
| Powertrain Control Module (PCM) | Under RH end of I/P                | 26-24     | 8 |
| TCC/Brake Switch                | On brake pedal support bracket     | Not Shown |   |
| TP Sensor                       | Top RH side of engine              | Not Shown |   |
| Transfer Case Switch            | Side of transfer case              | Not Shown |   |

## CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C100  | At bulkhead connector                   | 26-21     | 4 |
| C101  | At bulkhead connector                   | Not Shown |   |
| C106A | LH side of cowl near bulkhead connector | Not Shown |   |
| C160  | Center rear of engine                   | Not Shown |   |
| C160A | Top front of engine                     | Not Shown |   |
| C161A | Top front of engine                     | Not Shown |   |
| C174  | Top front of engine                     | 26-24     | 8 |
| C200  | Under RH side of I/P, near blower motor | Not Shown |   |

## GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 26-21 | 4 |
|------|------------------------------------|-------|---|

## GROUND:

|      |                          |           |   |
|------|--------------------------|-----------|---|
| G106 | Rear of RH cylinder head | 26-18     | 1 |
| G108 | Top RH rear of engine    | Not Shown |   |

## SPLICES:

|      |                                         |           |   |
|------|-----------------------------------------|-----------|---|
| S100 | At RH battery                           | Not Shown |   |
| S108 | Upper RH side of engine                 | 26-18     | 1 |
| S109 | Upper LH side of engine                 | 26-18     | 1 |
| S113 | Engine compartment                      | 26-19     | 2 |
| S118 | Rear of engine                          | 26-19     | 2 |
| S136 | Rear of engine compartment, near center | 26-21     | 4 |
| S137 | Near fuel pump relay                    | 26-19     | 2 |
| S145 | At glow plug controller                 | 26-20     | 3 |
| S146 | At glow plug controller                 | 26-20     | 3 |

## 8A-26-2 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S

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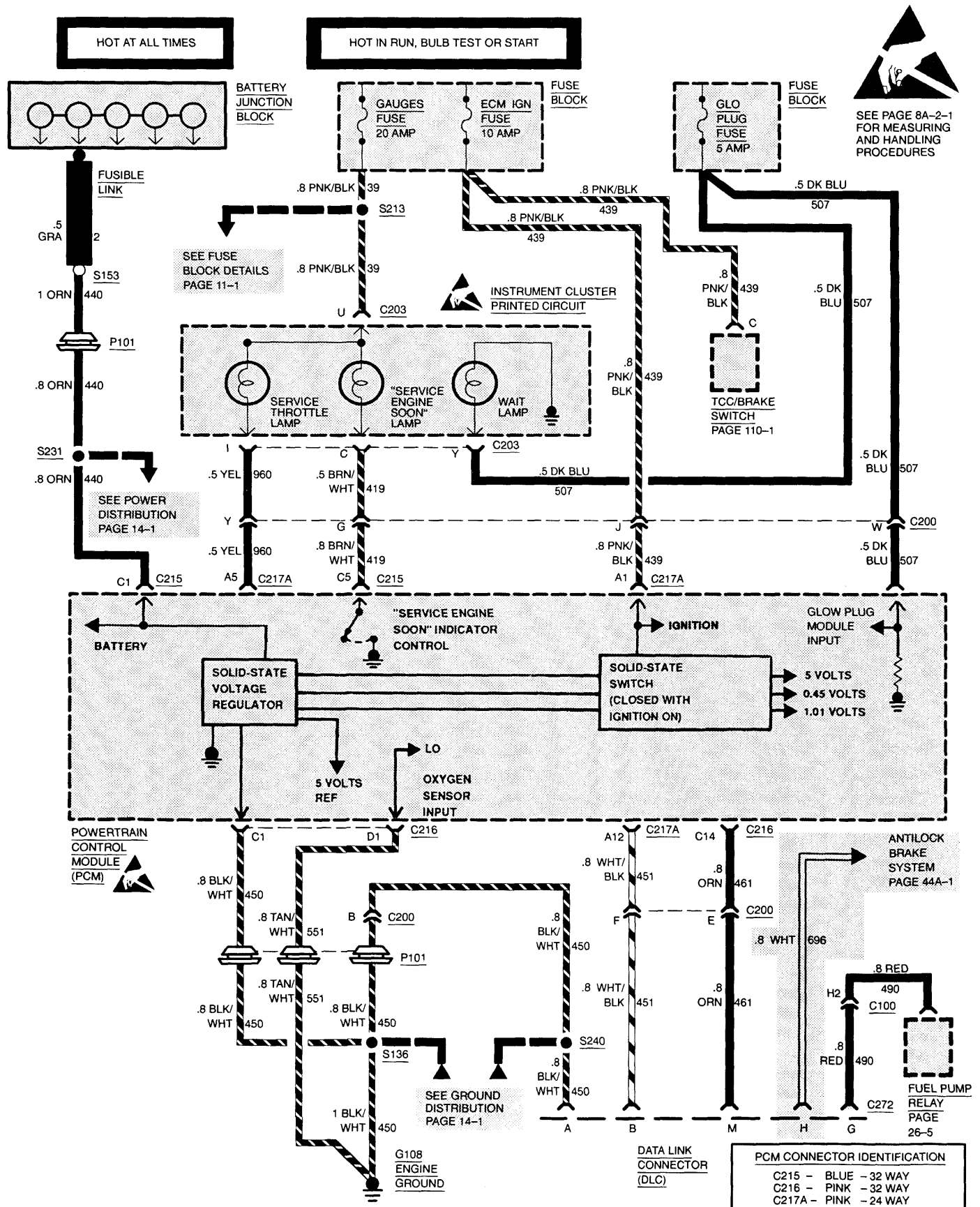
### COMPONENT LOCATION (CONTINUED)

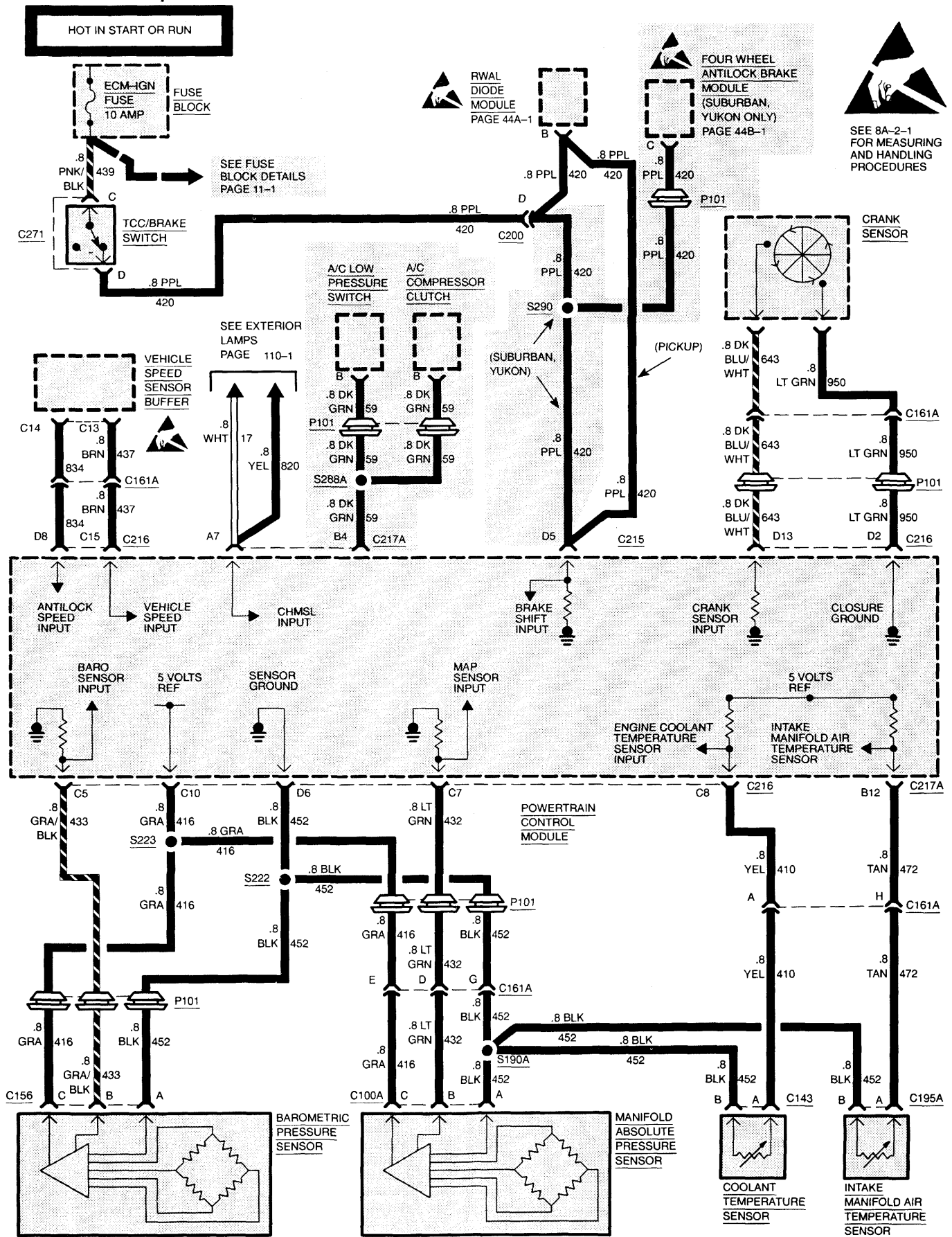
### Page — Figure

|                        |                                                         |           |   |
|------------------------|---------------------------------------------------------|-----------|---|
| S153                   | Near battery junction block                             | 26-22     | 5 |
| S161                   | At battery junction block                               | 26-22     | 5 |
| S190A                  | Engine harness near cowl, LH rear engine compartment at | Not Shown |   |
| S207                   | Under LH side of I/P                                    | 26-23     | 6 |
| S213                   | Under LH side of I/P                                    | 26-23     | 6 |
| S222                   | Under RH side of I/P, near PCM                          | 26-24     | 8 |
| S223                   | Near PCM, under RH side of I/P                          | 26-24     | 8 |
| S231                   | Engine harness, near PCM                                | 26-24     | 8 |
| S238                   | Engine harness, near PCM                                | 26-24     | 8 |
| S240                   | Behind LH side of I/P                                   | 26-23     | 7 |
| S243                   | Engine harness, near P101                               | Not Shown |   |
| S288A                  | Near PCM, under RH side of I/P                          | Not Shown |   |
| S290 (Suburban, Yukon) | Under LH side of I/P                                    | Not Shown |   |

# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-3

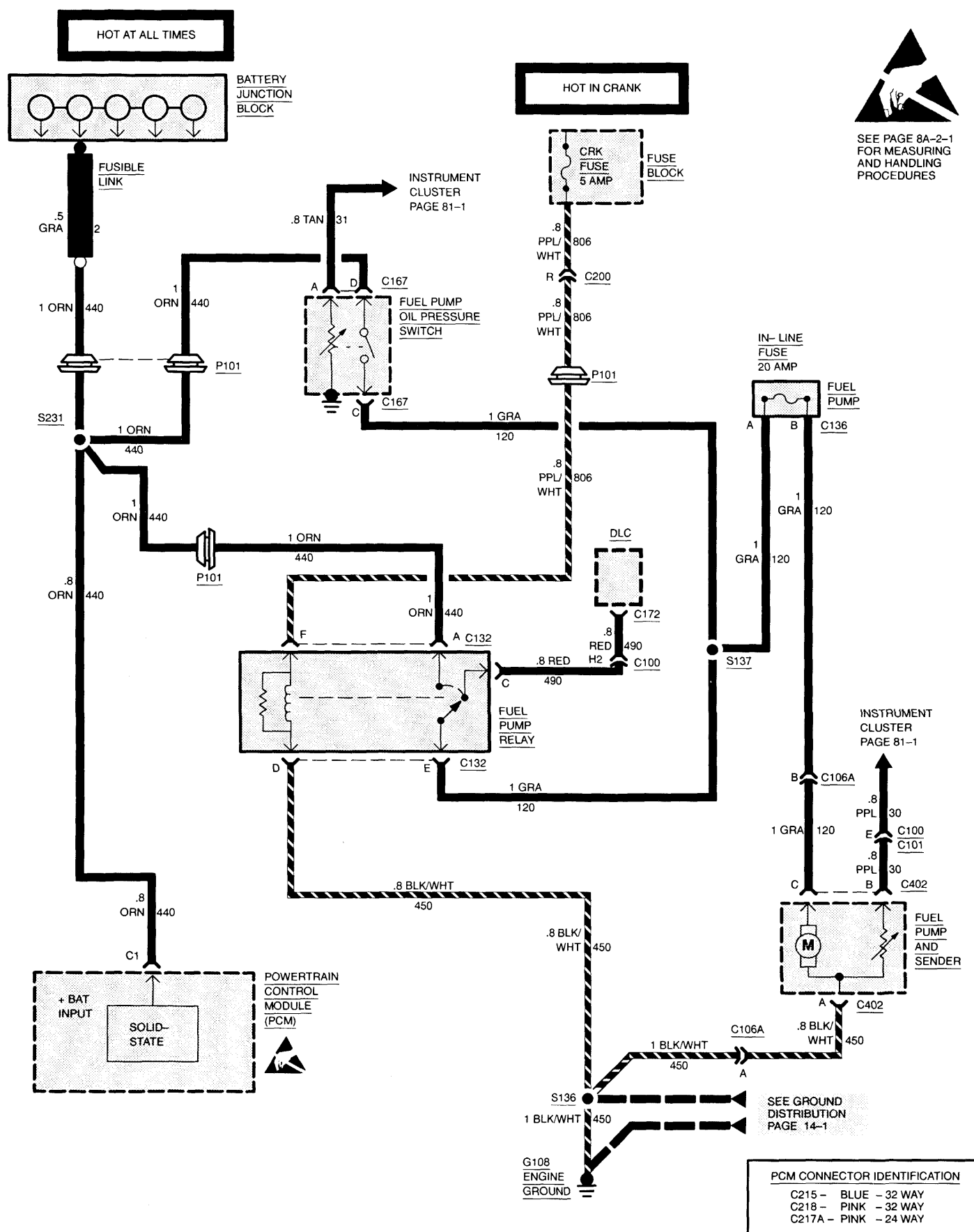
(W/HD AUTOMATIC TRANSMISSION)



**W/HD AUTOMATIC TRANSMISSION**

# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-5

## (FUEL PUMP CONTROLS)

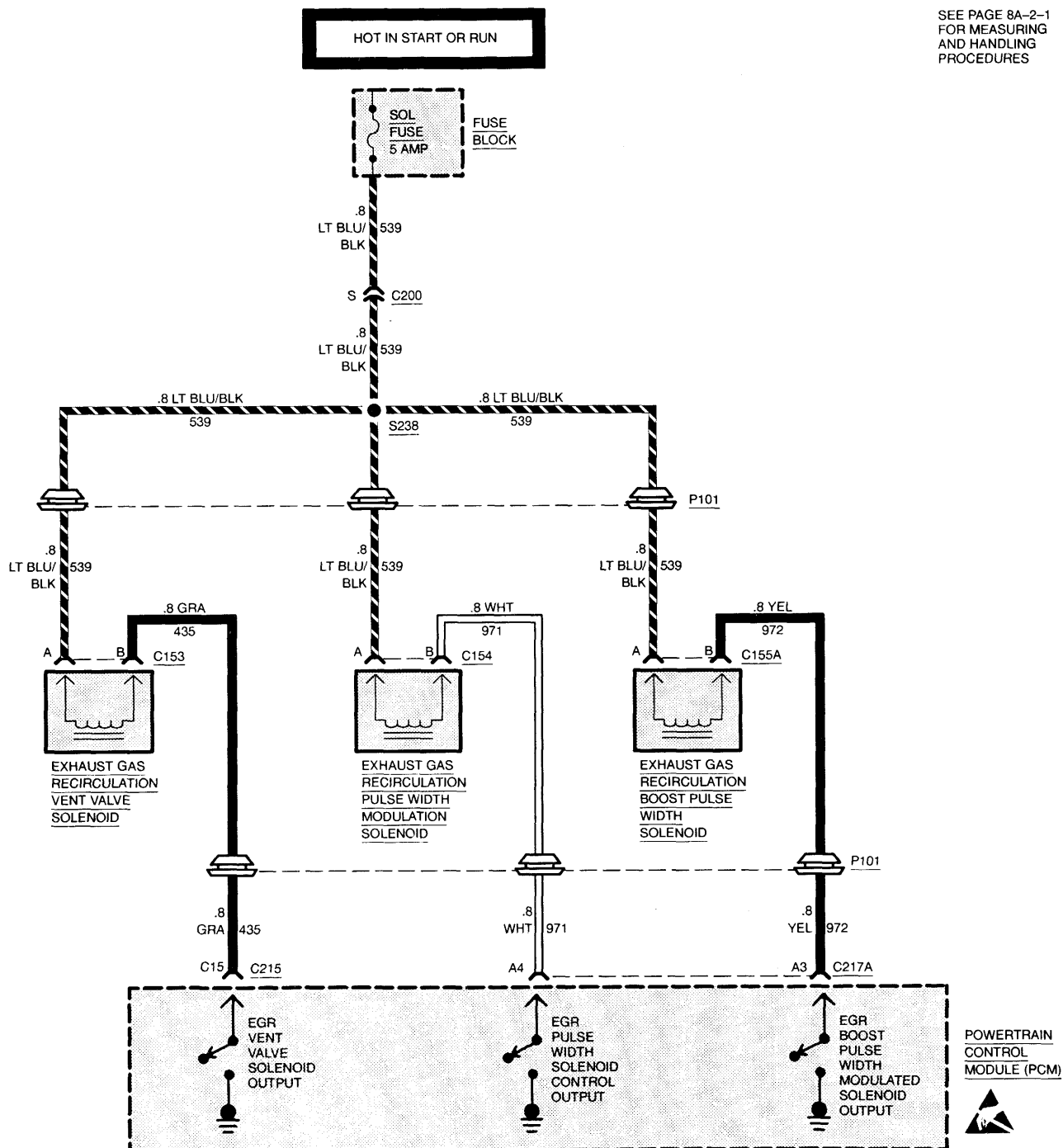




# 8A-26-6 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S W/HD AUTOMATIC TRANSMISSION



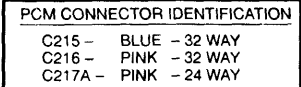
SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



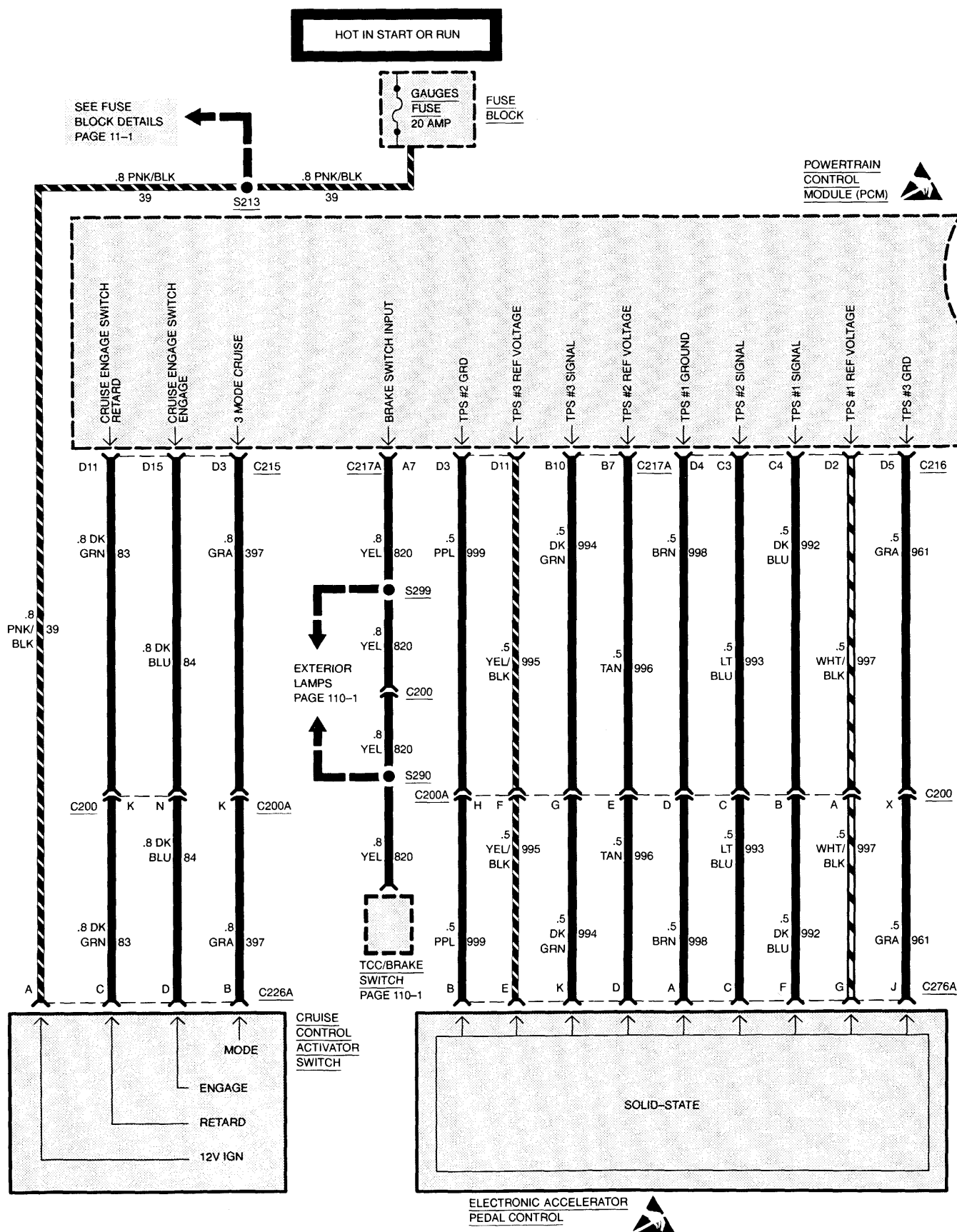
## PCM CONNECTOR IDENTIFICATION

C215 - BLUE - 32 WAY  
C218 - PINK - 32 WAY  
C217A - PINK - 24 WAY

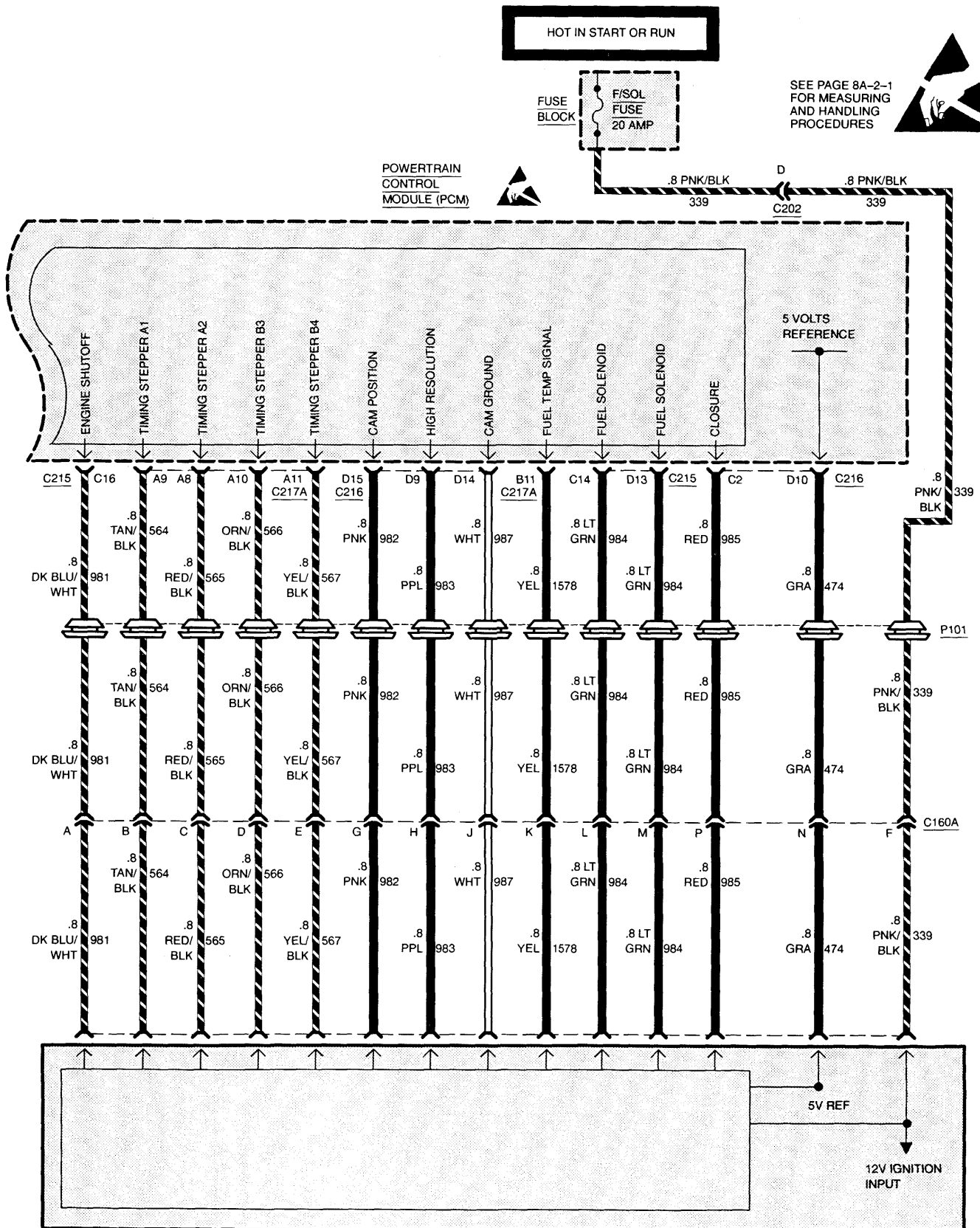
## (W/HD AUTOMATIC TRANSMISSION)



# 8A-26-8 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S



**ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-9**



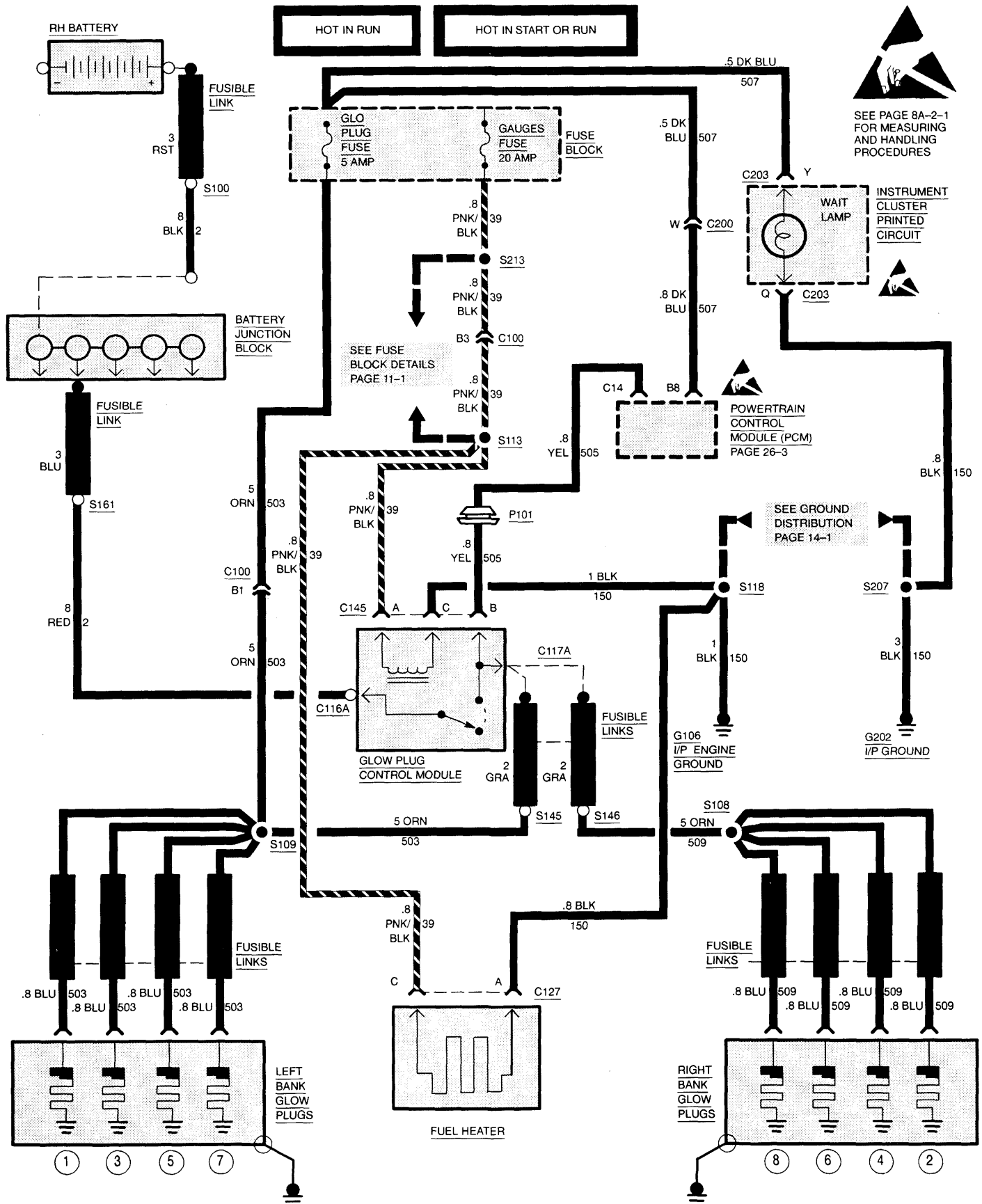
**ELECTRONIC  
INJECTION PUMP**

### PCM CONNECTOR IDENTIFICATION

C215 - BLUE - 32 WAY  
C216 - PINK - 32 WAY  
C217A - PINK - 24 WAY

# 8A-26-10 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S

## GLOW PLUG SYSTEM



# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-11

## POWERTRAIN CONTROL MODULE — 6.5L TURBO DIESEL ENGINE (32-PIN BLUE)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                          |
|-------------|-----------|------------|--------|--------------------------------------|
| 440         | .8        | ORN        | C1     | 12V + BATTERY                        |
| 1493        | .8        | DK BLU     | C2     | 4WD INPUT                            |
|             |           |            | C3     | NOT USED                             |
|             |           |            | C4     | NOT USED                             |
| 419         | .8        | BRN/WHT    | C5     | "SERVICE ENGINE SOON" LAMP<br>OUTPUT |
|             |           |            | C6     | NOT USED                             |
| 1222        | .8        | LT GRN     | C7     | TRANS SHIFT SOLENOID A               |
| 1224        | .8        | PNK        | C8     | TRANS RANGE MODE A                   |
| 1225        | .8        | DK BLU     | C9     | TRANS RANGE MODE B                   |
| 1226        | .8        | RED        | C10    | TRANS RANGE MODE C                   |
| 1350        | .8        | DK BLU     | C11    | 3/2 SHIFT CONTROL                    |
|             |           |            | C12    | NOT USED                             |
| 1223        | .8        | YEL/BLK    | C13    | TRANS SHIFT SOLENOID B               |
| 984         | .8        | LT GRN     | C14    | FUEL SOLENOID                        |
| 435         | .8        | GRA        | C15    | EGR SOLENOID                         |
| 981         | .8        | DK BLU/WHT | C16    | FUEL SHUTOFF                         |
|             |           |            | D1     | NOT USED                             |
| 997         | .5        | WHT/BLK    | D2     | REFERENCE VOLTAGE TPS 1              |
| 397         | .8        | GRA        | D3     | 3 MODE ELECTRONIC CRUISE<br>CONTROL  |
|             |           |            | D4     | NOT USED                             |
| 420         | .8        | PPL        | D5     | BRAKE SWITCH INPUT                   |
|             |           |            | D6     | NOT USED                             |
|             |           |            | D7     | NOT USED                             |
| 834         | .5        | BRN        | D8     | EBS CONTROL SIGNAL                   |
|             |           |            | D9     | NOT USED                             |
|             |           |            | D10    | NOT USED                             |
| 83          | .8        | DK GRN     | D11    | CRUISE CONTROL SWITCH —<br>RETARD    |
|             |           |            | D12    | NOT USED                             |
| 984         | .8        | LT GRN     | D13    | FUEL SOLENOID                        |
|             |           |            | D14    | NOT USED                             |
| 84          | .8        | DK BLU     | D15    | CRUISE CONTROL SWITCH —<br>ENGAGE    |
|             |           |            | D16    | NOT USED                             |

# 8A-26-12 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S

## POWERTRAIN CONTROL MODULE — 6.5L TURBO DIESEL ENGINE (32-PIN PINK)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                              |
|-------------|-----------|------------|--------|------------------------------------------|
| 450         | .8        | BLK/WHT    | C1     | SYSTEM GROUND                            |
| 985         | .8        | RED        | C2     | CLOSURE SIGNAL                           |
| 993         | .5        | LT BLU     | C3     | TPS 2 SIGNAL                             |
| 992         | .5        | DK BLU     | C4     | TPS 1 SIGNAL                             |
| 433         | .8        | GRA/BLK    | C5     | BAROMETRIC PRESSURE SENSOR INPUT         |
| 1228        | .8        | RED/BLK    | C6     | TRANS FORCE MOTOR HIGH                   |
| 432         | .8        | LT GRN     | C7     | MANIFOLD ABSOLUTE PRESSURE SENSOR INPUT  |
| 410         | .8        | YEL        | C8     | COOLANT TEMPERATURE                      |
| 1227        | .8        | BLK/YEL    | C9     | TRANS TEMPERATURE INPUT                  |
| 416         | .8        | GRA        | C10    | +5 VOLT REFERENCE                        |
| 1229        | .8        | LT BLU/WHT | C11    | TRANS FORCE MOTOR LOW                    |
| 1230        | .8        | GRA/RED    | C12    | TRANS SPEED SENSOR INPUT                 |
| 505         | .8        | YEL        | C13    | GLOW PLUG RELAY                          |
| 1061        | .8        | ORN/BLK    | C14    | SERIAL DATA                              |
| 437         | .8        | BRN        | C15    | VEHICLE SPEED SENSOR INPUT               |
|             |           |            | C16    | NOT USED                                 |
| 551         | .8        | TAN/WHT    | D1     | ENGINE GROUND                            |
| 950         | .8        | LT GRN     | D2     | CLOSURE GROUND                           |
| 999         | .5        | PPL        | D3     | TPS 2 GROUND                             |
| 998         | .5        | BRN        | D4     | TPS 1 GROUND                             |
| 961         | .5        | GRA        | D5     | TPS 3 GROUND                             |
| 452         | .8        | BLK        | D6     | TRANS TEMPERATURE/PRESSURE REFERENCE LOW |
|             |           |            | D7     | NOT USED                                 |
| 1586        | .8        | BRN/WHT    | D8     | 2000 PULSE VEHICLE SPEED INPUT           |
| 983         | .8        | PPL        | D9     | TPS 2 SIGNAL                             |
| 474         | .8        | GRA        | D10    | +5 VOLT REFERENCE                        |
| 995         | .5        | YEL/BLK    | D11    | REFERENCE VOLTAGE TPS 3                  |
| 1231        | .8        | DK BLU/WHT | D12    | TRANS SPEED SENSOR INPUT                 |
| 643         | .8        | DK BLU/WHT | D13    | CRANK SENSOR                             |
| 987         | .8        | WHT        | D14    | CAM POSITION SENSOR GROUND               |
| 982         | .8        | PNK        | D15    | CAM POSITION SENSOR                      |
|             |           |            | D16    | NOT USED                                 |

# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-13

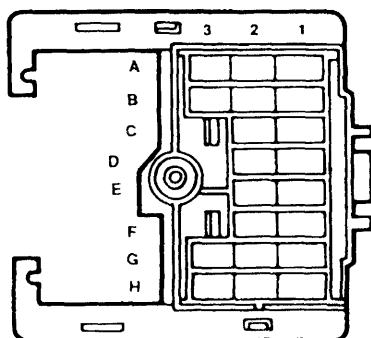
## POWERTRAIN CONTROL MODULE — 6.5L TURBO DIESEL ENGINE (32-PIN PINK)

| CIRCUIT NO. | WIRE SIZE | COLOR   | CAVITY | DESCRIPTION                     |
|-------------|-----------|---------|--------|---------------------------------|
| 439         | .8        | PNK/BLK | A1     | 12V IGNITION (FUSED)            |
|             |           |         | A2     | NOT USED                        |
|             |           |         | A3     | NOT USED                        |
| 971         | .8        | WHT     | A4     | EGR VENT SOLENOID               |
| 960         | .5        | YEL     | A5     | "SERVICE THROTTLE" LAMP OUTPUT  |
|             |           |         | A6     | NOT USED                        |
| 820         | .8        | YEL     | A7     | CHMSL INPUT                     |
| 565         | .8        | RED/BLK | A8     | TIMING STEPPER A2               |
| 564         | .8        | TAN/BLK | A9     | TIMING STEPPER A1               |
| 566         | .8        | ORN/BLK | A10    | TIMING STEPPER B3               |
| 567         | .8        | YEL/BLK | A11    | TIMING STEPPER B4               |
| 451         | .8        | WHT/BLK | A12    | DIAGNOSTIC ENABLE               |
|             |           |         | B1     | NOT USED                        |
|             |           |         | B2     | NOT USED                        |
|             |           |         | B3     | NOT USED                        |
| 59          |           | DK GRN  | B4     | A/C ON INPUT                    |
|             |           |         | B5     | NOT USED                        |
|             |           |         | B6     | NOT USED                        |
| 996         | .5        | TAN     | B7     | REFERENCE VOLTAGE TPS 2         |
| 507         | .5        | DK BLU  | B8     | GLOW PLUG "WAIT" LAMP OUTPUT    |
|             |           |         | B9     | NOT USED                        |
| 994         | .5        | DK GRN  | B10    | TPS 3 SIGNAL INPUT              |
| 1578        | .8        | YEL     | B11    | FUEL TEMPERATURE INPUT          |
| 472         | .8        | TAN     | B12    | INTAKE MANIFOLD AIR TEMPERATURE |



# 8A-26-14 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S

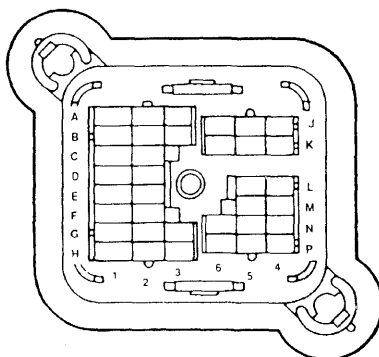
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GRAY  
Metri-Pack

**C100**  
Bulkhead Connector - Eng

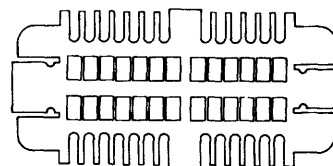
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GRAY  
Metri-Pack

**C100**  
Bulkhead Connector - I/P

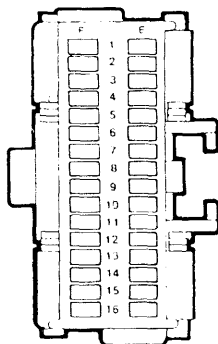
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BLACK  
Bow Series

**C203**  
I/P Cluster

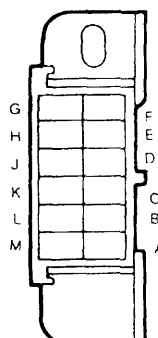
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BLUE  
Metri-Pack 280

**C216**  
PCM

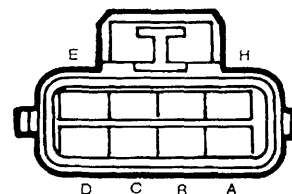
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BLACK  
Metri-Pack 480

**C272**  
Data Link Connector

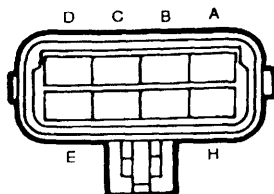
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BLACK  
Metri-Pack 150

**C161A**  
In-Line PCM to Engine

12047931



BLACK  
Metri-Pack 150

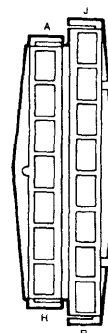
**C161A**  
In-Line Engine to PCM

12041254



**C200**  
In-Line I/P to Bulkhead

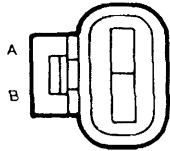
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**C200**  
In-Line Bulkhead to I/P

# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-15

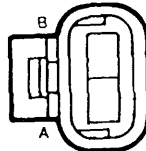
12084247



**GRAY**  
Metri-Pack 150

**C195A**  
Intake Manifold Air Temperature  
Sensor

12078084



**BLACK**  
Metri-Pack 150

**C143**  
Coolant Temperature Sensor

12020403



**BLACK**

**C100A**  
MAP Sensor

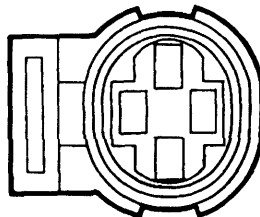
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**BLACK**

**C156**  
Barometric Pressure Sensor

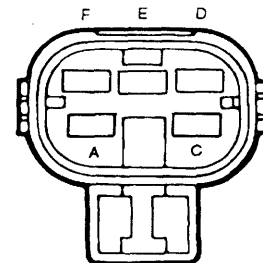
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**GRAY**  
Metri-Pack 150

**C167**  
Fuel Pump Oil Pressure Switch

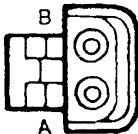
12052287



**BLACK**  
Metri-Pack

**C132**  
Fuel Pump Relay

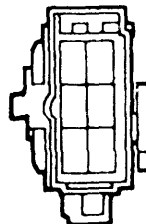
12015792



**BLACK**  
Weather Pack

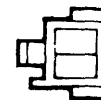
**C106A**  
In-Line Fuse to Fuel Pump and  
Sender

12020099



**C102**  
In-Line Fuel Pump to Bulkhead

12033709

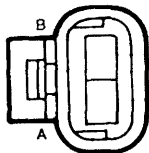


**BLACK**  
Metri-Pack 280

**C271**  
TCC/Brake Switch

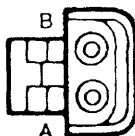
# 8A-26-16 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S

12078084



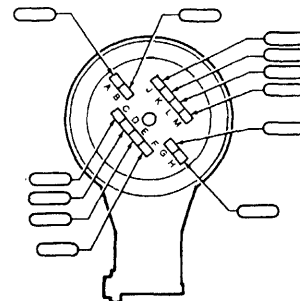
**BLACK**  
Metri-Pack 150  
**C365**  
Transmission Speed Sensor

12015792



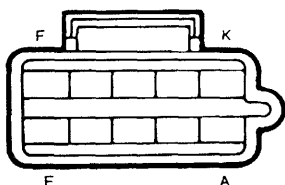
**BLACK**  
Weather Pack  
**C155A**  
Transfer Case Switch

12084690



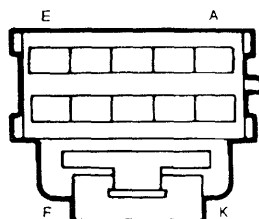
**C348**  
Transmission

12064770



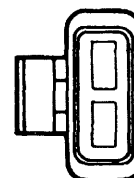
**NATURAL**  
Metri-Pack 150  
**C200A**  
In-Line Electronic Accelerator  
Pedal Control to PCM

12064769



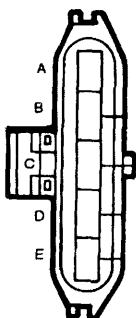
**NATURAL**  
Metri-Pack 150  
**C200A**  
In-Line PCM to Electronic  
Accelerator Pedal Control

12066681



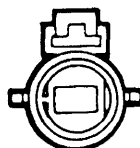
**BLACK**  
Metri-Pack 630  
**C130**  
Fuel Pump In-Line Fuse

12015982



**C145**  
Glow Plug Control Module

12065172



**BLACK**  
Metri-Pack 280  
**C160**  
In-Line Transfer Case Switch to  
PCM

12065171



**BLACK**  
Metri-Pack 280  
**C160**  
In-Line PCM to Transfer Case  
Switch

# ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S 8A-26-17

12020600



**BLACK**  
Metri-Pack 280  
**C365**  
**Transmission Speed Sensor**

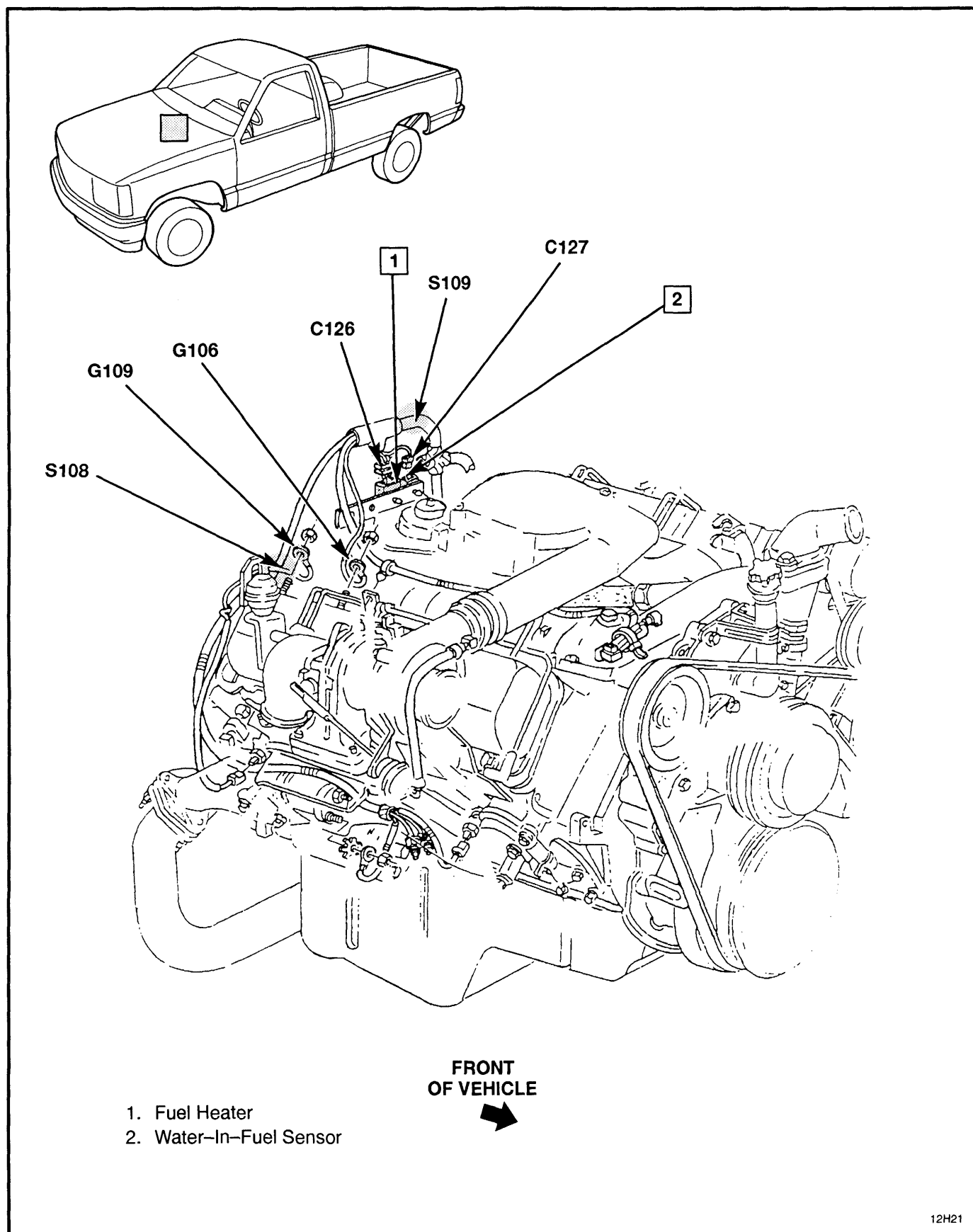


Figure 1 — Turbo Diesel Engine Wiring, RH Side

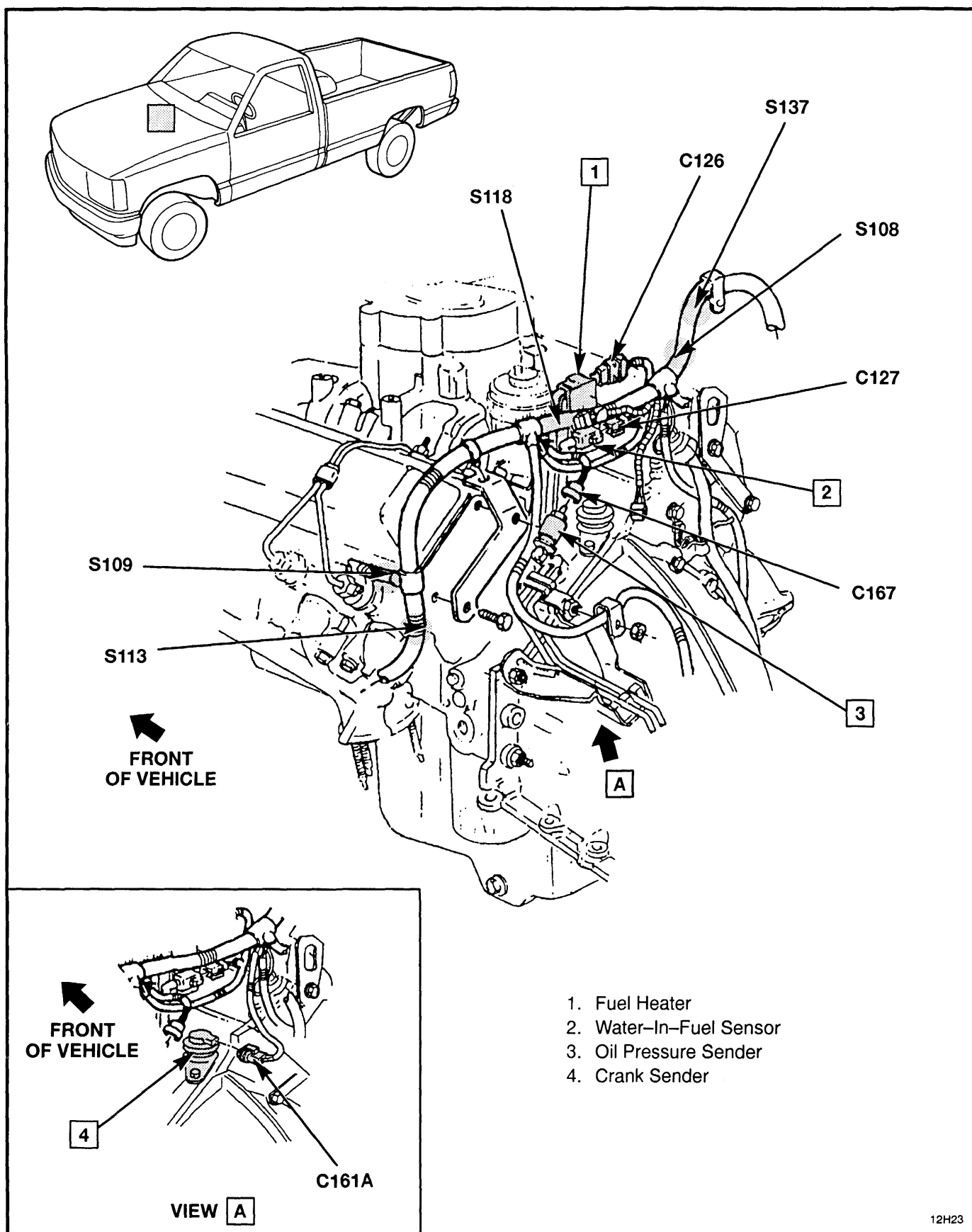


Figure 2 — 6.5L Diesel Engine Wiring, Rear

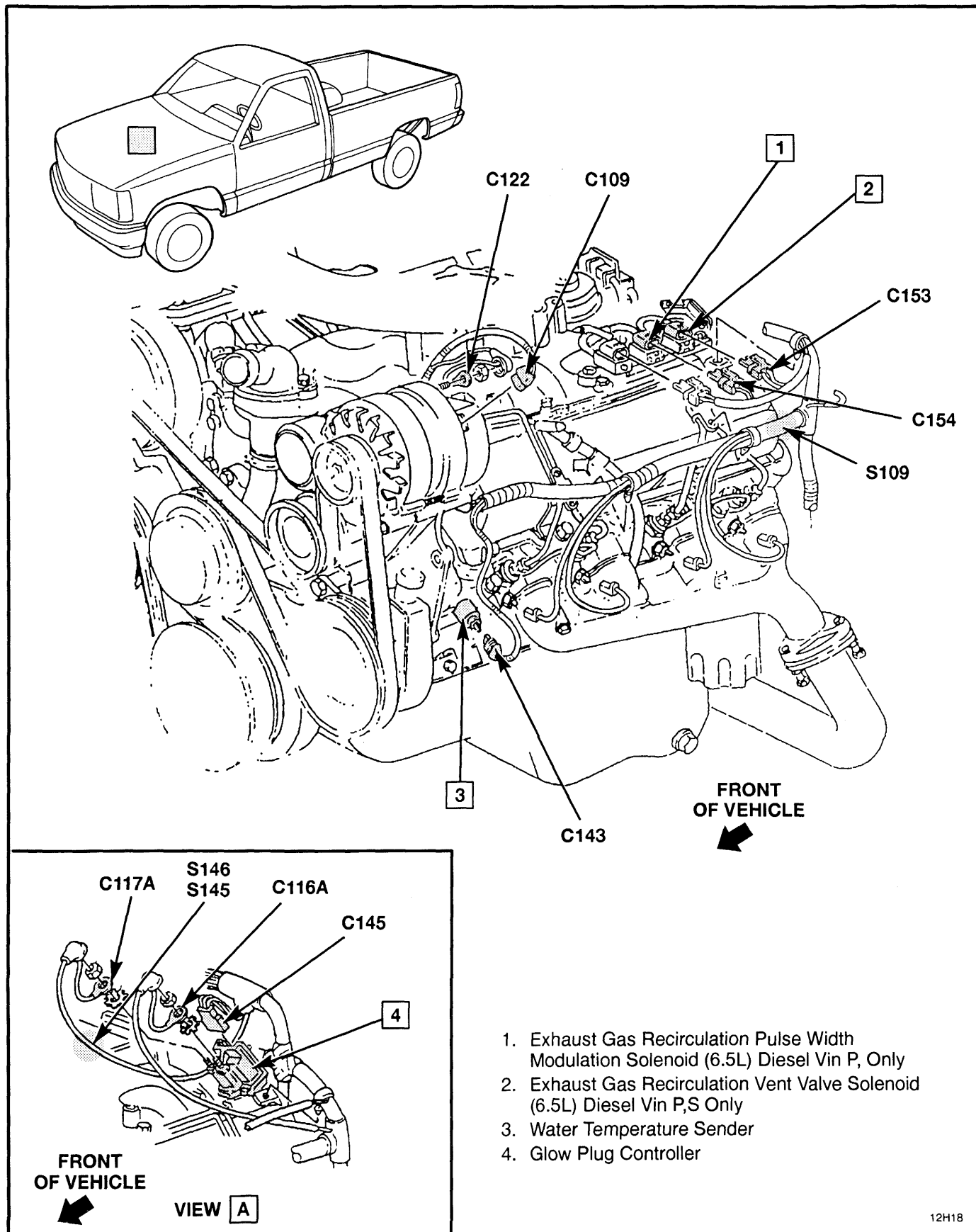


Figure 3 — 6.5L Diesel Engine Wiring, LH Side

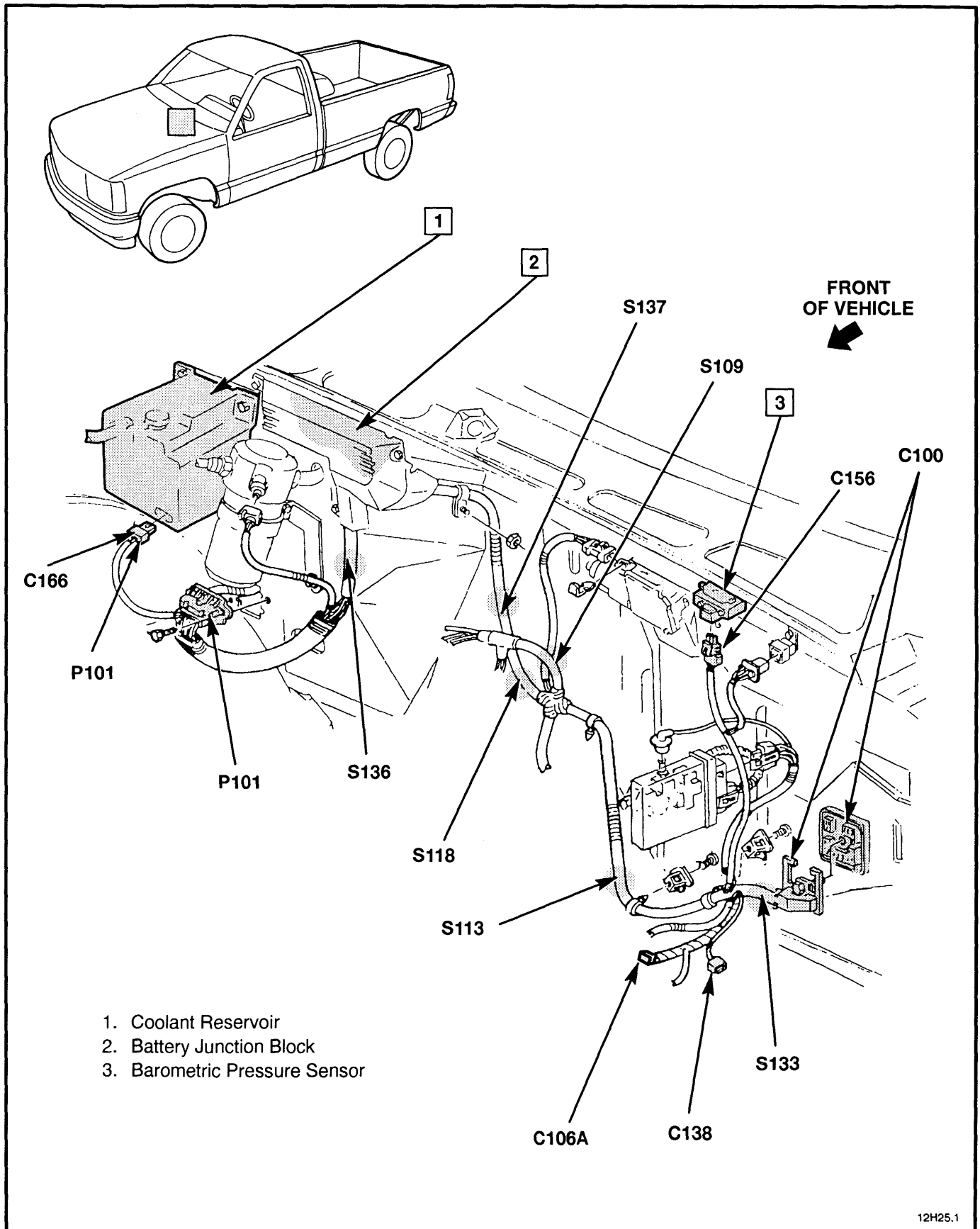
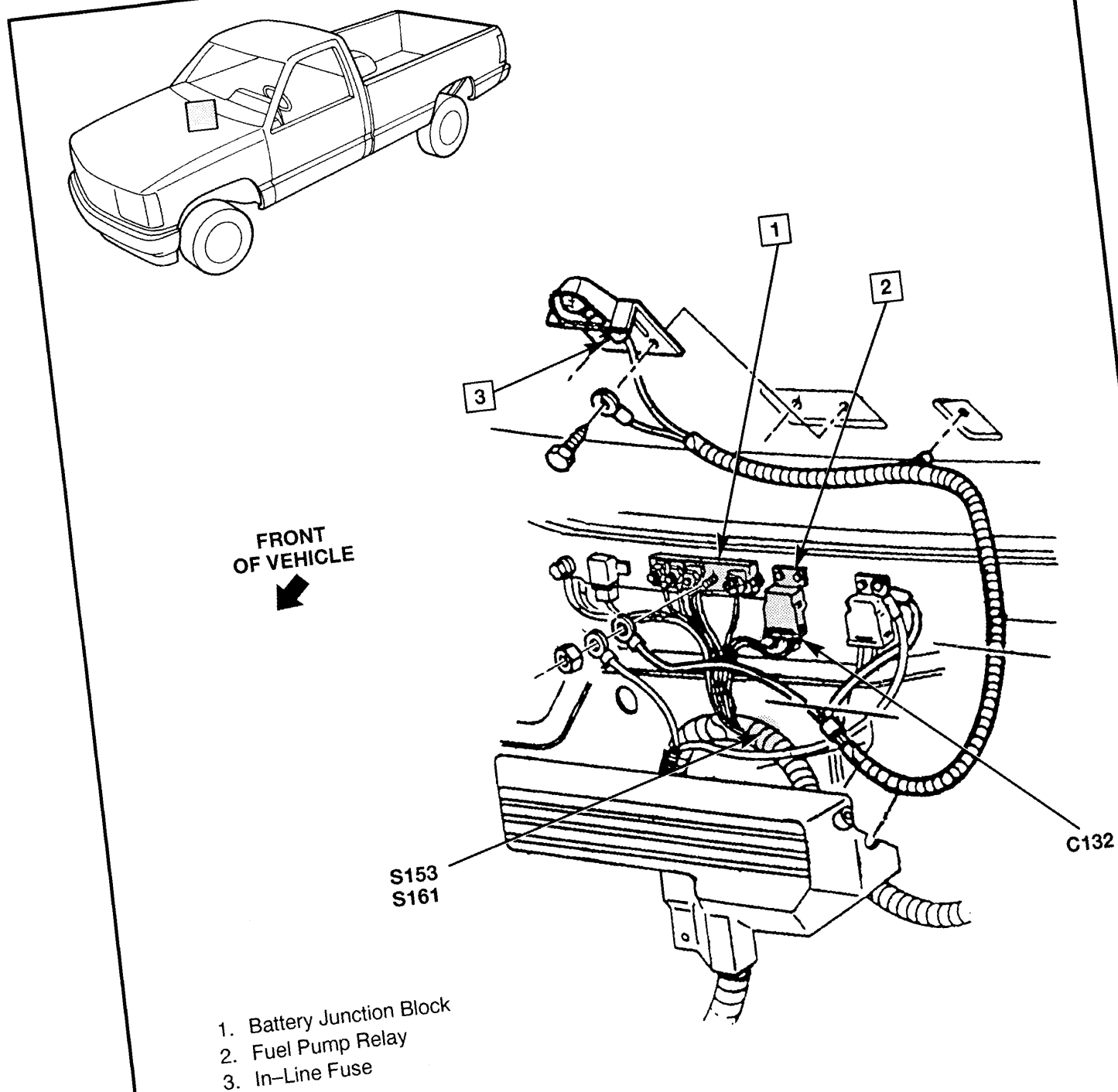


Figure 4 — Cowl Wiring, (6.5L) Diesel Engine



8A-26-22 ENGINE CONTROLS 6.5L (396 CID) HD V8 DIESEL VIN S



12L21

Figure 5 — Battery Junction Block Wiring

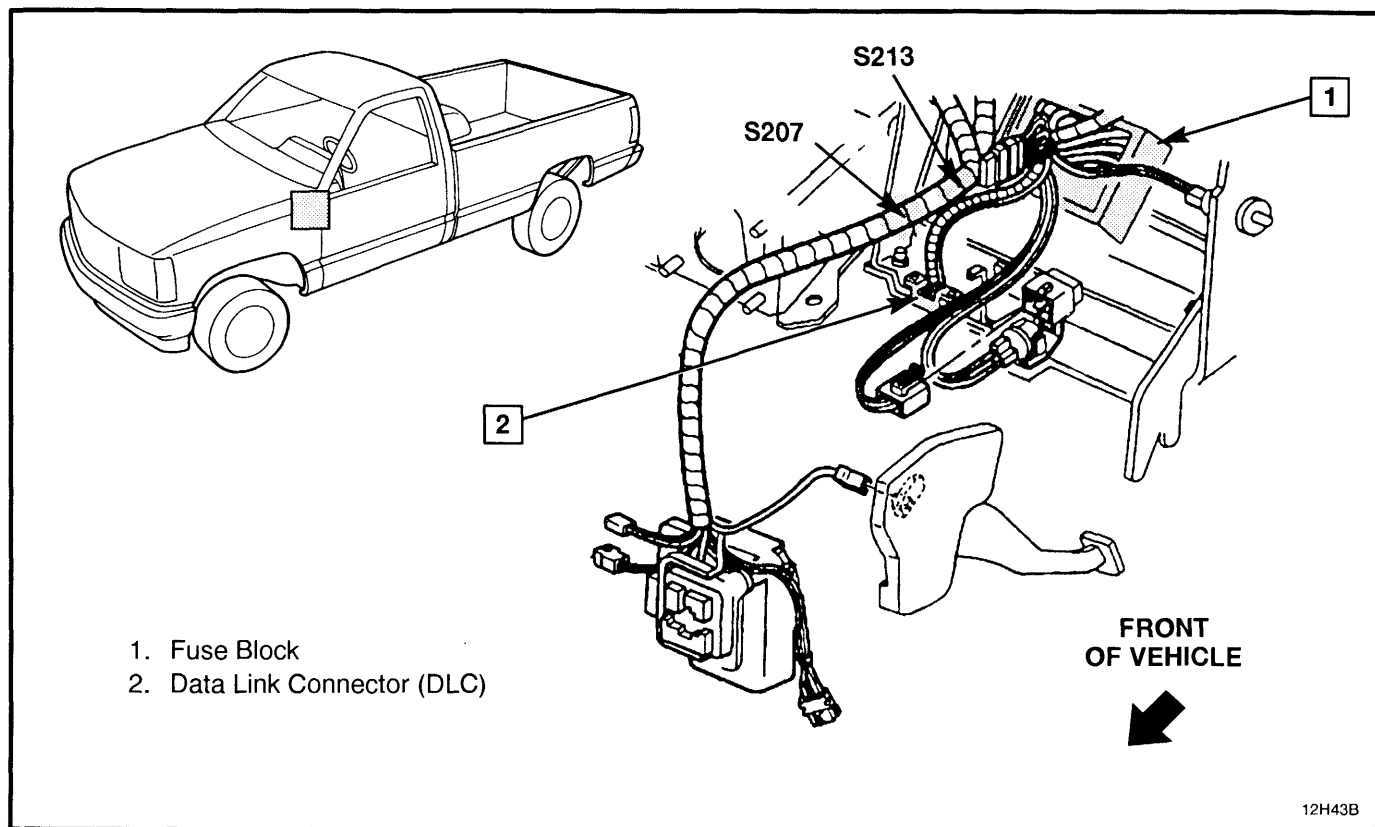


Figure 6 — Instrument Panel, LH Side

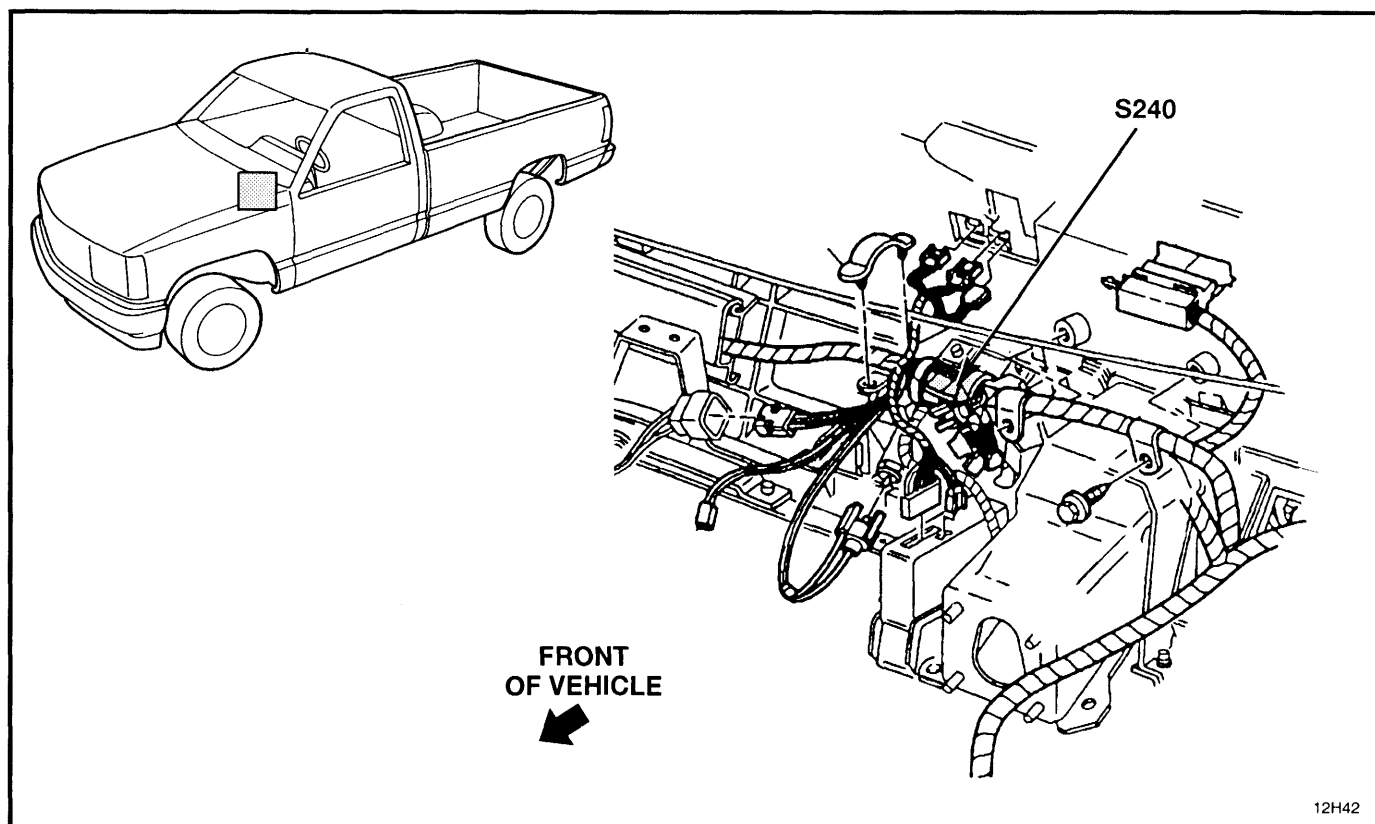


Figure 7 — Instrument Panel Wiring, RH Side

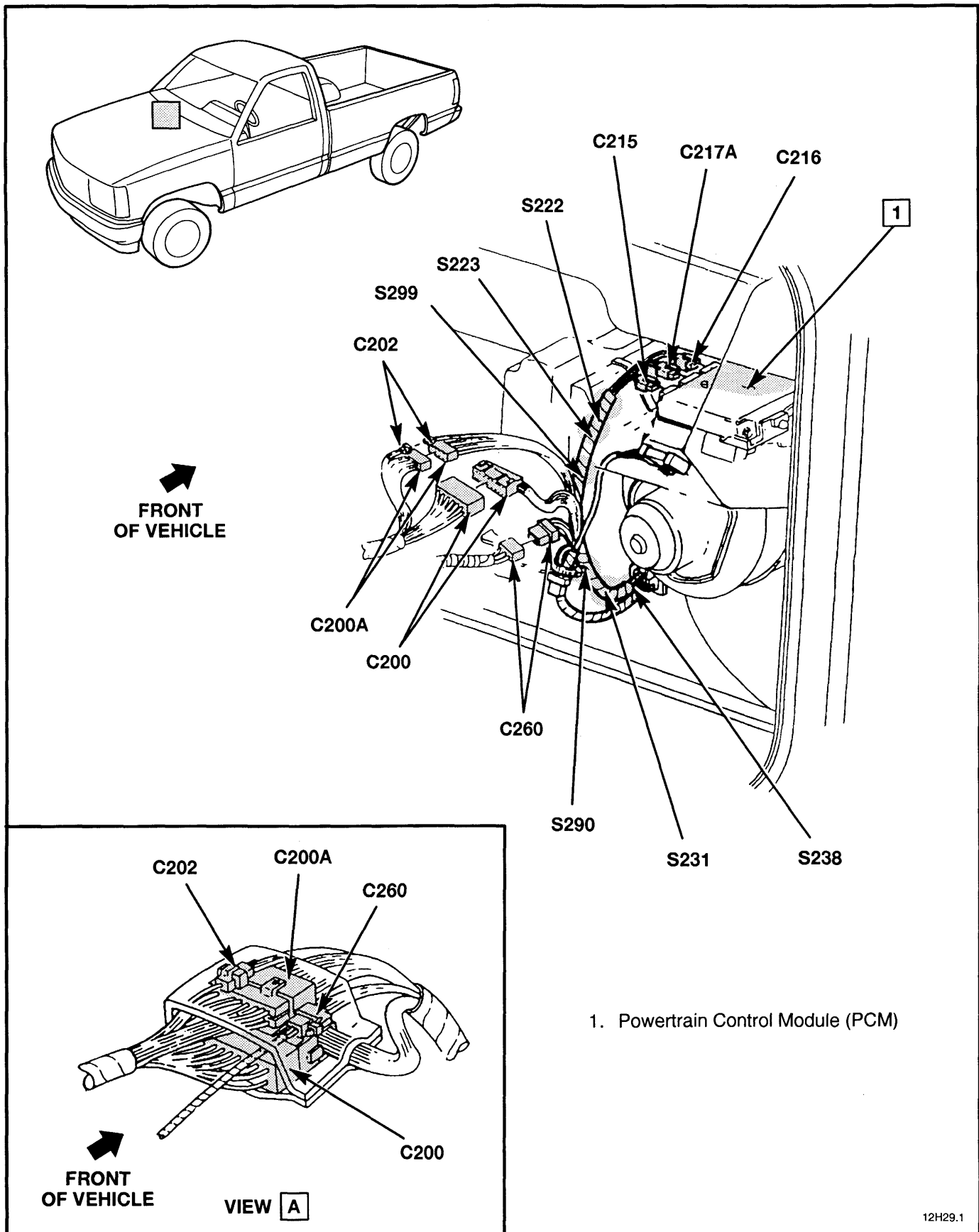


Figure 8 — PCM Wiring, Diesel Engines

# ENGINE CONTROLS 6.5L (396 CID) V8 TURBO DIESEL VIN F 8A-27-1

## COMPONENT LOCATION

## Page — Figure

|                                 |                                    |           |   |
|---------------------------------|------------------------------------|-----------|---|
| Barometric Pressure Sensor      | Upper LH side of cowl              | Not Shown |   |
| Battery                         | LH front of engine compartment     | 27-20     | 4 |
| Battery Junction Block          | RH rear engine compartment at cowl | 27-20     | 4 |
| Clutch Pedal Position Switch    | On clutch pedal support bracket    | Not Shown |   |
| DLC                             | Under LH side of I/P               | 27-22     | 6 |
| Fuel Pump Oil Pressure Switch   | Upper rear of engine               | 27-18     | 2 |
| Fuel Pump Relay                 | RH upper cowl                      | 27-21     | 5 |
| Fuel Pump and Sender            | In fuel tank                       | Not Shown |   |
| EGR Solenoid (Pulse Width)      | LH rear top of engine              | 27-19     | 3 |
| Electronic Accelerator Pedal    |                                    |           |   |
| Actuator                        | Top of accelerator bracket         | Not Shown |   |
| Electronic Injection Pump       | Top front of engine                | Not Shown |   |
| Engine Coolant Temperature      |                                    |           |   |
| Sensor                          | LH front of engine                 | 27-19     | 3 |
| Fuel Heater                     | Top rear of engine                 | 27-17     | 1 |
| Fuse Block                      | Under LH side of I/P               | 27-22     | 6 |
| Glow Plug Controller            | LH rear top of engine              | 27-19     | 3 |
| Intake Manifold Air Temperature |                                    |           |   |
| Sensor                          | Front of engine                    | Not Shown |   |
| I/P Cluster                     | LH side of I/P                     | Not Shown |   |
| MAP Sensor                      | LH rear engine compartment at cowl | Not Shown |   |
| Powertrain Control Module (PCM) | Under RH end of I/P                | 27-23     | 8 |
| TCC/Brake Switch                | On brake pedal support bracket     | Not Shown |   |
| TP Sensor                       | Top RH side of engine              | Not Shown |   |

## CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C100  | At bulkhead connector                   | 27-20     | 4 |
| C101  | At bulkhead connector                   | Not Shown |   |
| C106A | LH side of cowl near bulkhead connector | 27-20     | 4 |
| C160A | Top front of engine                     | Not Shown |   |
| C161A | Top front of engine                     | Not Shown |   |
| C174  | Top front of engine                     | Not Shown |   |
| C200  | Under RH side of I/P, near blower motor | 27-23     | 8 |

## GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 27-20 | 4 |
|------|------------------------------------|-------|---|

## GROUND:

|      |                       |           |   |
|------|-----------------------|-----------|---|
| G106 | Top RH rear of engine | 27-17     | 1 |
| G108 | Top RH rear of engine | Not Shown |   |

## SPLICES:

|       |                                                      |           |   |
|-------|------------------------------------------------------|-----------|---|
| S108  | Upper RH side of engine                              | 27-17     | 1 |
| S109  | Upper LH side of engine                              | 27-17     | 1 |
| S113  | Engine compartment                                   | 27-18     | 2 |
| S118  | Rear of engine                                       | 27-18     | 2 |
| S136  | Rear of engine compartment, near center              | 27-18     | 2 |
| S137  | Near fuel pump relay                                 | 27-20     | 4 |
| S145  | At glow plug controller                              | 27-19     | 3 |
| S146  | At glow plug controller                              | 27-19     | 3 |
| S153  | Near battery junction block                          | 27-21     | 5 |
| S161  | At battery junction block                            | 27-21     | 5 |
| S190A | Engine harness near cowl, LH rear engine compartment | Not Shown |   |
| S207  | Under LH side of I/P                                 | 27-22     | 6 |
| S213  | Under LH side of I/P                                 | 27-22     | 6 |

## **8A-27-2 ENGINE CONTROLS HD 6.5L (396 CID) V8 TURBO DIESEL VIN F**

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### **COMPONENT LOCATION**

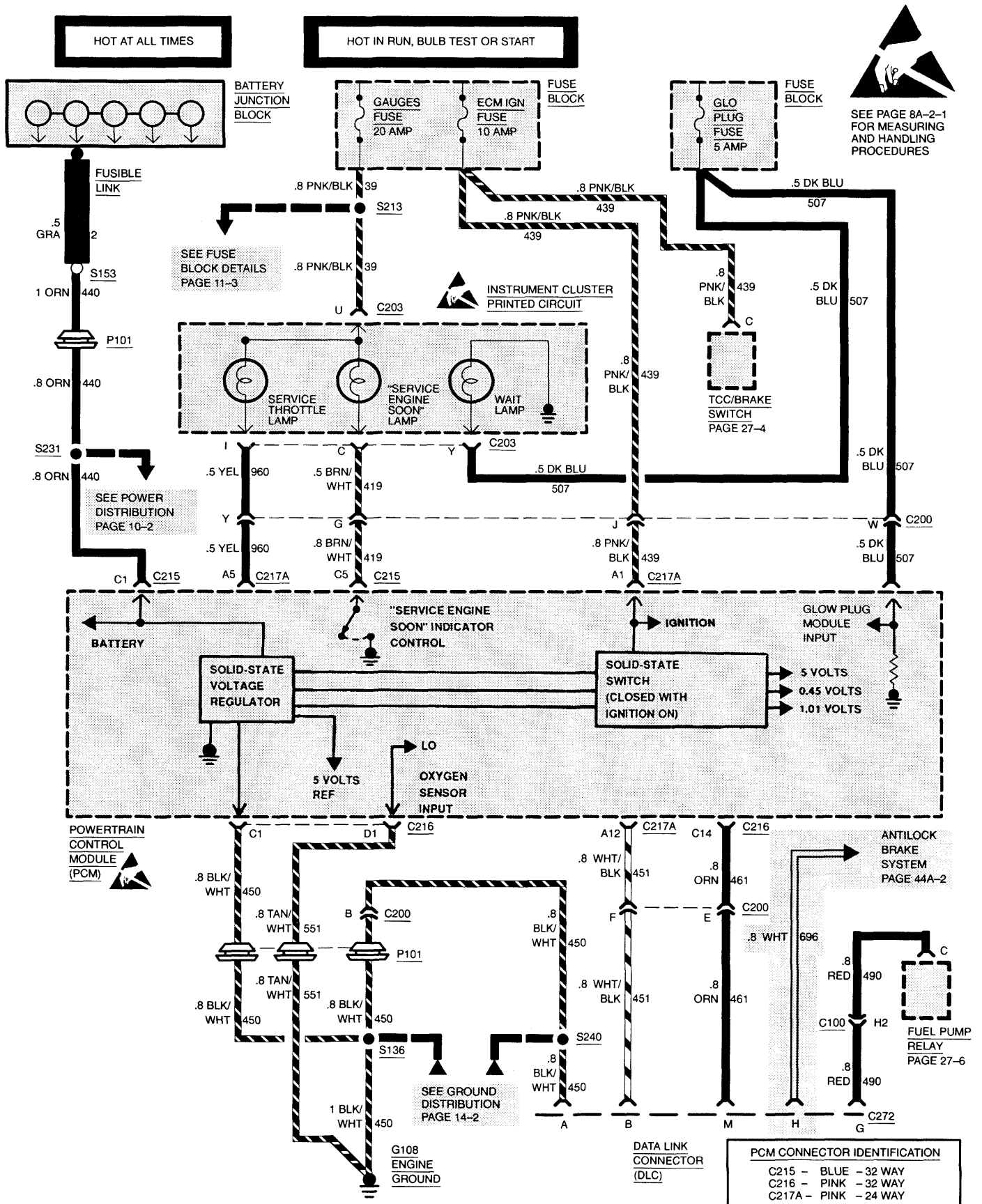
**Page — Figure**

#### **SPLICES (CONTINUED):**

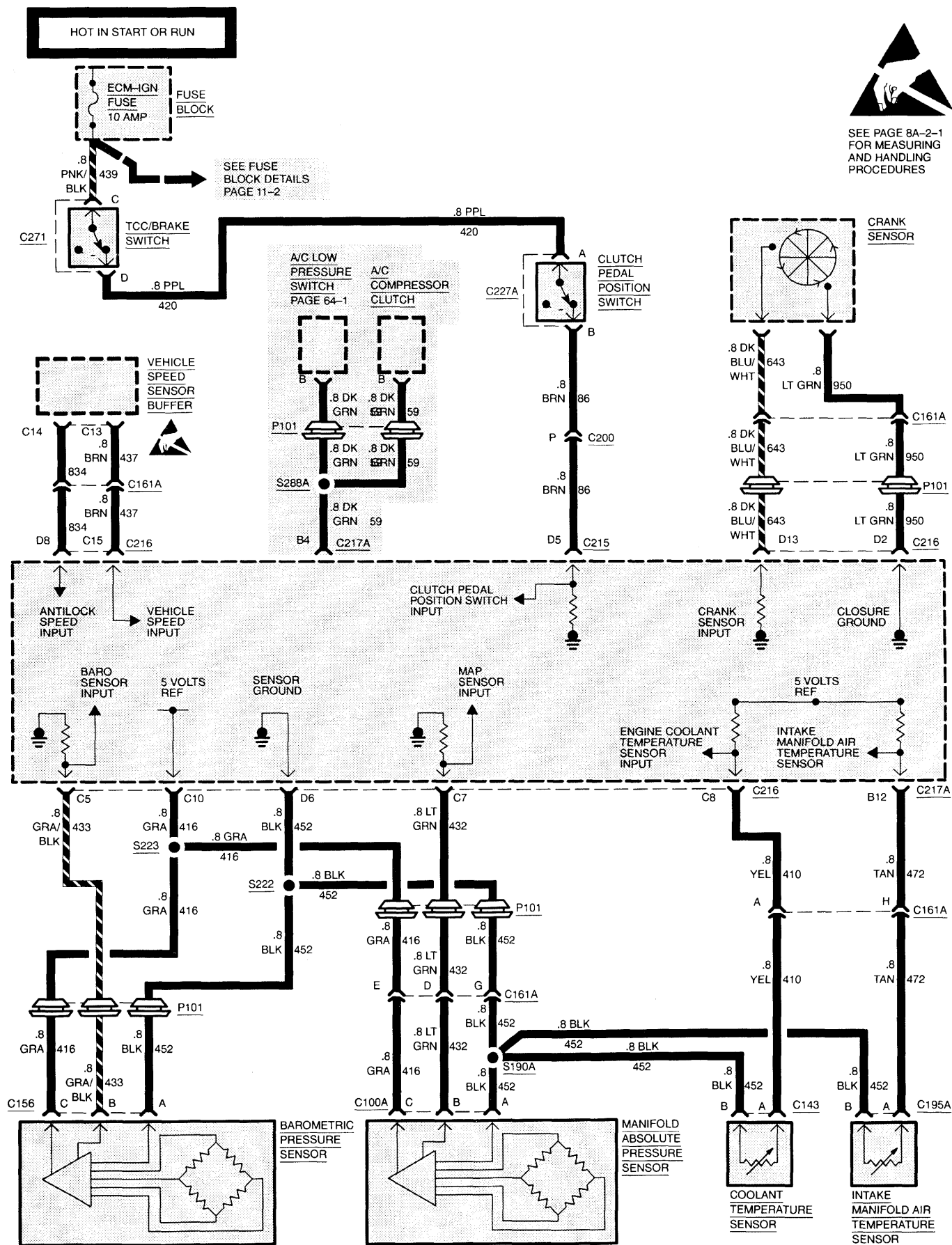
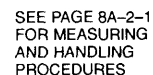
|                        |                                            |           |   |
|------------------------|--------------------------------------------|-----------|---|
| S222                   | ..... Under RH side of I/P, near PCM ..... | 27-23     | 8 |
| S223                   | ..... Near PCM, under RH side of I/P ..... | 27-23     | 8 |
| S231                   | ..... Engine harness, near PCM .....       | 27-23     | 8 |
| S238                   | ..... Engine harness, near PCM .....       | 27-23     | 8 |
| S240                   | ..... Behind LH side of I/P .....          | 27-22     | 7 |
| S288A                  | ..... Near PCM, under RH side of I/P ..... | Not Shown |   |
| S290 (Suburban, Yukon) | ..... Under RH side of I/P, near PCM ..... | 27-23     | 8 |

# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F L65 8A-27-3

## W/MANUAL TRANSMISSION OR HD AUTOMATIC TRANSMISSION



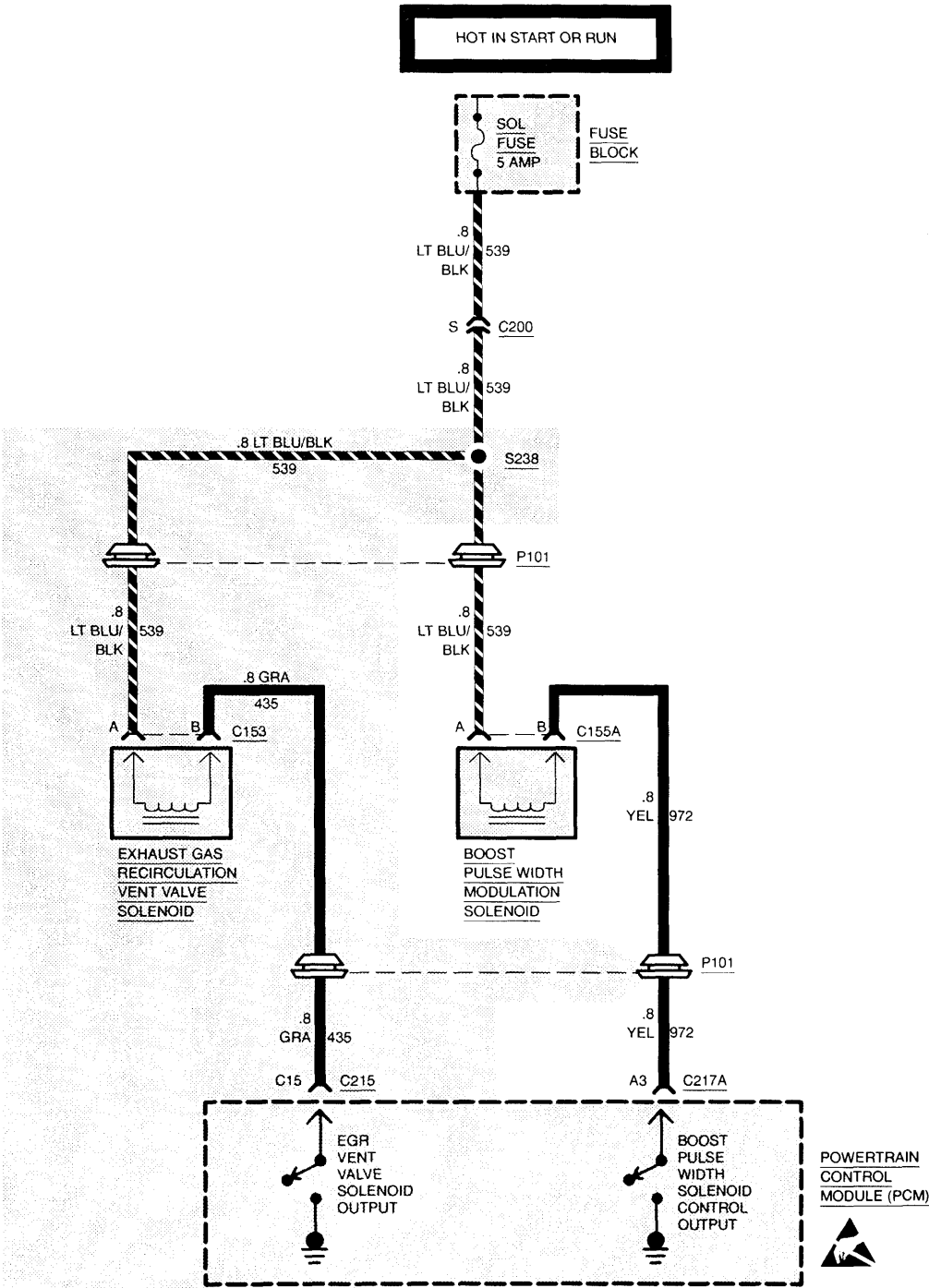
## W/MANUAL OR HD AUTOMATIC TRANSMISSION



ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F L65 8A-27-5  
W/MANUAL OR HD AUTOMATIC TRANSMISSION



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



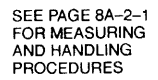
POWERTRAIN  
CONTROL  
MODULE (PCM)



PCM CONNECTOR IDENTIFICATION  
C215 - BLUE - 32 WAY  
C218 - PINK - 24 WAY  
C217A - PINK - 32 WAY

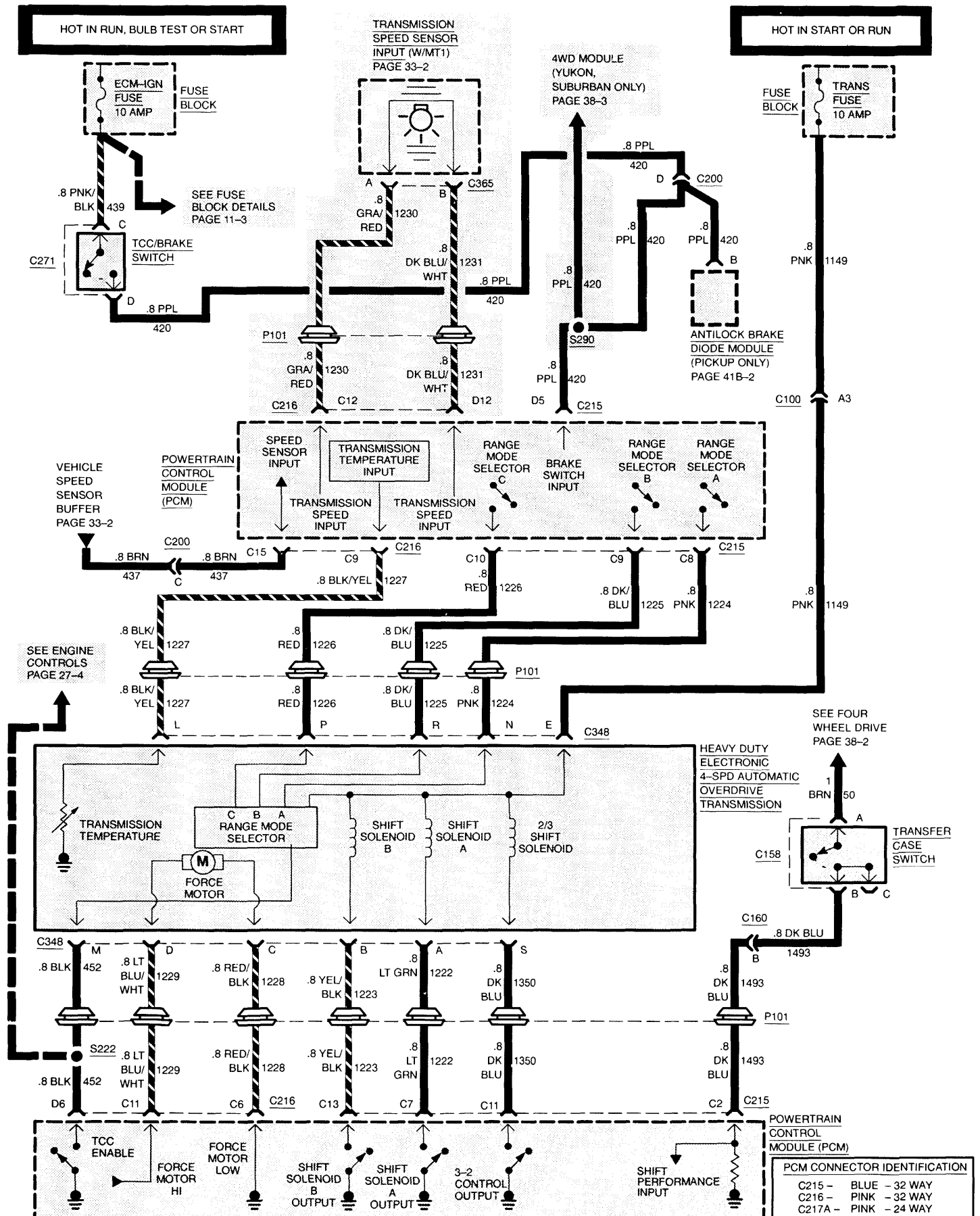


## FUEL PUMP CONTROLS

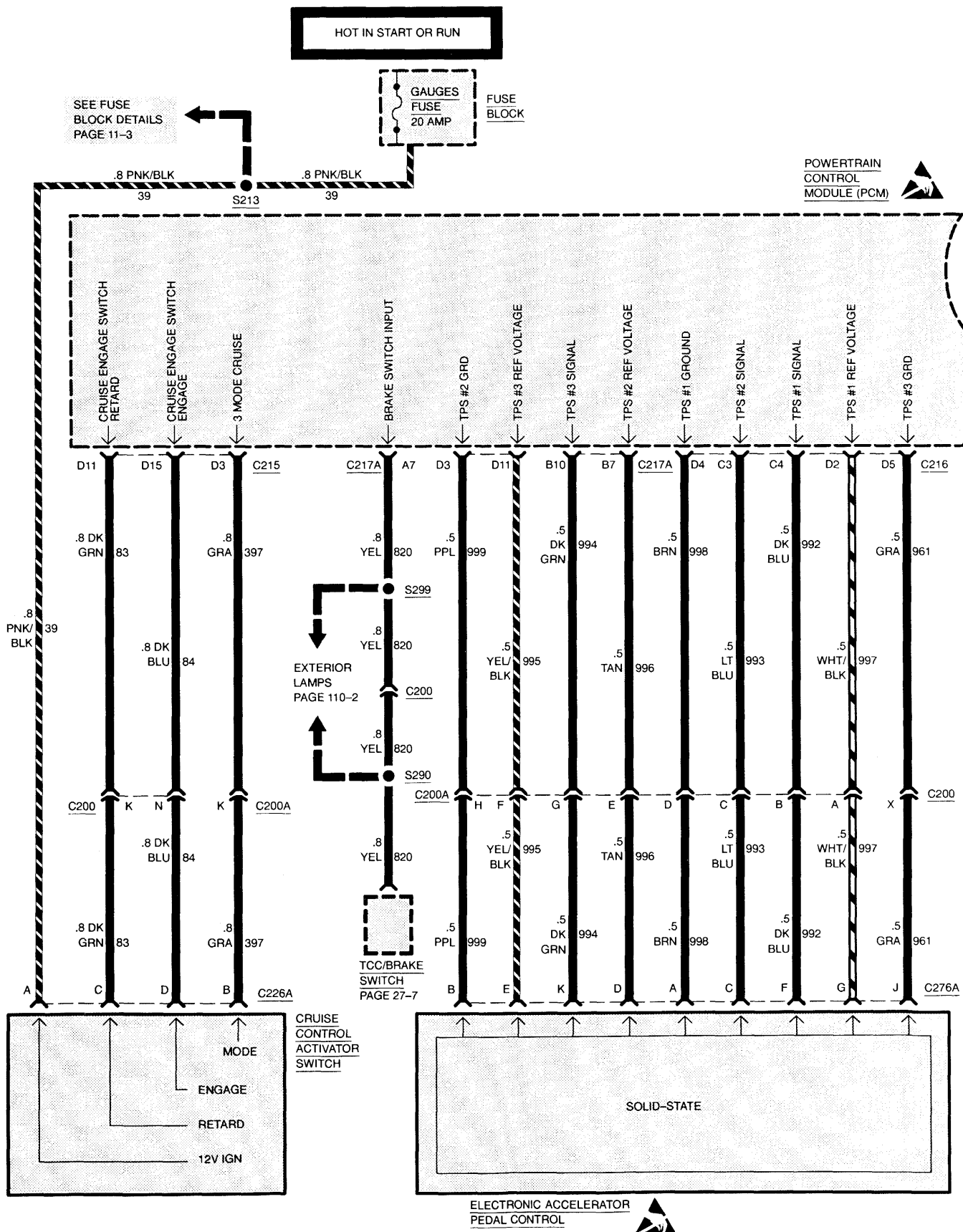


# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F L65 8A-27-7

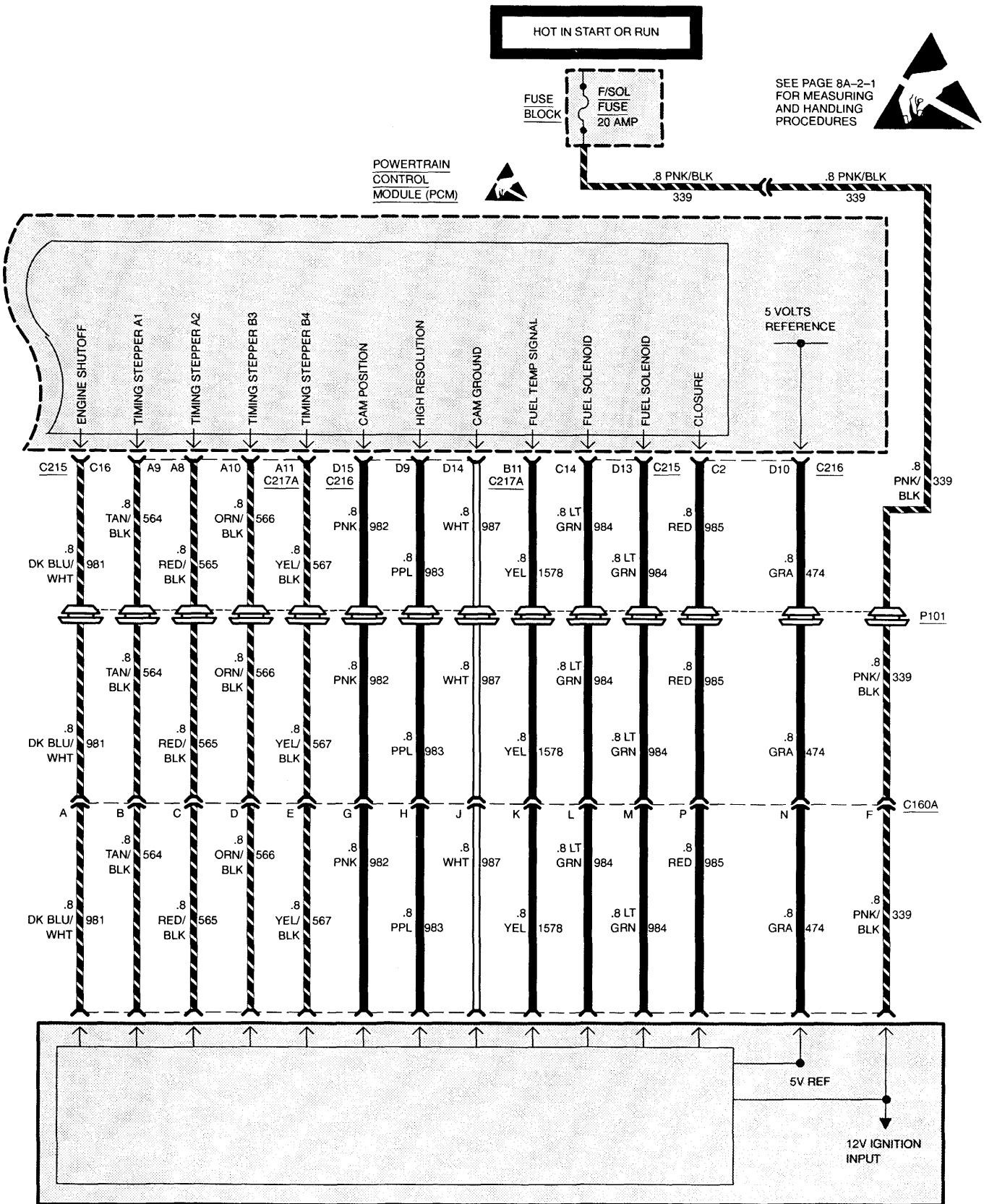
## W/HD AUTOMATIC TRANSMISSION



## 8A-27-8 ENGINE CONTROLS HD 6.5L TURBO DIESEL V8 VIN F



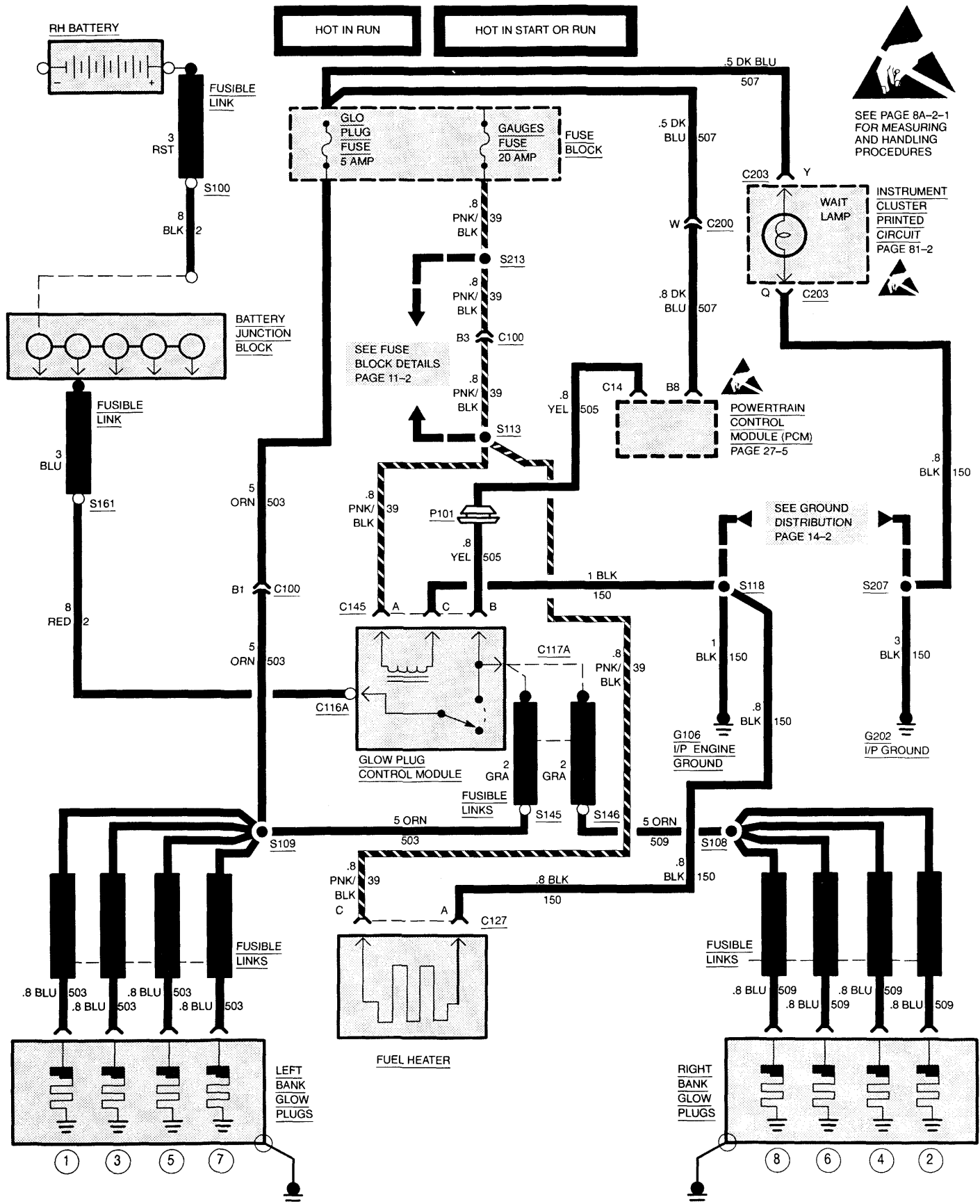
# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F L65 8A-27-9



| PCM CONNECTOR IDENTIFICATION |        |        |
|------------------------------|--------|--------|
| C215 -                       | BLUE - | 32 WAY |
| C216 -                       | PINK - | 32 WAY |
| C217A -                      | PINK - | 24 WAY |

# 8A-27-10 ENGINE CONTROLS HD 6.5L TURBO DIESEL V8 VIN F

## GLOW PLUG SYSTEM



# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F 8A-27-11

## POWERTRAIN CONTROL MODULE — HD 6.5L TURBO DIESEL ENGINE (32-PIN BLUE)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                          |
|-------------|-----------|------------|--------|--------------------------------------|
| 440         | .8        | ORN        | C1     | 12V + BATTERY                        |
| *1493       | .8        | DK BLU     | C2     | 4WD INPUT                            |
|             |           |            | C3     | NOT USED                             |
|             |           |            | C4     | NOT USED                             |
| 419         | .8        | BRN/WHT    | C5     | "SERVICE ENGINE SOON" LAMP<br>OUTPUT |
|             |           |            | C6     | NOT USED                             |
| *1222       | .8        | LT GRN     | C7     | TRANS SHIFT SOLENOID A               |
| *1224       | .8        | PNK        | C8     | TRANS RANGE MODE A                   |
| *1225       | .8        | DK BLU     | C9     | TRANS RANGE MODE B                   |
| *1226       | .8        | RED        | C10    | TRANS RANGE MODE C                   |
| 1350        | .8        | DK BLU     | C11    | 3/2 SHIFT CONTROL                    |
|             |           |            | C12    | NOT USED                             |
| *1223       | .8        | YEL/BLK    | C13    | TRANS SHIFT SOLENOID B               |
| 984         | .8        | LT GRN     | C14    | FUEL SOLENOID                        |
| 435         | .8        | GRA        | C15    | EGR SOLENOID                         |
| 981         | .8        | DK BLU/WHT | C16    | FUEL SHUTOFF                         |
|             |           |            | D1     | NOT USED                             |
| 997         | .5        | WHT/BLK    | D2     | REFERENCE VOLTAGE TPS 1              |
| 397         | .8        | GRA        | D3     | 3 MODE ELECTRONIC CRUISE<br>CONTROL  |
|             |           |            | D4     | NOT USED                             |
| 420         | .8        | PPL        | D5     | BRAKE SWITCH INPUT                   |
|             |           |            | D6     | NOT USED                             |
|             |           |            | D7     | NOT USED                             |
| 834         | .5        | BRN        | D8     | EBS CONTROL SIGNAL                   |
|             |           |            | D9     | NOT USED                             |
|             |           |            | D10    | NOT USED                             |
| 83          | .8        | DK GRN     | D11    | CRUISE CONTROL SWITCH —<br>RETARD    |
|             |           |            | D12    | NOT USED                             |
| 984         | .8        | LT GRN     | D13    | FUEL SOLENOID                        |
|             |           |            | D14    | NOT USED                             |
| 84          | .8        | DK BLU     | D15    | CRUISE CONTROL SWITCH —<br>ENGAGE    |
|             |           |            | D16    | NOT USED                             |

\* W/AUTO TRANS ONLY

# 8A-27-12 ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F

## POWERTRAIN CONTROL MODULE — HD 6.5L TURBO DIESEL ENGINE (32-PIN PINK)

| CIRCUIT NO. | WIRE SIZE | COLOR      | CAVITY | DESCRIPTION                              |
|-------------|-----------|------------|--------|------------------------------------------|
| 450         | .8        | BLK/WHT    | C1     | SYSTEM GROUND                            |
| 985         | .8        | RED        | C2     | CLOSURE SIGNAL                           |
| 993         | .5        | LT BLU     | C3     | TPS 2 SIGNAL                             |
| 992         | .5        | DK BLU     | C4     | TPS 1 SIGNAL                             |
| 433         | .8        | GRA/BLK    | C5     | BAROMETRIC PRESSURE SENSOR INPUT         |
| *1228       | .8        | RED/BLK    | C6     | TRANS FORCE MOTOR HIGH                   |
| 432         | .8        | LT GRN     | C7     | MANIFOLD ABSOLUTE PRESSURE SENSOR INPUT  |
| 410         | .8        | YEL        | C8     | COOLANT TEMPERATURE                      |
| *1227       | .8        | BLK/YEL    | C9     | TRANS TEMPERATURE INPUT                  |
| 416         | .8        | GRA        | C10    | +5 VOLT REFERENCE                        |
| *1229       | .8        | LT BLU/WHT | C11    | TRANS FORCE MOTOR LOW                    |
| 1230        | .8        | GRA/RED    | C12    | TRANS SPEED SENSOR INPUT                 |
| 505         | .8        | YEL        | C13    | GLOW PLUG RELAY                          |
| 1061        | .8        | ORN/BLK    | C14    | SERIAL DATA                              |
| 437         | .8        | BRN        | C15    | VEHICLE SPEED SENSOR INPUT               |
|             |           |            | C16    | NOT USED                                 |
| 551         | .8        | TAN/WHT    | D1     | ENGINE GROUND                            |
| 950         | .8        | LT GRN     | D2     | CLOSURE GROUND                           |
| 999         | .5        | PPL        | D3     | TPS 2 GROUND                             |
| 998         | .5        | BRN        | D4     | TPS 1 GROUND                             |
| 961         | .5        | GRA        | D5     | TPS 3 GROUND                             |
| 452         | .8        | BLK        | D6     | TRANS TEMPERATURE/PRESSURE REFERENCE LOW |
|             |           |            | D7     | NOT USED                                 |
| 1586        | .8        | BRN/WHT    | D8     | 2000 PULSE VEHICLE SPEED INPUT           |
| 983         | .8        | PPL        | D9     | TPS 2 SIGNAL                             |
| 474         | .8        | GRA        | D10    | +5 VOLT REFERENCE                        |
| 995         | .5        | YEL/BLK    | D11    | REFERENCE VOLTAGE TPS 3                  |
| 1231        | .8        | DK BLU/WHT | D12    | TRANS SPEED SENSOR INPUT                 |
| 643         | .8        | DK BLU/WHT | D13    | CRANK SENSOR                             |
| 987         | .8        | WHT        | D14    | CAM POSITION SENSOR GROUND               |
| 982         | .8        | PNK        | D15    | CAM POSITION SENSOR                      |
|             |           |            | D16    | NOT USED                                 |

\* W/AUTO TRANS ONLY

# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F 8A-27-13

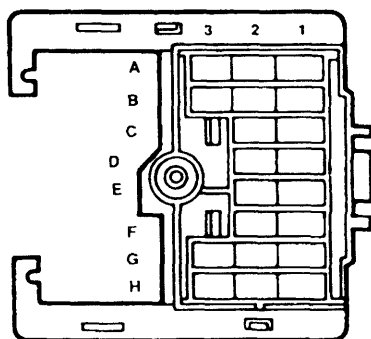
## POWERTRAIN CONTROL MODULE — HD 6.5L TURBO DIESEL ENGINE (32-PIN PINK)

| CIRCUIT NO. | WIRE SIZE | COLOR   | CAVITY | DESCRIPTION                     |
|-------------|-----------|---------|--------|---------------------------------|
| 439         | .8        | PNK/BLK | A1     | 12V IGNITION (FUSED)            |
|             |           |         | A2     | NOT USED                        |
|             |           |         | A3     | NOT USED                        |
| 971         | .8        | WHT     | A4     | EGR VENT SOLENOID               |
| 960         | .5        | YEL     | A5     | "SERVICE THROTTLE" LAMP OUTPUT  |
|             |           |         | A6     | NOT USED                        |
| 820         | .8        | YEL     | A7     | CHMSL INPUT                     |
| 565         | .8        | RED/BLK | A8     | TIMING STEPPER A2               |
| 564         | .8        | TAN/BLK | A9     | TIMING STEPPER A1               |
| 566         | .8        | ORN/BLK | A10    | TIMING STEPPER B3               |
| 567         | .8        | YEL/BLK | A11    | TIMING STEPPER B4               |
| 451         | .8        | WHT/BLK | A12    | DIAGNOSTIC ENABLE               |
|             |           |         | B1     | NOT USED                        |
|             |           |         | B2     | NOT USED                        |
|             |           |         | B3     | NOT USED                        |
| 59          |           | DK GRN  | B4     | A/C ON INPUT                    |
|             |           |         | B5     | NOT USED                        |
|             |           |         | B6     | NOT USED                        |
| 996         | .5        | TAN     | B7     | REFERENCE VOLTAGE TPS 2         |
| 507         | .5        | DK BLU  | B8     | GLOW PLUG "WAIT" LAMP OUTPUT    |
|             |           |         | B9     | NOT USED                        |
| 994         | .5        | DK GRN  | B10    | TPS 3 SIGNAL INPUT              |
| 1578        | .8        | YEL     | B11    | FUEL TEMPERATURE INPUT          |
| 472         | .8        | TAN     | B12    | INTAKE MANIFOLD AIR TEMPERATURE |



# 8A-27-14 ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F

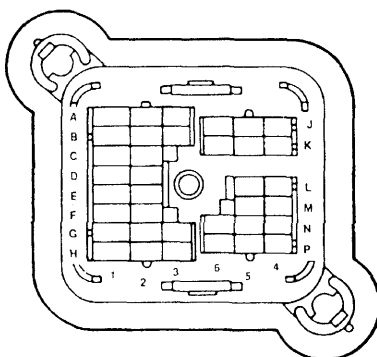
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GRAY  
Metri-Pack

**C100**  
Bulkhead Connector – Eng

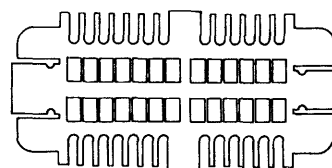
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GRAY  
Metri-Pack

**C100**  
Bulkhead Connector – I/P

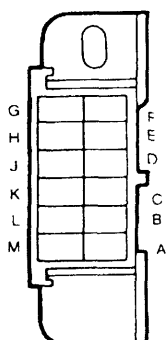
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BLACK  
Bow Series

**C203**  
I/P Cluster

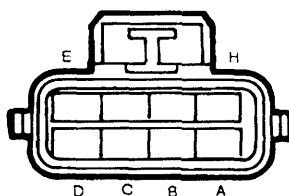
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BLACK  
Metri-Pack 480

**C272**  
Data Link Connector

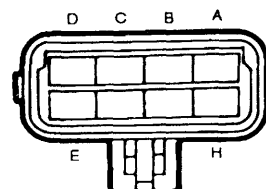
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BLACK  
Metri-Pack 150

**C161A**  
In-Line PCM to Engine

12047931



BLACK  
Metri-Pack 150

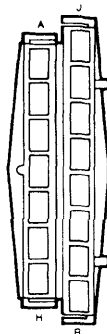
**C161A**  
In-Line Engine to PCM

12041254



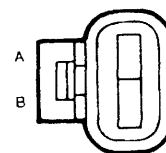
**C200**  
In-Line I/P to Bulkhead

12020213



**C200**  
In-Line Bulkhead to I/P

12084247

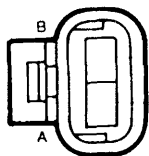


GRAY  
Metri-Pack 150

**C195A**  
Intake Manifold Air Temperature  
Sensor

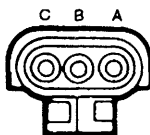
# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F 8A-27-15

12078084



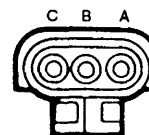
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Metri-Pack 150  
**C143**  
Coolant Temperature Sensor

12020403



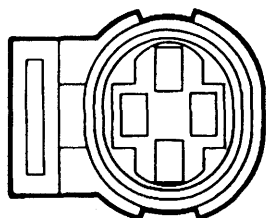
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**C100A**  
MAP Sensor

12020403



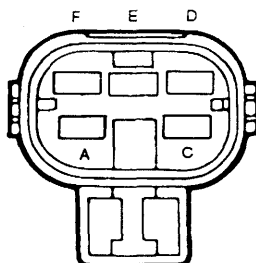
**BLACK**  
**C156**  
Barometric Pressure Sensor

12065401



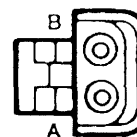
**GRAY**  
Metri-Pack 150  
**C167**  
Fuel Pump Oil Pressure Switch

12052287



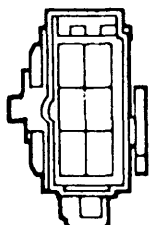
**BLACK**  
Metri-Pack  
**C132**  
Fuel Pump Relay

12015792



**BLACK**  
Weather Pack  
**C106A**  
In-Line Fuse to Fuel Pump and Sender

12020099



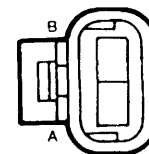
**C102**  
In-Line Fuel Pump to Bulkhead

12033709



**BLACK**  
Metri-Pack 280  
**C271**  
TCC/Brake Switch

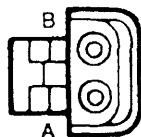
12078084



**BLACK**  
Metri-Pack 150  
**C365**  
Transmission Speed Sensor

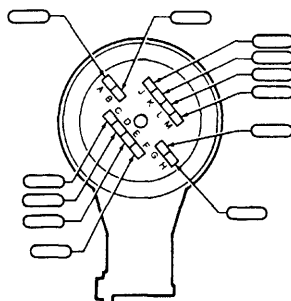
# 8A-27-16 ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F

12015792



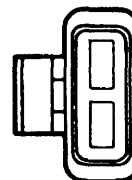
**BLACK**  
Weather Pack  
**C155A**  
Transfer Case Switch

12084690



**C348**  
Transmission

12066681



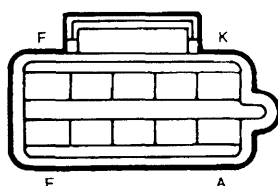
**BLACK**  
Metri-Pack 630  
**C130**  
Fuel Pump In-Line Fuse

12034417



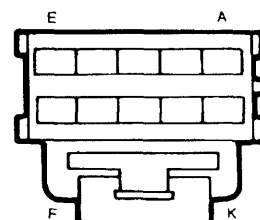
**C227A**  
Clutch Pedal Position Switch

12064770



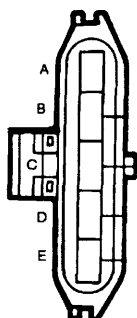
**NATURAL**  
Metri-Pack 150  
**C200A**  
In-Line Electronic Accelerator  
Pedal Control to PCM

12064769



**NATURAL**  
Metri-Pack 150  
**C200A**  
Inline PCM to Electronic  
Accelerator Pedal Control

12015982



**C145**  
Glow Plug Control Module

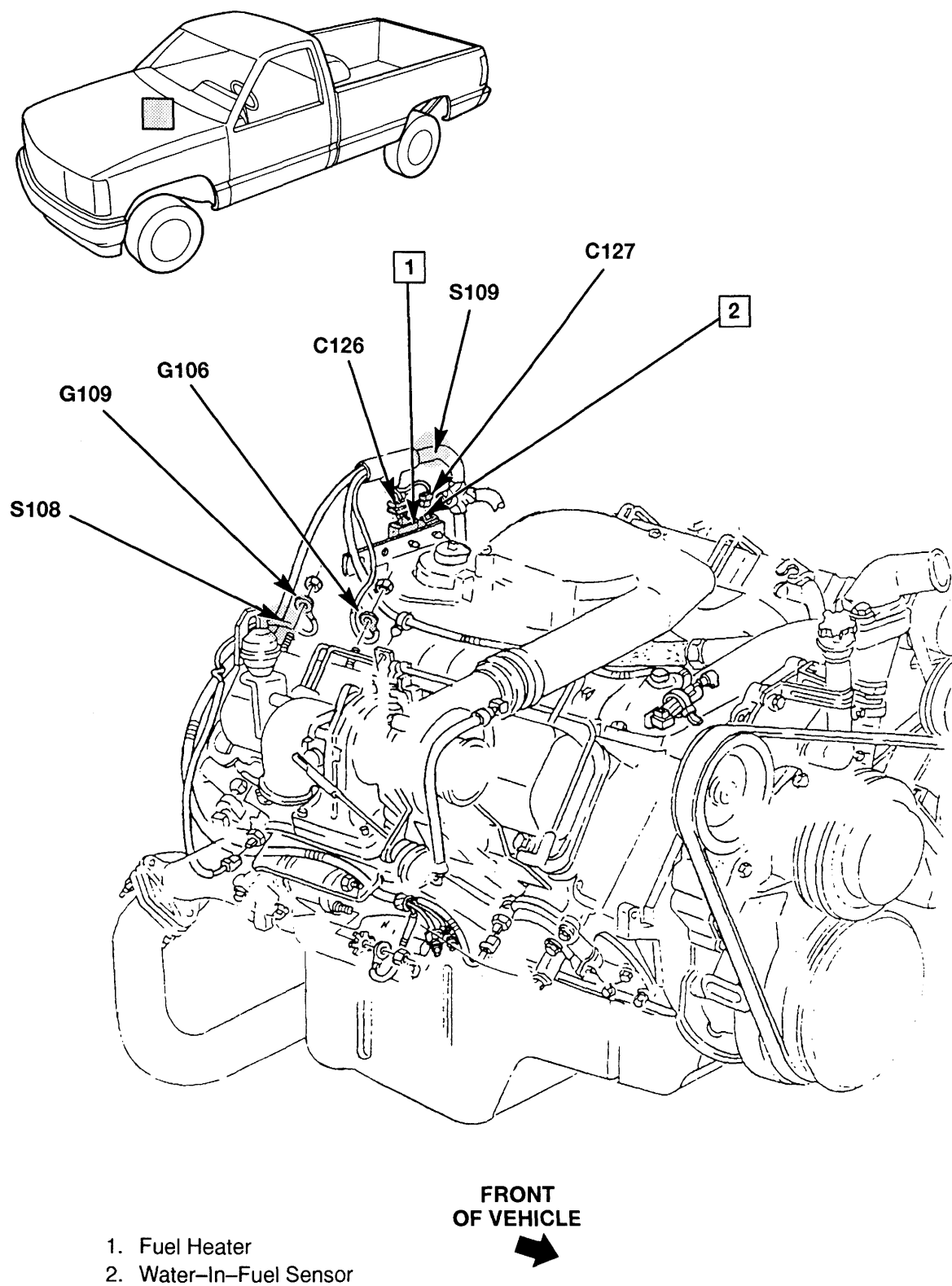


Figure 1 — Turbo Diesel Engine Wiring, RH Side

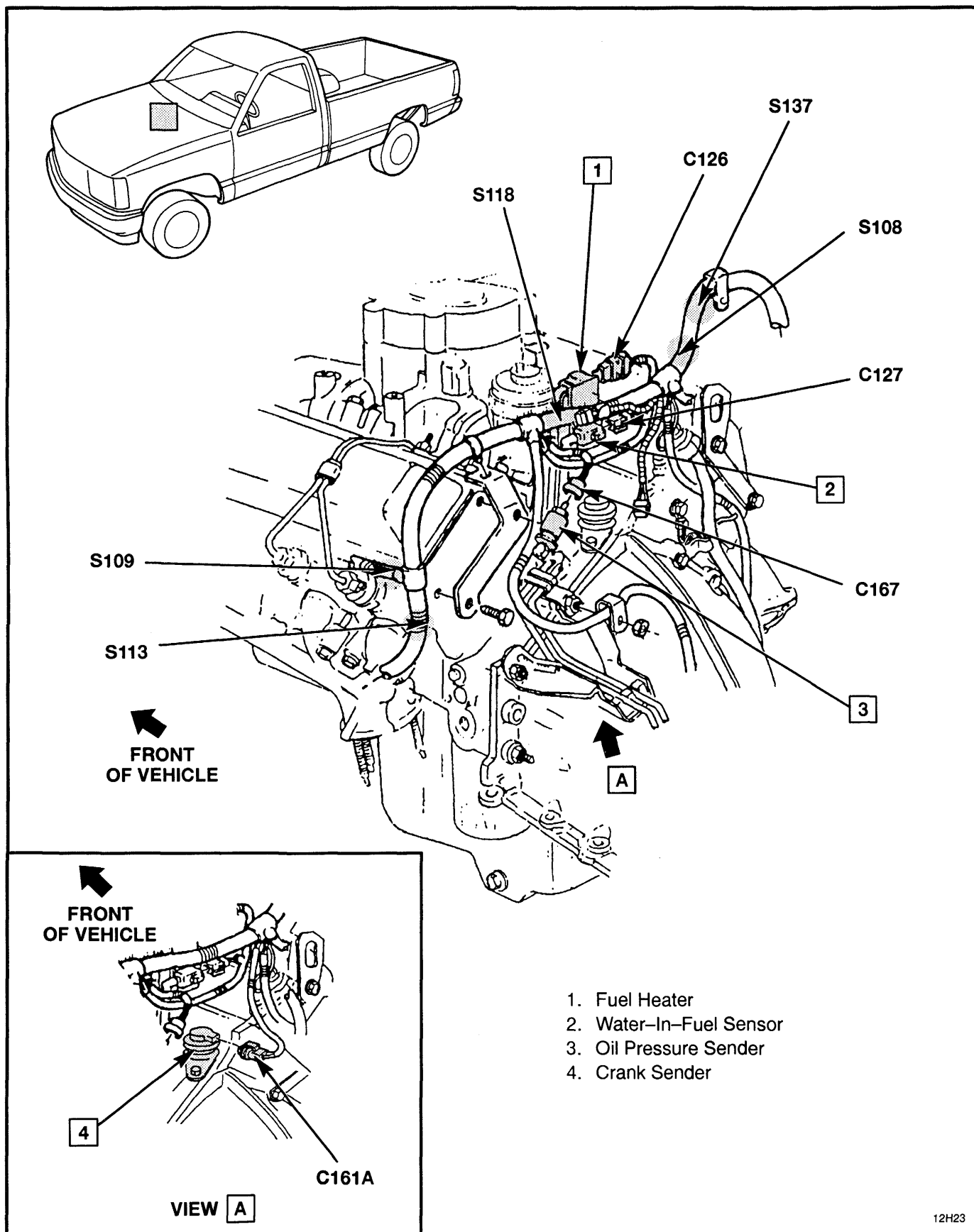


Figure 2 — 6.5L Diesel Engine Wiring, Rear

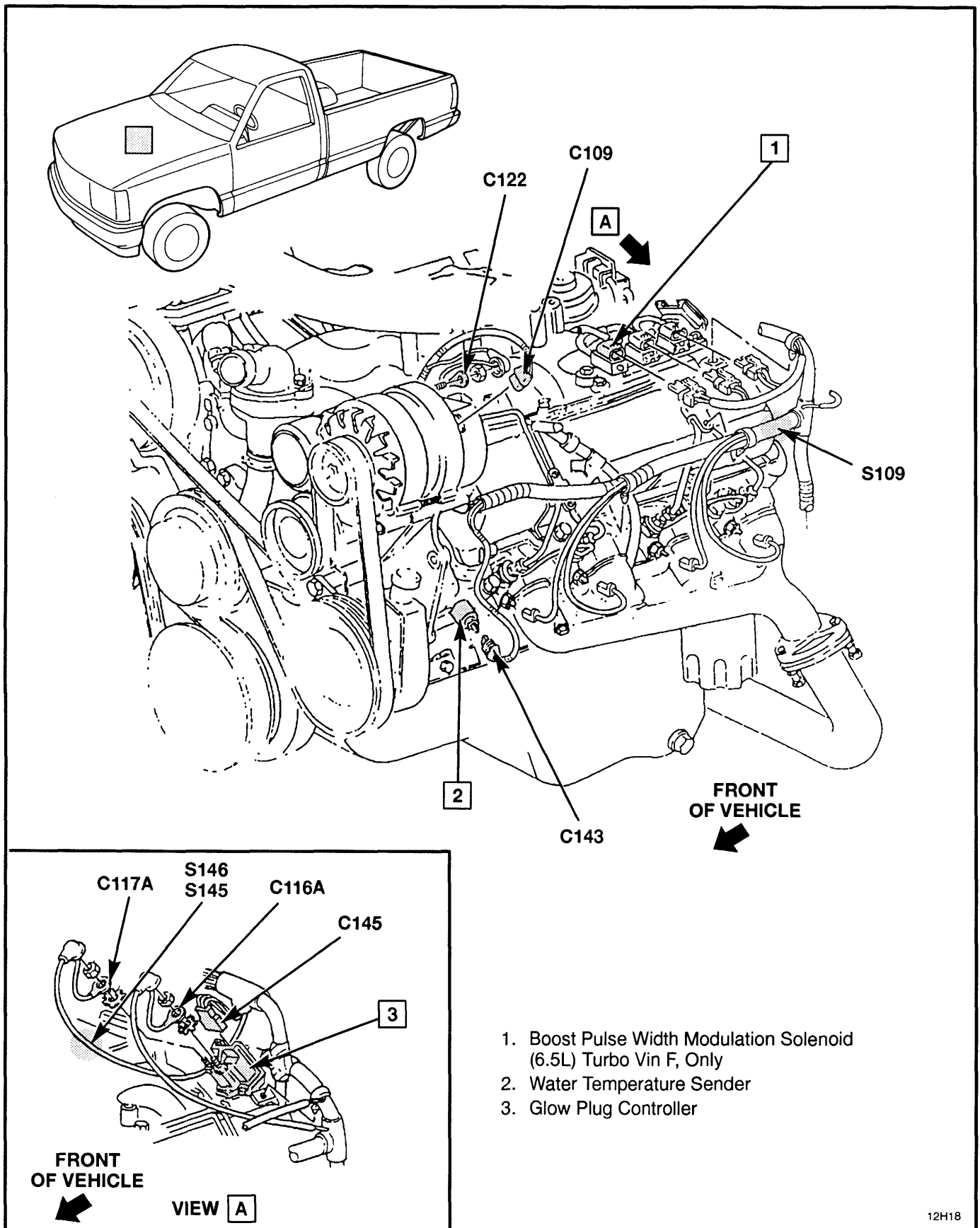


Figure 3 — 6.5L Diesel Engine Wiring, LH Side

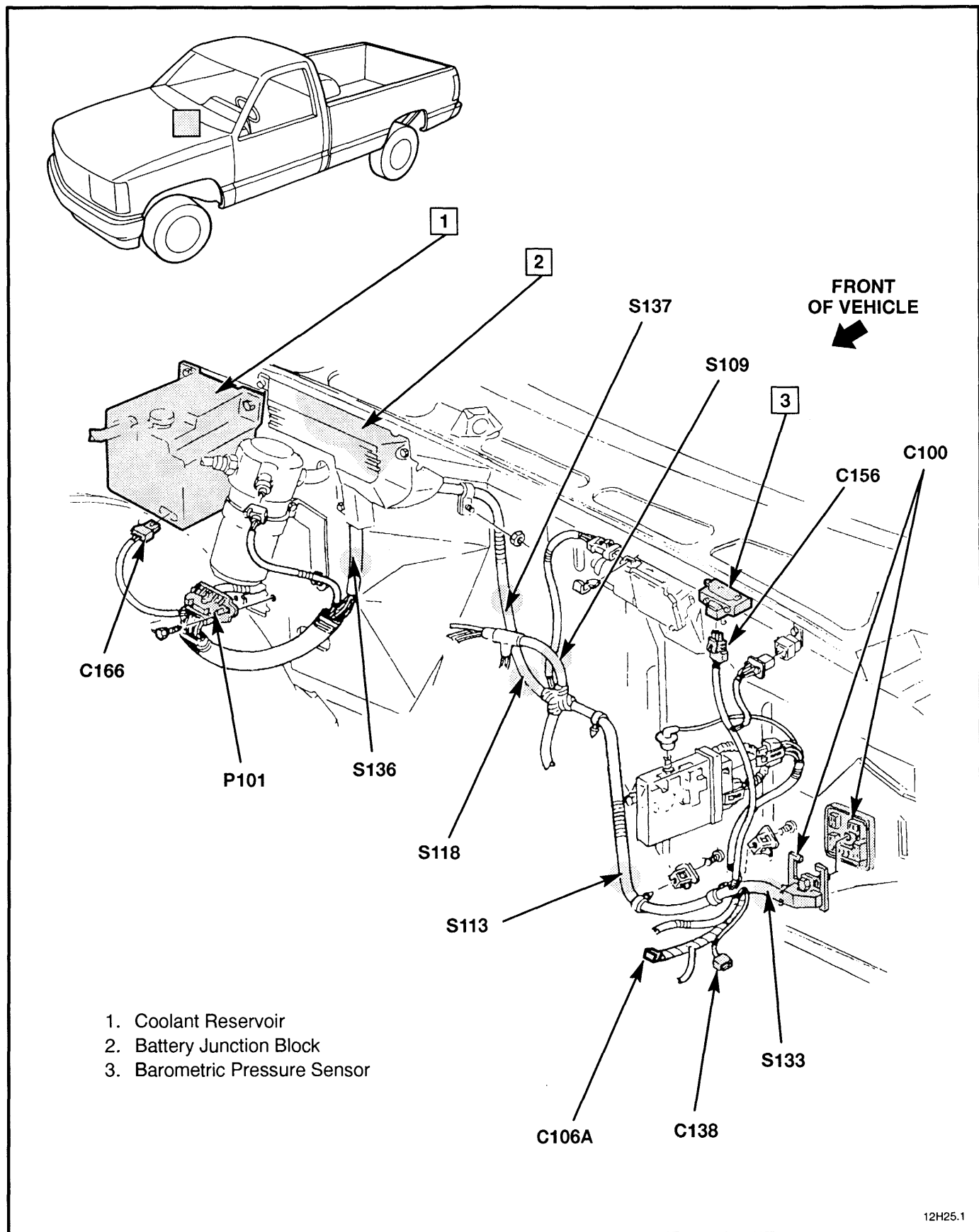


Figure 4 — Cowl Wiring, (6.5L) Diesel Engine

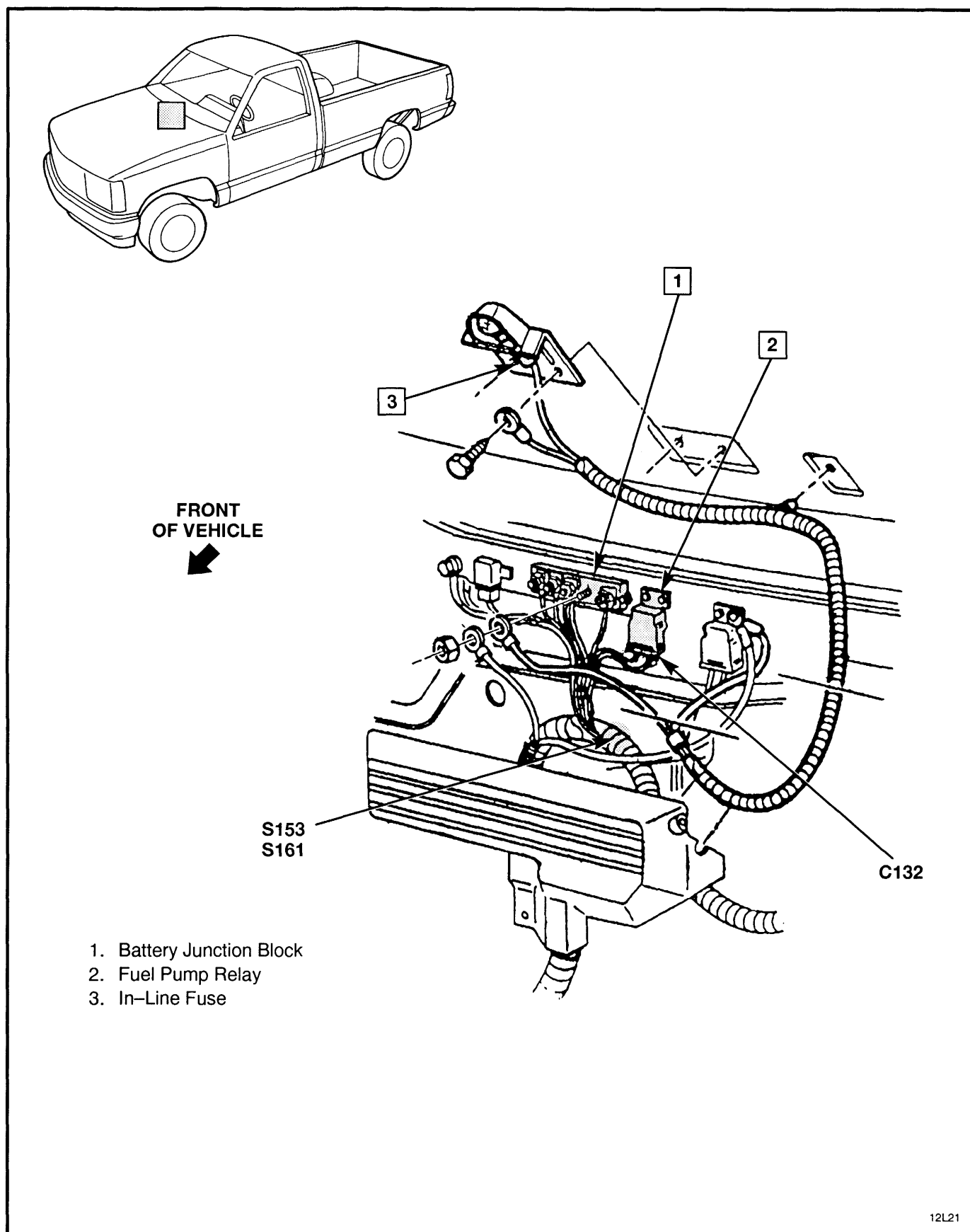


Figure 5 — Battery Junction Block Wiring



## 8A-27-22 ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F

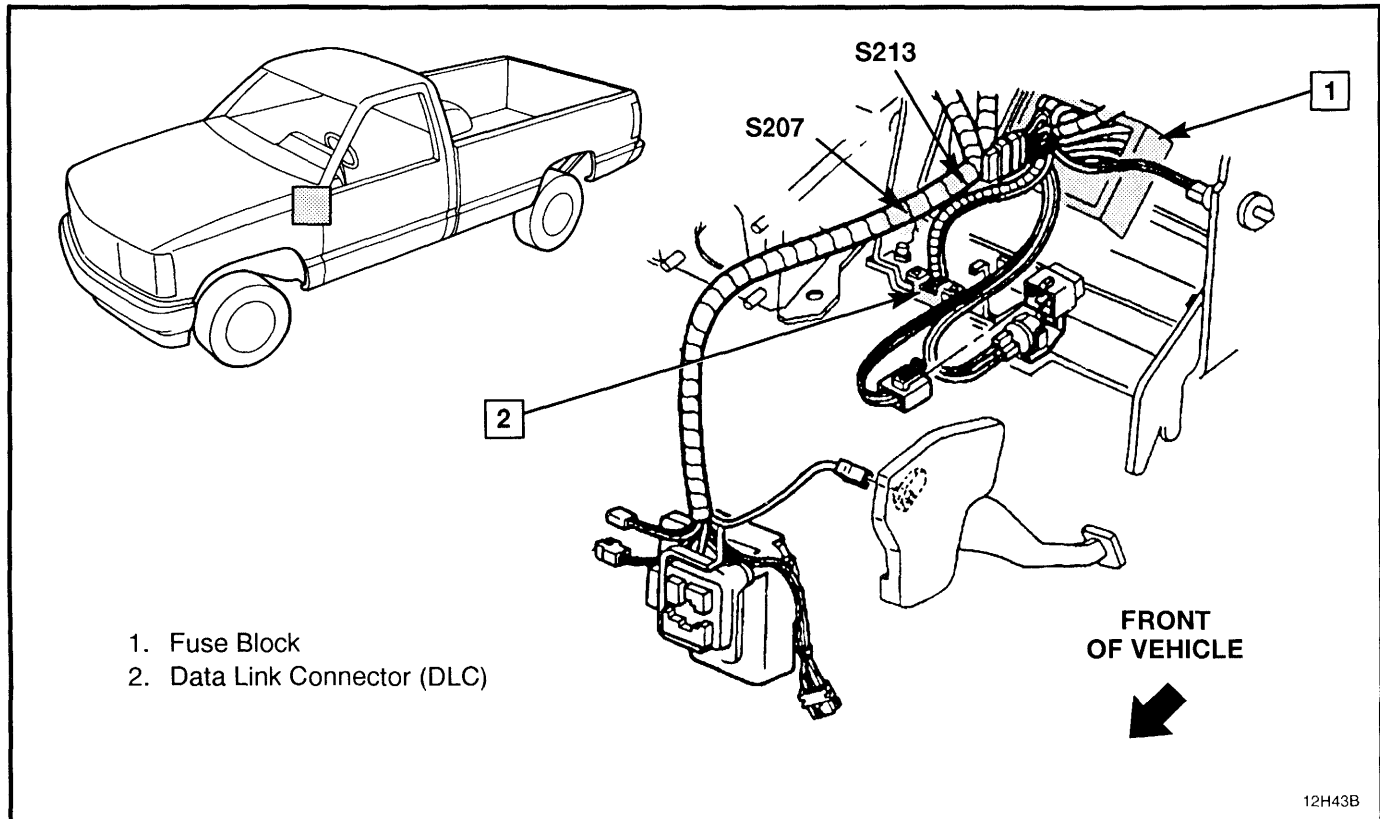


Figure 6 — Instrument Panel, LH Side

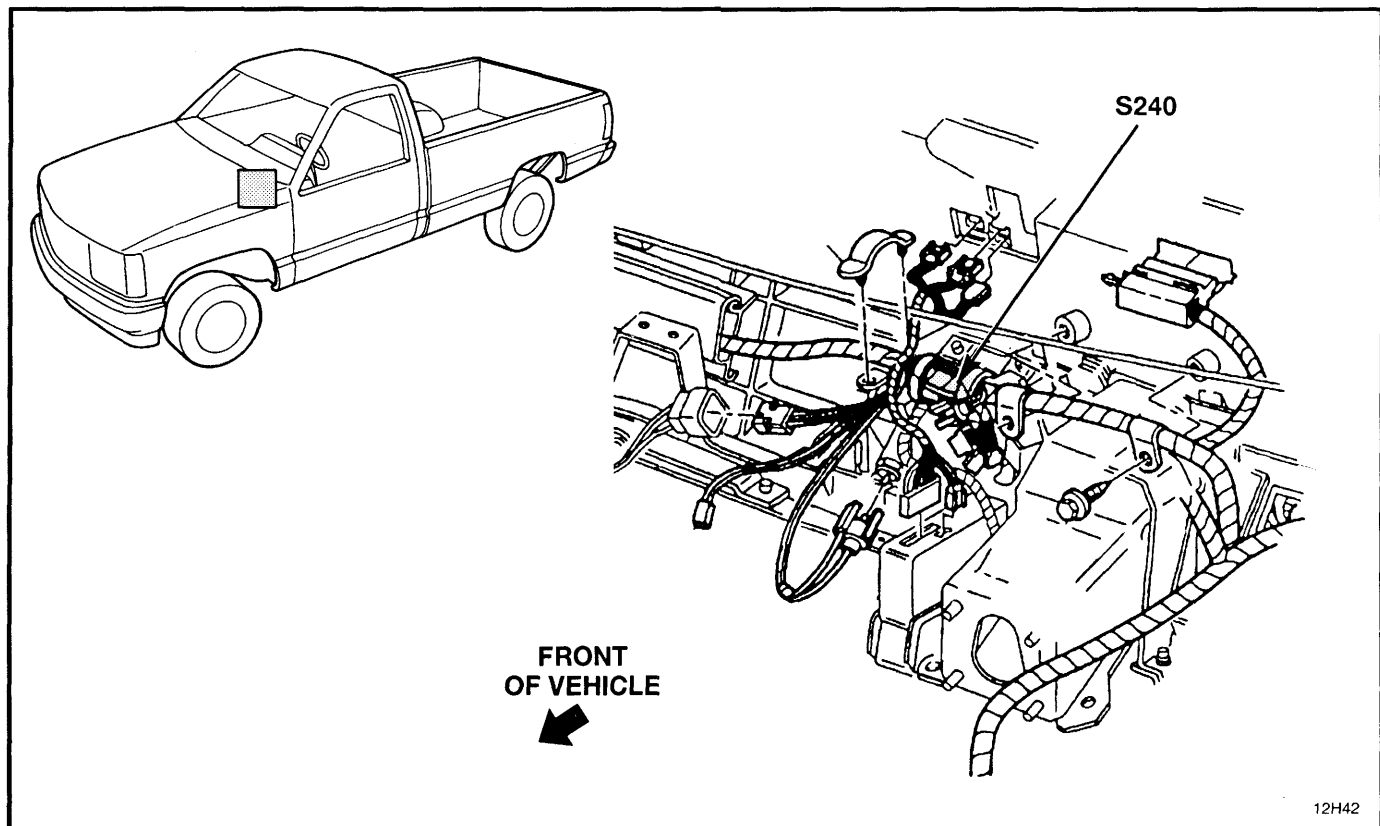
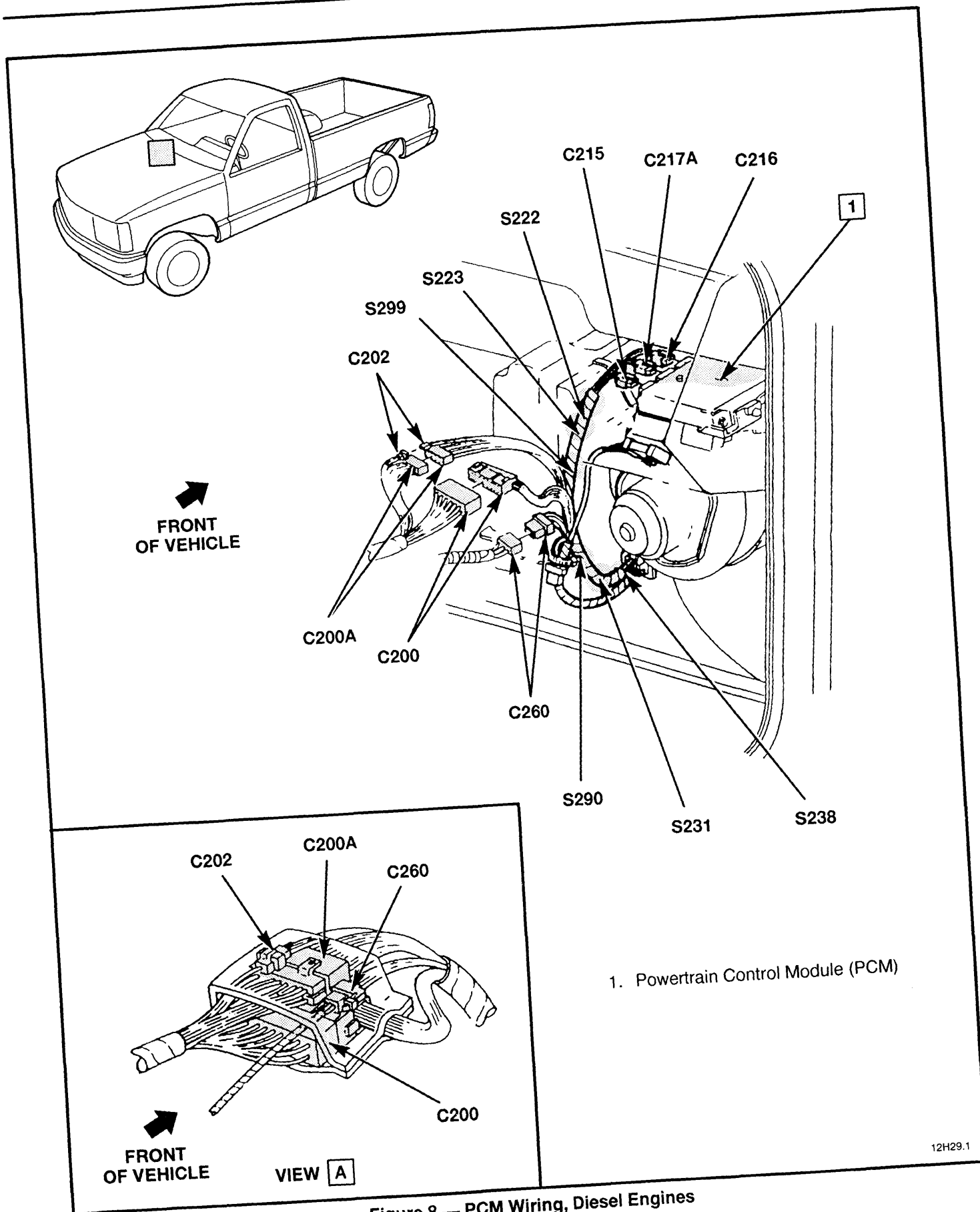


Figure 7 — Instrument Panel Wiring, RH Side

# ENGINE CONTROLS 6.5L TURBO DIESEL V8 VIN F 8A-27-23



12H29.1

Figure 8 — PCM Wiring, Diesel Engines

**BLANK**

## **CIRCUIT OPERATION**

### **STARTER**

When the Ignition Switch is moved to the START position, battery voltage is supplied to the Starter Solenoid through the PPL (6) wire. On manual transmission vehicles, the clutch pedal must be depressed. Both solenoid windings are energized. The circuit through the Pull-In Winding is completed to ground through the Starter Motor. The windings work together magnetically to pull in and hold in the Plunger. The Plunger moves the Shift Lever. This action causes the Starter Drive Assembly to rotate as it engages the Flywheel ring gear on the engine. At the same time, the Plunger also closes the solenoid switch contacts in the Starter Solenoid. Full battery voltage is supplied directly to the Starter Motor and it cranks the engine.

As soon as the Solenoid Switch contacts close, voltage is no longer supplied through the Pull-In Windings, since battery voltage is supplied to both ends of the windings. The Hold-In Winding remains energized, and its magnetic field is strong enough to hold the Plunger, Shift Lever and Drive Assembly Solenoid Switch contacts in place to continue cranking the engine.

When the Ignition Switch is released from the START position, battery voltage is removed from the PPL (6) wire and the junction of the two windings. Voltage is supplied from the Motor contacts through both windings to ground at the end of the Hold-In Windings. However, the voltage supplied to the Pull-In Winding is now opposing the voltage supplied when the winding was first energized. The magnetic fields of the Pull-In and Hold-In Windings now oppose one another. This action of the windings, with the help of the Return Spring, causes the Starter Drive Assembly to disengage and Solenoid Switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

### **CHARGING**

The Generator provides voltage to operate the vehicle's electrical system and to charge its Battery. A magnetic field is created when current flows through the Rotor. This field rotates as the Rotor is driven by the engine, creating an AC voltage in the Stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the Battery terminal.

This Generator's regulator uses digital techniques to supply the Rotor current and thereby controlling the output voltage. The Rotor current is proportional to the width of the electrical pulses supplied to it by the Regulator. When the Ignition Switch is placed in RUN, narrow width pulses are supplied to the Rotor, creating a weak magnetic field. When the engine is started, the Regulator senses Generator rotation by detecting AC voltage at the Stator through an internal wire. Once the engine is running, the Regulator varies the field current by controlling the pulse width. This regulates the Generator output voltage for proper battery charging and electrical system operation.

The digital regulator controls the VOLTS Indicator lamp with a solid-state lamp driver. The lamp driver turns on the lamp whenever undervoltage, overvoltage or a stopped Generator is detected.

## 8A-30-2 START AND CHARGE

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### COMPONENT LOCATION

### Page — Figure

|                        |                                        |           |   |
|------------------------|----------------------------------------|-----------|---|
| Battery Junction Block | RH rear of engine compartment, at cowl | 30-10     | 2 |
| Battery, LH            | LH front of engine compartment         | Not Shown |   |
| Battery, RH            | RH front of engine compartment         | Not Shown |   |
| Clutch Start Switch    | At top of clutch pedal                 | 30-11     | 4 |
| Generator              | LH top front of engine                 | 30-9      | 1 |
| Ignition Switch        | Under I/P, on steering column          | 30-12     | 5 |
| I/P Cluster            | LH side of I/P                         | Not Shown |   |
| Starter Motor          | RH lower rear side of engine           | 30-9      | 1 |

### CONNECTORS:

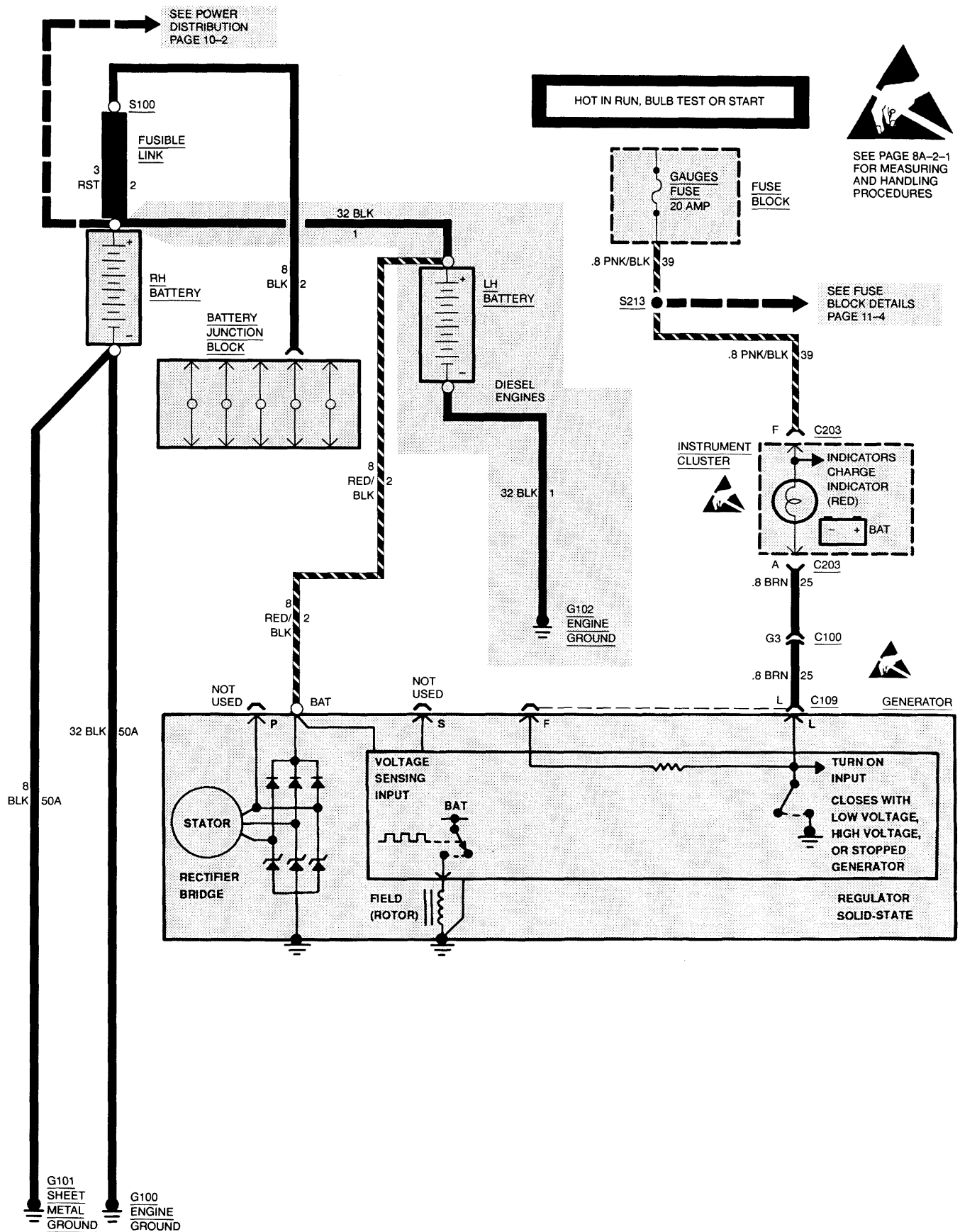
|      |                       |       |   |
|------|-----------------------|-------|---|
| C100 | At bulkhead connector | 30-12 | 6 |
|------|-----------------------|-------|---|

### GROUND:

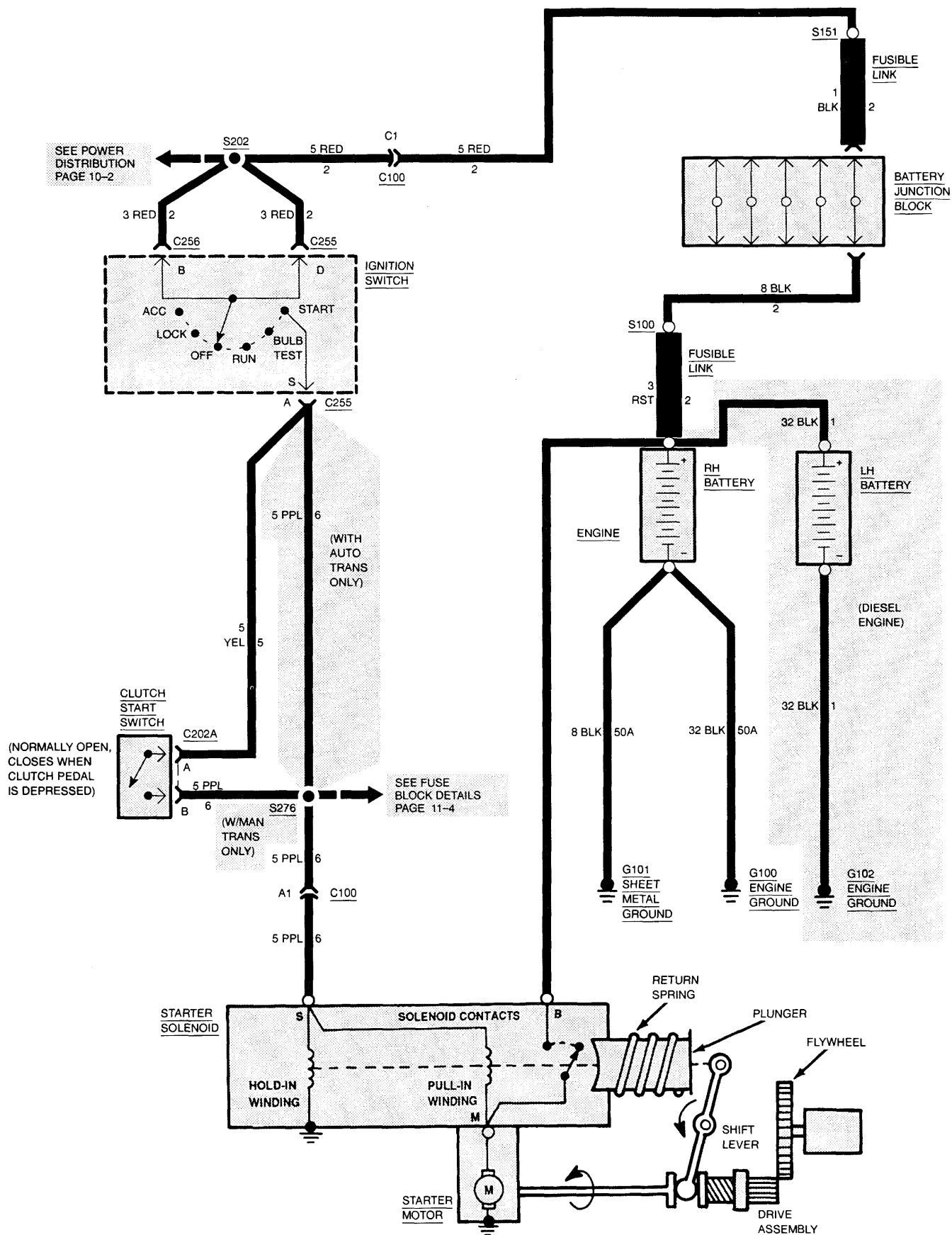
|               |                               |           |   |
|---------------|-------------------------------|-----------|---|
| G100          | RH front of engine            | 30-10     | 2 |
| G101          | RH inner fender, near battery | Not Shown |   |
| G102 (Diesel) | LH front top of engine        | 30-11     | 3 |

### SPLICES:

|      |                                              |           |   |
|------|----------------------------------------------|-----------|---|
| S100 | Positive battery cable, near battery         | 30-10     | 2 |
| S151 | Center of cowl, below battery junction block | 30-13     | 7 |
| S155 | Center of cowl, below battery junction block | 30-13     | 7 |
| S202 | Under LH side of I/P                         | 30-12     | 5 |
| S213 | Under LH side of I/P                         | Not Shown |   |
| S276 | Under LH side of I/P                         | 30-12     | 6 |



# 8A-30-4 START AND CHARGE



## DIAGNOSIS — START AND CHARGE

### PRELIMINARY CHECKS:

1. Check condition of GAUGES and CRNK Fuse(s). If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).
2. Check condition of ACC-BATT circuit breaker. If circuit breaker is tripped, locate and repair source of overload. If circuit breaker will not reset, replace circuit breaker.

### ENGINE DOES NOT CRANK AND STARTER SOLENOID DOES NOT CLICK

| TEST                                                                                                                                                                                                            | RESULT                     | ACTION                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------|
| 1. Place transmission in PARK (auto) or depress clutch pedal for man trans. Connect voltmeter from PPL (6) wire at starter solenoid to ground. Place ignition switch in START position.                         | Battery voltage.           | GO to step 2.                                                                                 |
|                                                                                                                                                                                                                 | No voltage.                | GO to step 3 for man trans.<br>GO to step 5 for auto trans.                                   |
| 2. Connect voltmeter from PPL (6) wire to starter mounting bolts.                                                                                                                                               | Battery voltage.           | REPLACE starter solenoid.                                                                     |
|                                                                                                                                                                                                                 | Less than battery voltage. | CLEAN starter motor mounting bolts, starter motor and mounting surface.                       |
| 3. Disconnect clutch switch connector C202A. Connect voltmeter from YEL (5) wire at clutch pedal position switch connector C202A to ground. Ignition switch must be in START position.                          | Battery voltage.           | GO to step 4.                                                                                 |
|                                                                                                                                                                                                                 | No voltage.                | GO to step 5.                                                                                 |
| 4. Depress clutch and put transmission in Neutral. Apply parking brake. Connect fused jumper from YEL (5) to PPL (6) at clutch pedal position switch connector C202. Place ignition switch in START position.   | Engine cranks.             | REPLACE clutch pedal position switch.                                                         |
|                                                                                                                                                                                                                 | Engine does not crank.     | LOCATE and REPAIR open in PPL (6) wire from clutch pedal position switch to starter solenoid. |
| 5. With ignition switch OFF, connect voltmeter from RED (2) terminal at ignition switch connector C256 to ground. Repeat step except connect from RED (2) terminal at ignition switch connector C255 to ground. | Battery voltage.           | REPLACE ignition switch.                                                                      |
|                                                                                                                                                                                                                 | No voltage.                | LOCATE and REPAIR open in RED (2) wires and fusible link at junction block.                   |



## 8A-30-6 START AND CHARGE

### STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK OR CRANKS SLOWLY

| TEST                                                                                                | RESULT                                                            | ACTION                                                                           |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 1. Connect voltmeter to positive and negative battery terminals. Place ignition switch in START.    | Voltage reading greater than 9.5 volts after 15 seconds cranking. | GO to step 2.                                                                    |
|                                                                                                     | Voltage less than 9.5 volts after 15 seconds cranking.            | PERFORM a Battery Load Test. Refer to Section 6D in the 1994 C/K Service Manual. |
| 2. Connect voltmeter from negative battery terminal to engine block.                                | Less than .5 volts.                                               | GO to step 3.                                                                    |
|                                                                                                     | More than .5 volts.                                               | REPLACE negative battery cable.                                                  |
| 3. Connect voltmeter from positive battery terminal to starter solenoid terminal at BLK (50A) wire. | Less than .5 volts.                                               | REPAIR starter motor.                                                            |
|                                                                                                     | More than .5 volts.                                               | REPLACE positive battery cable.                                                  |

### VOLTS INDICATOR DOES NOT LIGHT WITH IGNITION SWITCH IN RUN AND ENGINE STOPPED

| TEST                                                                                                                                                          | RESULT                          | ACTION                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect generator connector C109. Place ignition switch in RUN position. Connect fused jumper from BRN (25) wire at generator connector C109 to ground. | VOLTS indicator lights.         | REPAIR generator.                                                                                                                       |
|                                                                                                                                                               | VOLTS indicator does not light. | CHECK condition of VOLTS indicator bulb. If good, LOCATE and REPAIR open in BRN (25) wire from generator connector C109 to I/P cluster. |

### VOLTS INDICATOR STAYS ON WHEN ENGINE IS RUNNING

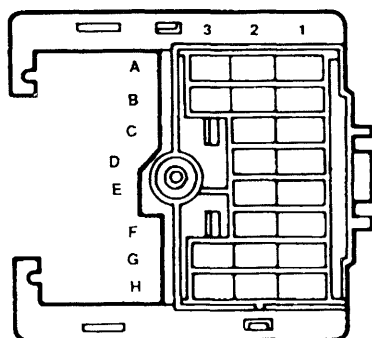
| TEST                                    | RESULT                          | ACTION                                                                                           |
|-----------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------|
| 1. Disconnect generator connector C109. | VOLTS indicator does not light. | REPAIR generator.                                                                                |
|                                         | VOLTS indicator remains lit.    | LOCATE and REPAIR short to ground in BRN (25) wire from generator connector C109 to I/P cluster. |

**BATTERY IS UNDERCHARGED OR OVERCHARGED**

| TEST                                                                                                                                                                          | RESULT                                            | ACTION                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect generator connector C109. Place ignition switch in RUN position. Connect voltmeter from BRN (25) wire at generator connector C109 to ground.                    | Battery voltage.                                  | GO to step 2.                                                                                                                           |
|                                                                                                                                                                               | No voltage.                                       | CHECK condition of VOLTS indicator bulb. If good, LOCATE and REPAIR open in BRN (25) wire from generator connector C109 to I/P cluster. |
| 2. Connect voltmeter from RED (2) wire at generator to ground.                                                                                                                | Battery voltage.                                  | GO to step 3.                                                                                                                           |
|                                                                                                                                                                               | No voltage.                                       | LOCATE and REPAIR open in RED (2) wire and fusible link from generator connector C122 to junction block.                                |
| 3. Reconnect generator connector C109 . Have all accessories turned off and engine running at fast idle. Connect voltmeter from battery terminal C122 on generator to ground. | Reading 13-16 volts.                              | PERFORM Generator Bench Test. Refer to Section 6D in the 1994 C/K Service Manual.                                                       |
|                                                                                                                                                                               | Reading of less than or greater than 13-16 volts. | REPAIR generator.                                                                                                                       |

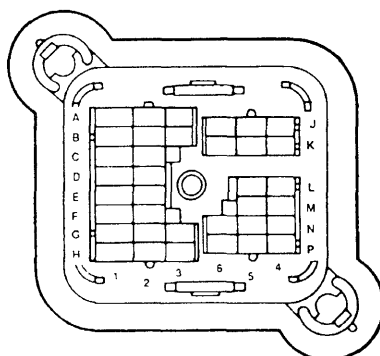
## 8A-30-8 START AND CHARGE

12020183



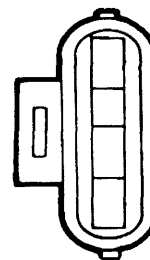
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12129068



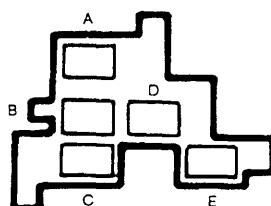
**BLACK**  
Metri-Pack 150  
**C109**  
Generator

12034417



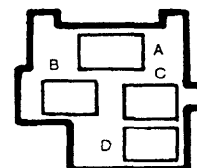
**C202A**  
Clutch Pedal Position Switch

12010966



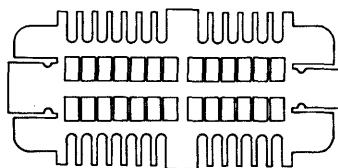
**BLUE**  
56 Series  
**C255**  
Ignition Switch

06294641

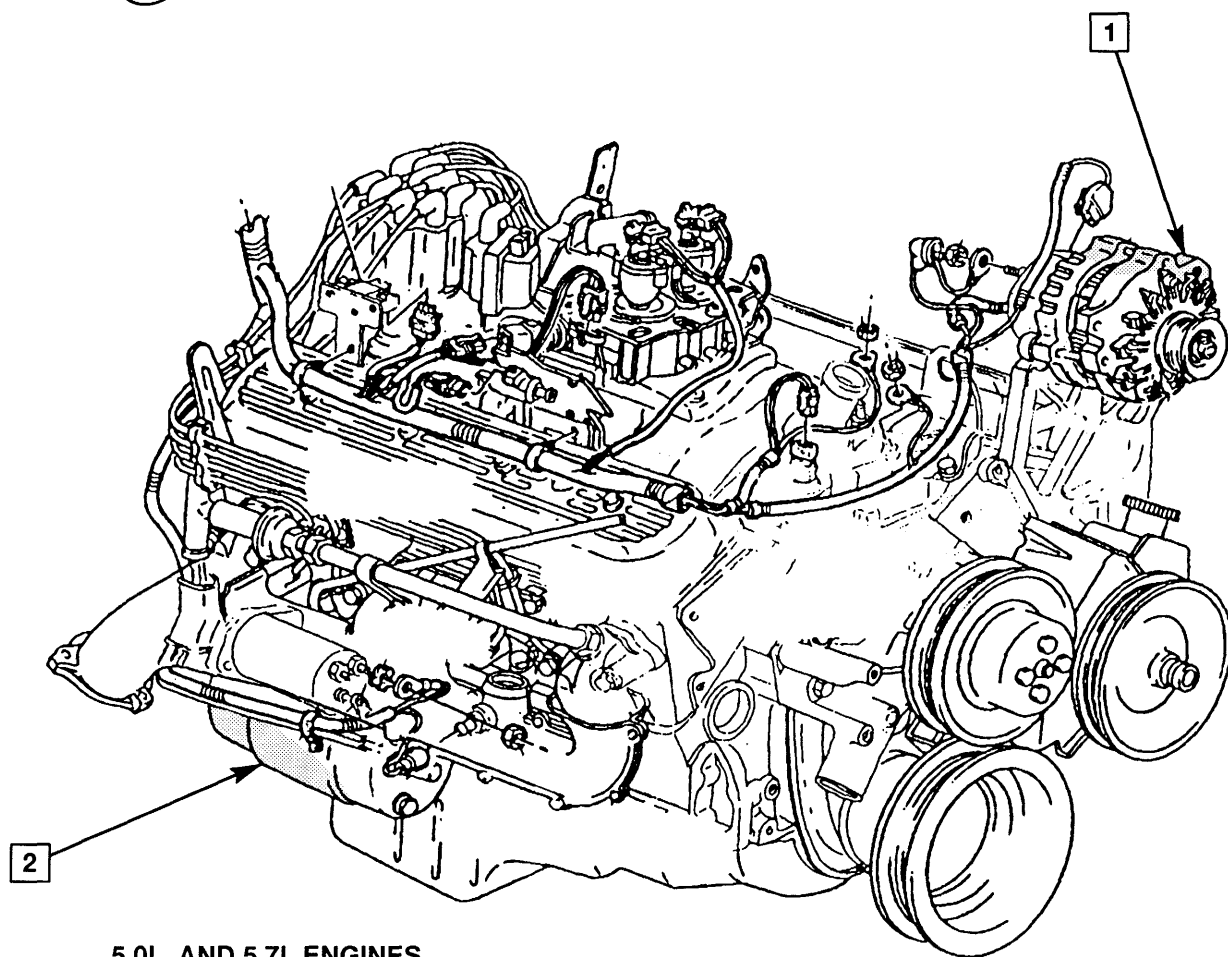
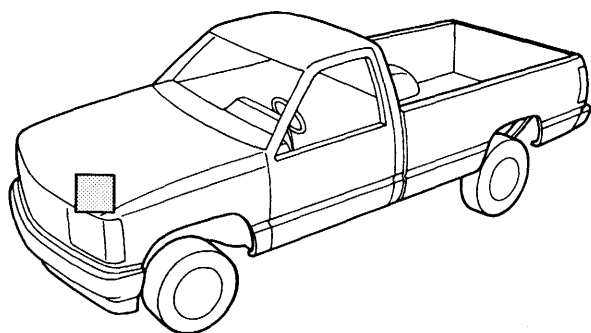


**BLACK**  
56 Series  
**C256**  
Ignition Switch

12089908



**BLACK**  
Bow Series  
**C203**  
I/P Cluster



5.0L AND 5.7L ENGINES  
SHOWN, ALL OTHER  
ENGINES SIMILAR

FRONT  
OF VEHICLE

- 1. Generator
- 2. Starter Motor

Figure 1 — RH Side of Engine, 5.0L (305 CID) and 5.7L (350 CID) V8 — Gasoline Engines

## 8A-30-10 START AND CHARGE

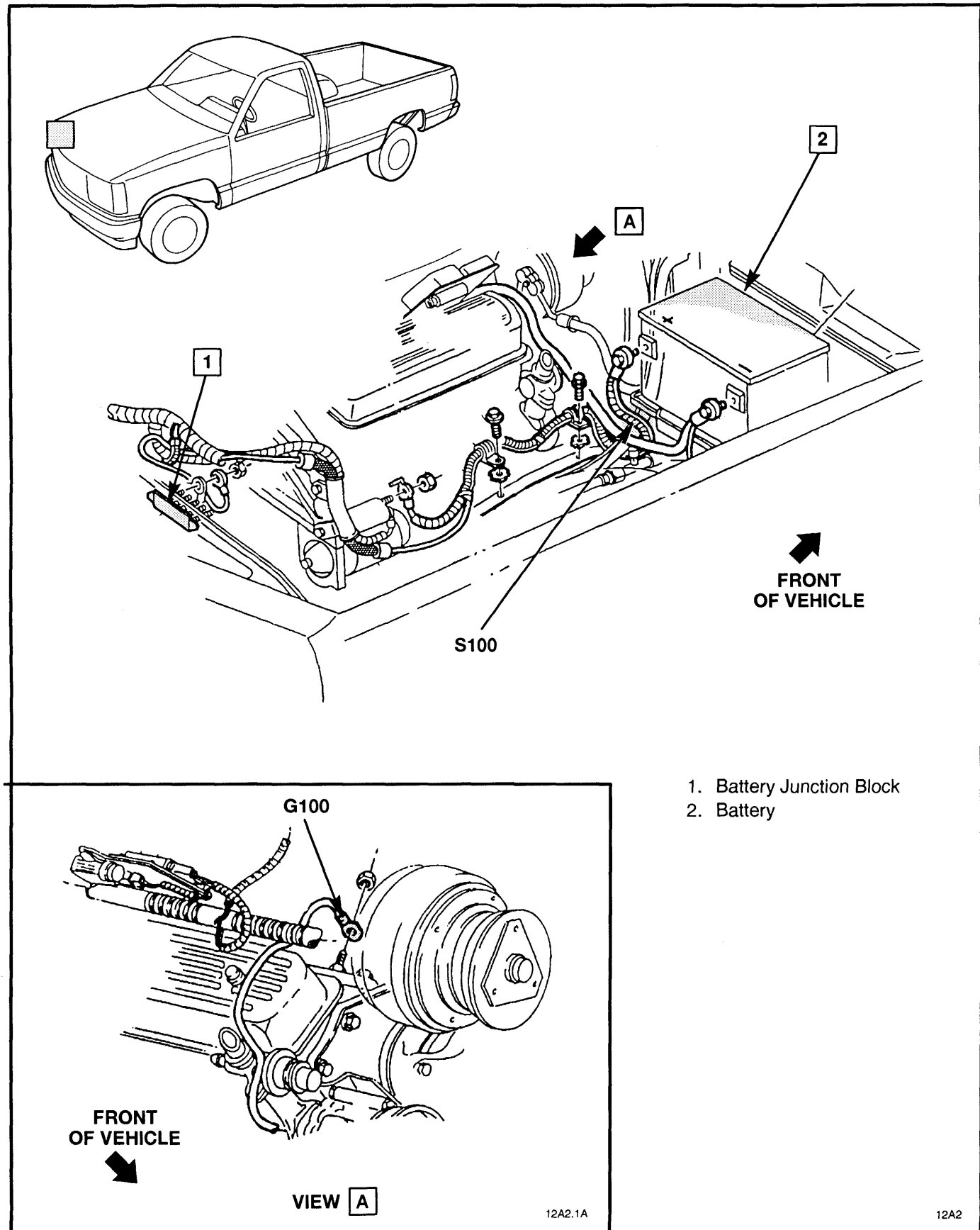


Figure 2 — Battery Wiring, Gasoline Engines

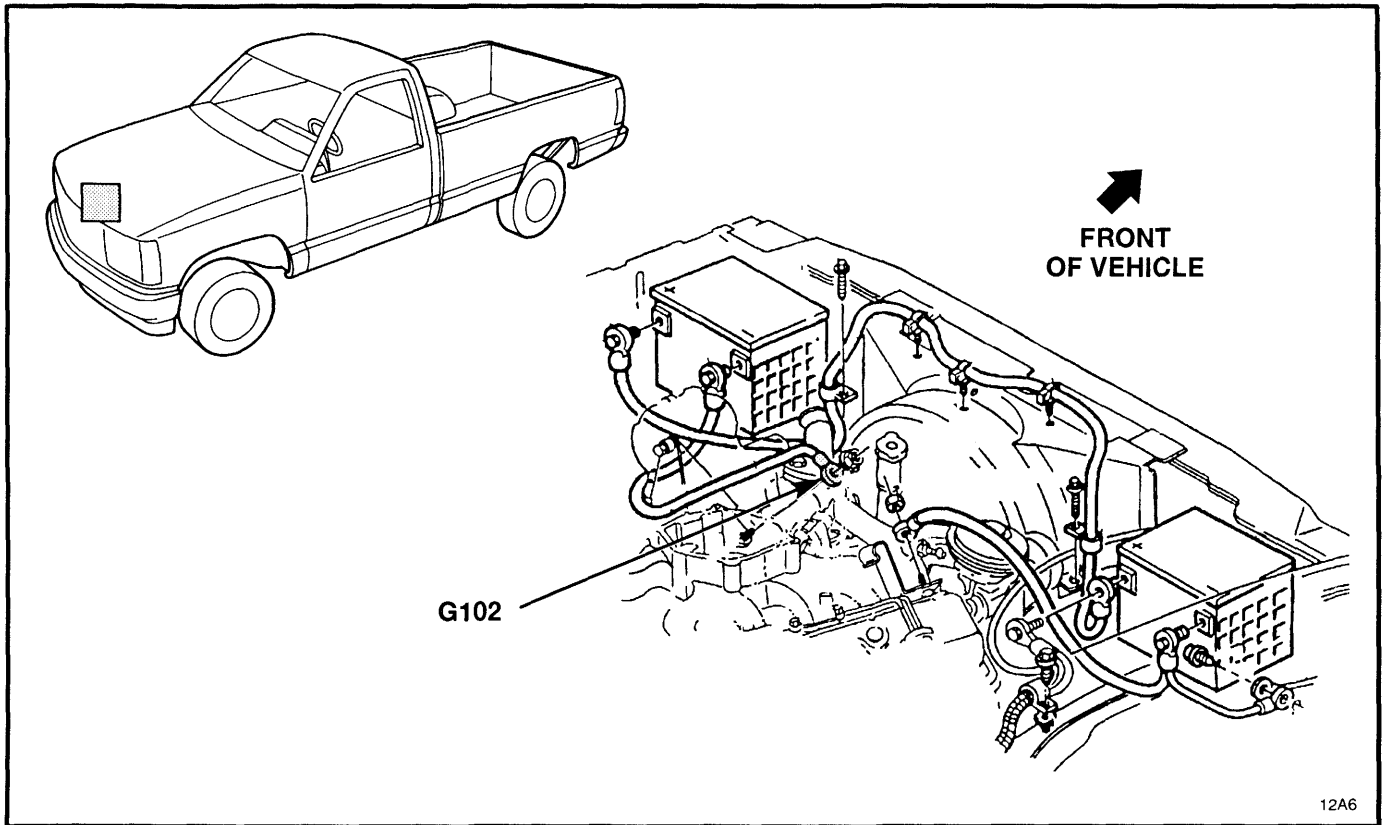


Figure 3 — Battery Cables, Diesel

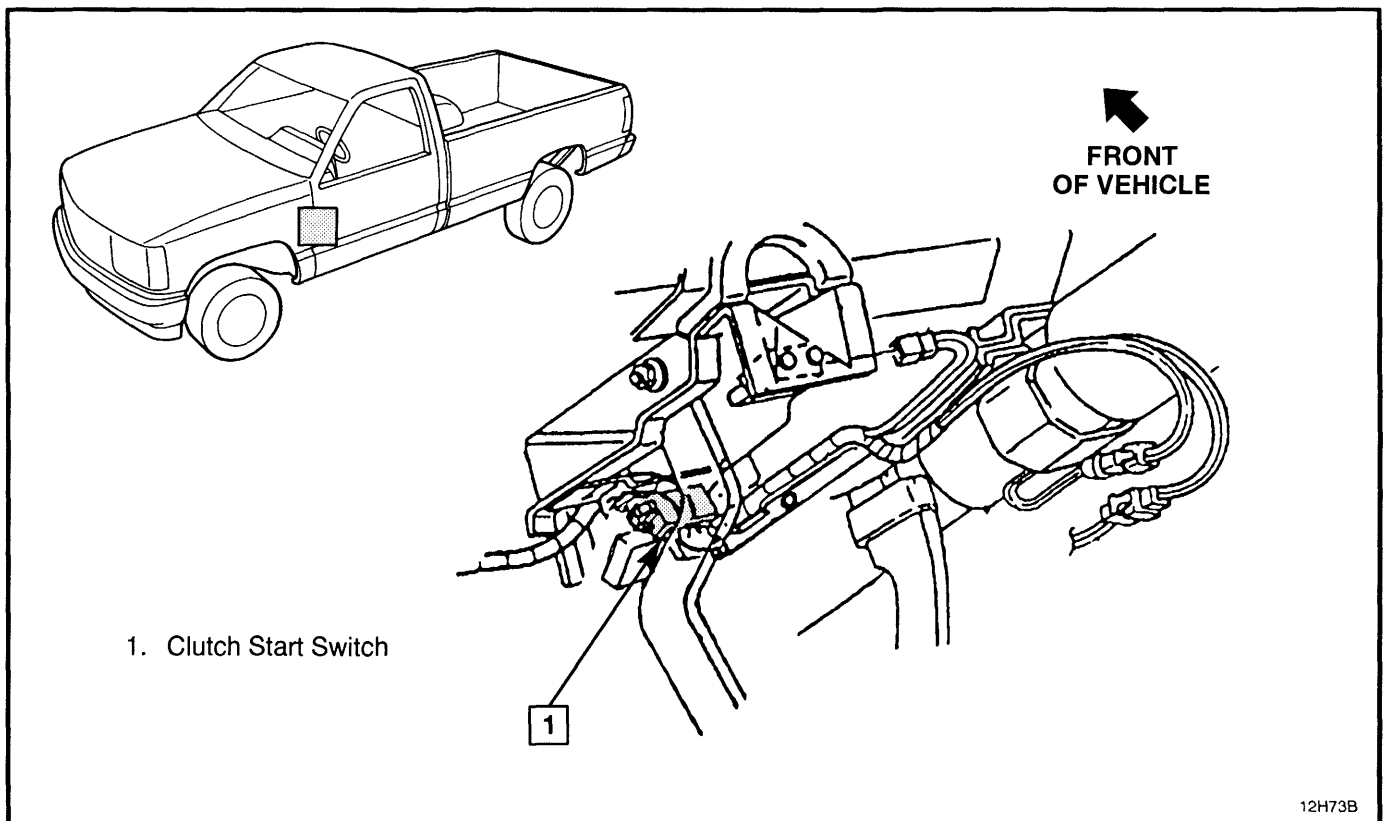


Figure 4 — Cruise Control Wiring

## 8A-30-12 START AND CHARGE

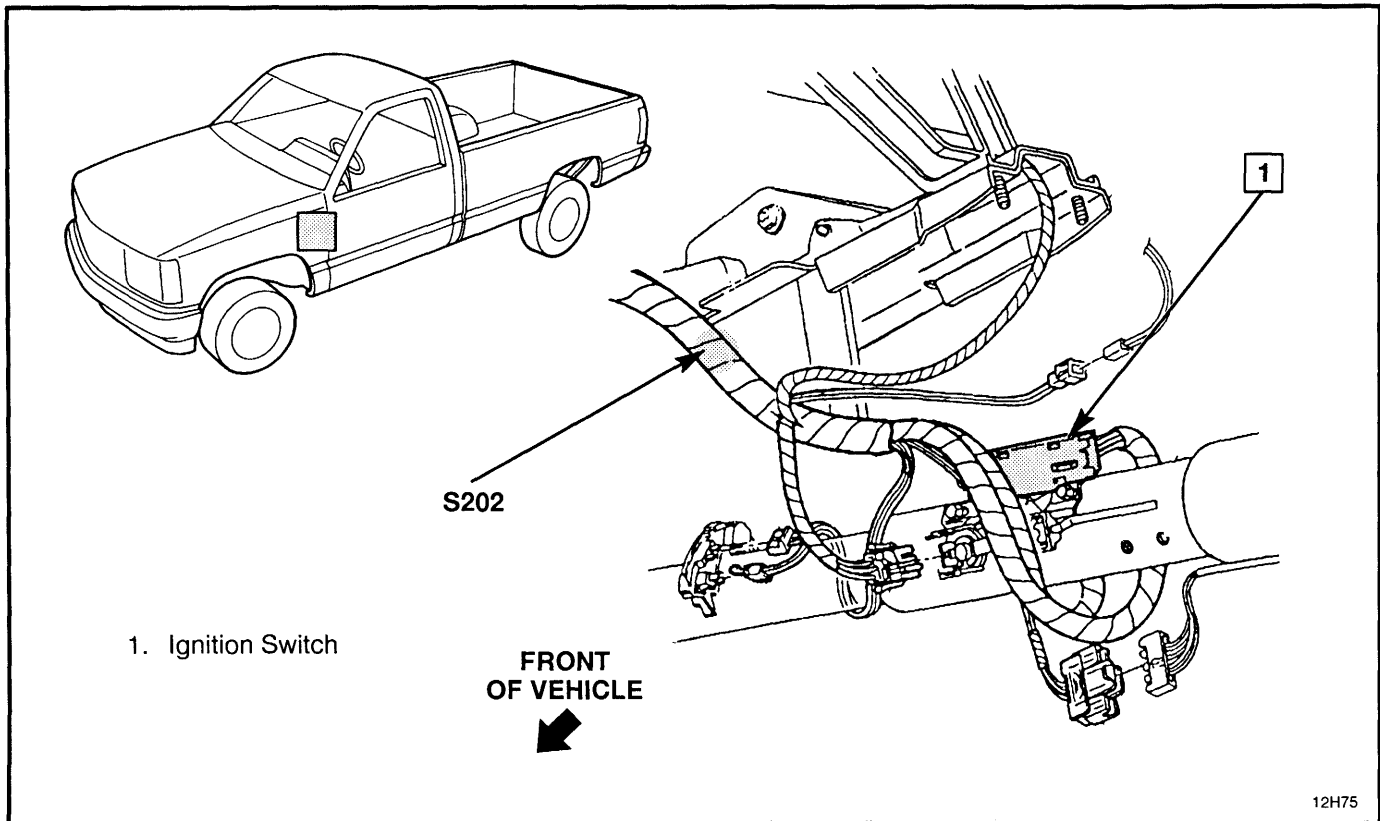


Figure 5 — LH Side of Steering Column Wiring

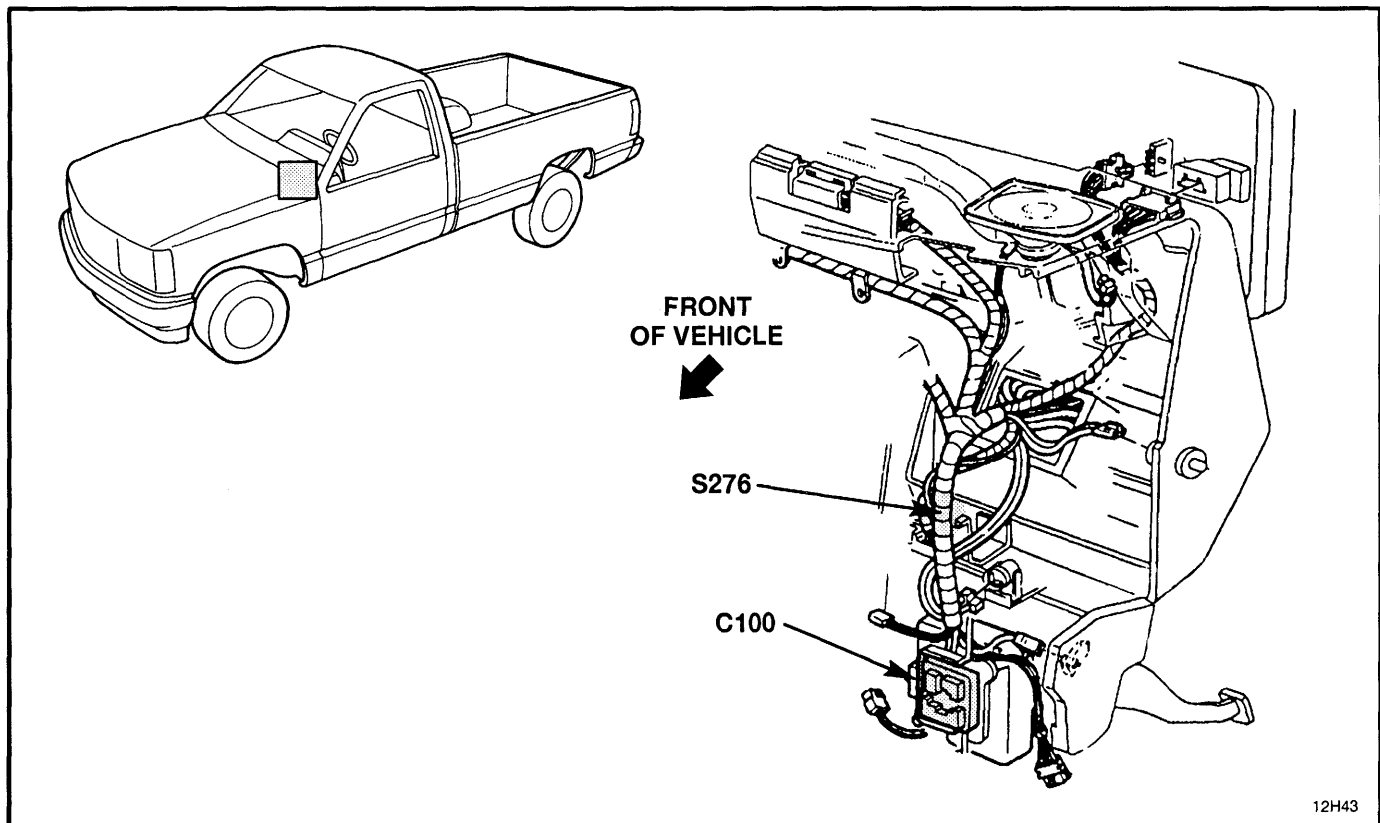


Figure 6 — LH Side of Instrument Panel

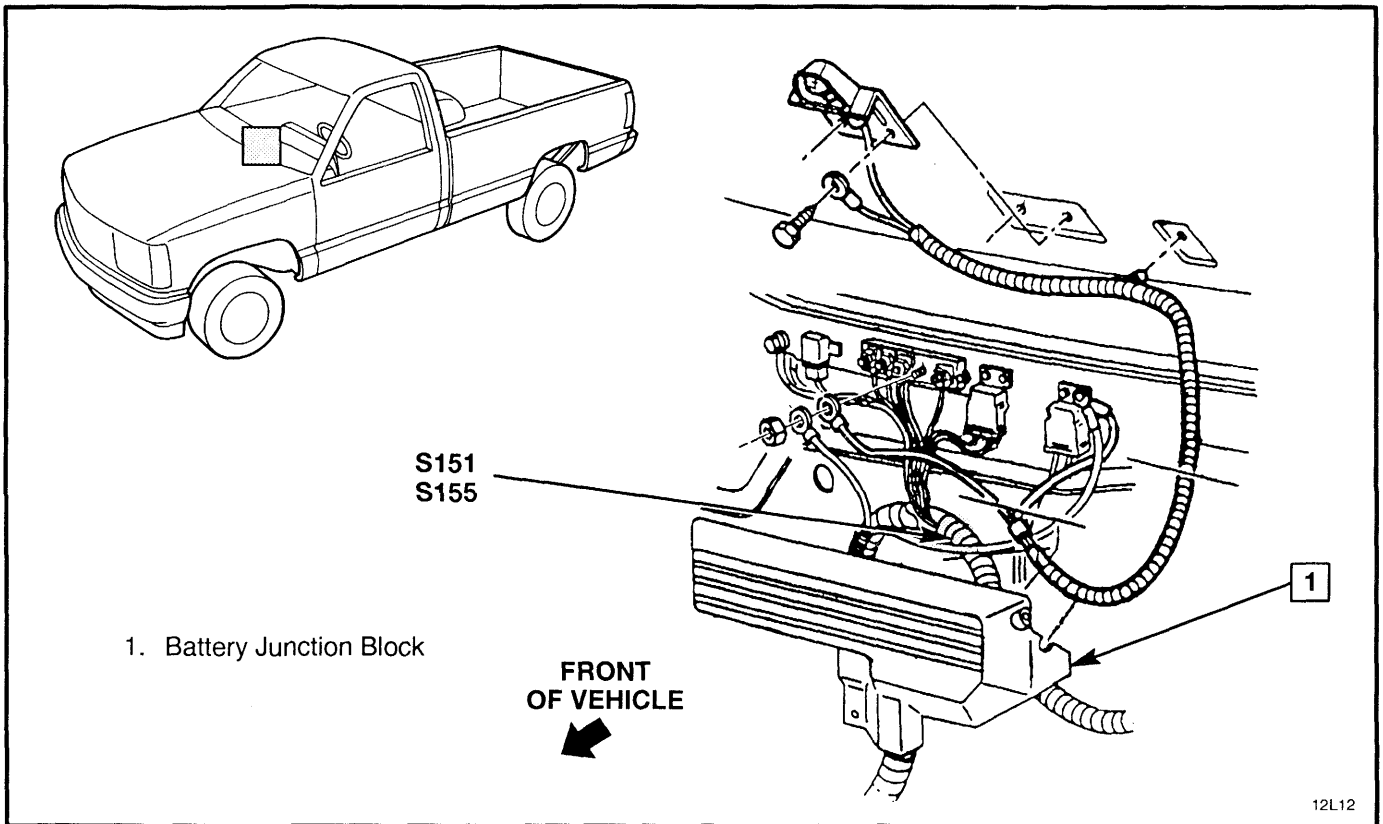


Figure 7 — Underhood Lamp Wiring



**BLANK**

## CIRCUIT OPERATION

Battery voltage is supplied to the Auxiliary Cooling Fan Control Relay by the RED (2) wire at all times and by the PNK/BLK (39) wire when the Ignition Switch is in RUN or START. When the Auxiliary Cooling Fan Control Temperature Switch closes at 107°C (225°F), the A/C high

pressure switch closes or the A/C Controller is activated, circuit 37 is grounded and the Auxiliary Cooling Fan Control Relay energizes. Battery voltage is supplied across the Auxiliary Cooling Fan Control Motor and the Auxiliary Cooling Fan operates.

## COMPONENT LOCATION

### Page — Figure

|                                          |                                     |           |   |
|------------------------------------------|-------------------------------------|-----------|---|
| A/C High Pressure Switch                 | RH front engine compartment         | 31-6      | 2 |
| Auxiliary Cooling Fan                    | In front of radiator                | 31-8      | 4 |
| Auxiliary Cooling Fan Relay              | LH rear side of engine compartment  | Not Shown |   |
| Auxiliary Cooling Fan Temperature Switch | RH cylinder head                    | 31-10     | 8 |
| Battery Junction Block                   | RH rear engine compartment, at cowl | 31-9      | 6 |
| Fuse Block                               | Lower LH side of I/P                | 31-7      | 3 |

## CONNECTORS:

|      |                                                     |           |   |
|------|-----------------------------------------------------|-----------|---|
| C100 | At bulkhead connector                               | Not Shown |   |
| C138 | LH rear engine compartment, near bulkhead connector | 31-10     | 8 |
| C260 | Near A/C blower motor case                          | 31-9      | 7 |

## DIODES:

|      |                                                                 |           |  |
|------|-----------------------------------------------------------------|-----------|--|
| D190 | Engine harness, rear of engine compartment, near junction block | Not Shown |  |
|------|-----------------------------------------------------------------|-----------|--|

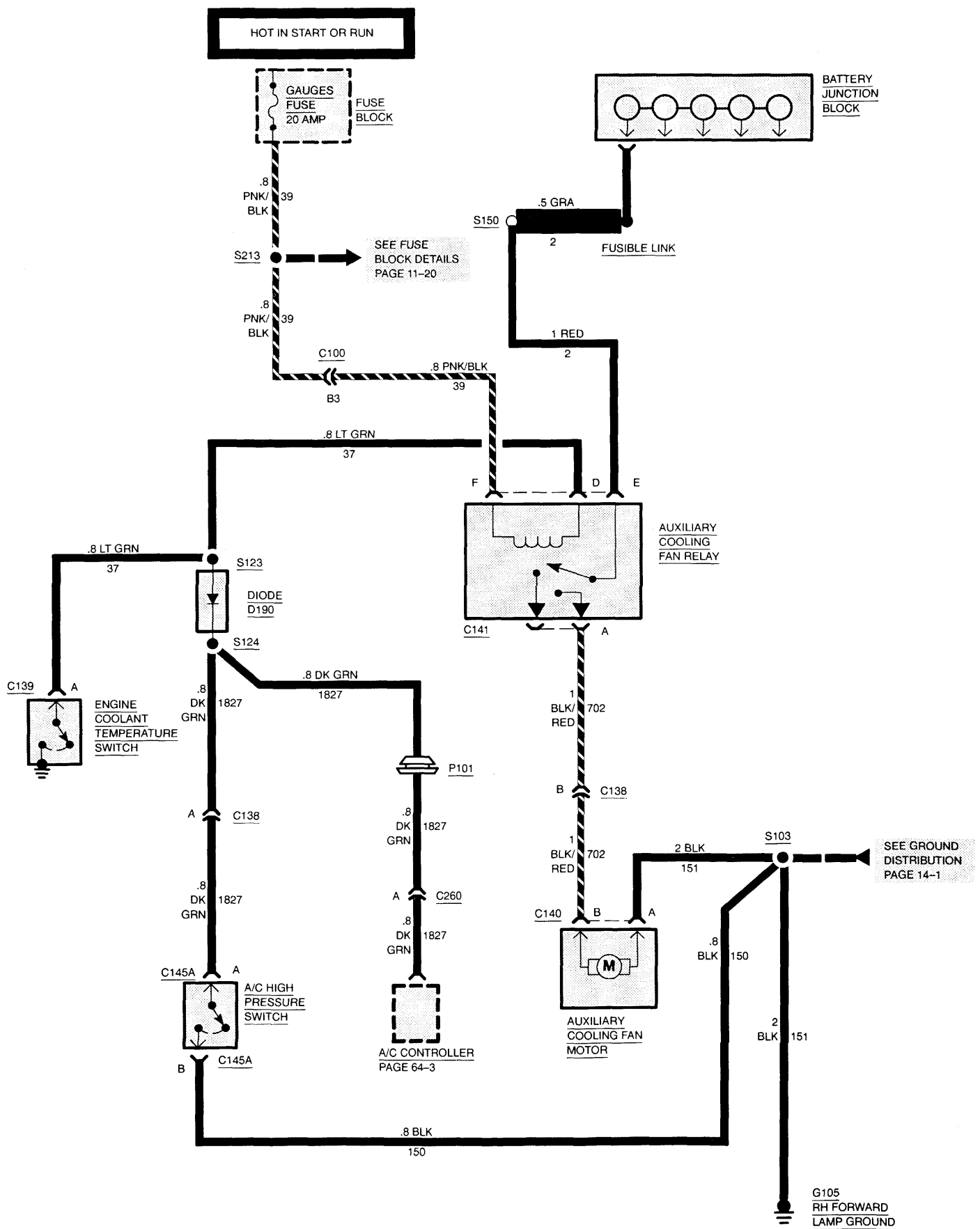
## GROUNDING:

|      |                               |           |  |
|------|-------------------------------|-----------|--|
| G105 | RH inner fender, near battery | Not Shown |  |
|------|-------------------------------|-----------|--|

## SPLICES:

|      |                                                 |           |   |
|------|-------------------------------------------------|-----------|---|
| S103 | RH side of engine compartment, near headlamp    | 31-8      | 5 |
| S123 | Rear of engine compartment, near junction block | Not Shown |   |
| S124 | Rear of engine compartment, near junction block | Not Shown |   |
| S150 | Center of cowl, below battery junction block    | 31-6      | 1 |
| S213 | Under LH side of I/P                            | 31-7      | 3 |

## 8A-31-2 AUXILIARY COOLING FAN



**DIAGNOSIS — AUXILIARY COOLING FAN**

**PRELIMINARY CHECKS:**

1. Check condition of GAUGES Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

**AUXILIARY COOLING FAN RUNS CONTINUOUSLY**

| TEST                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and with engine coolant temperature below 107°C (225°F), disconnect auxiliary cooling fan control temperature switch connector C139.     | Cooling fan runs.         | GO to step 2.                                                                                                                                                   |
|                                                                                                                                                                                   | Cooling fan does not run. | REPLACE cooling auxiliary cooling fan control temperature switch.                                                                                               |
| 2. Disconnect auxiliary cooling fan control relay connector C141. Connect test lamp from PNK/BLK (39) to LT GRN (37) wires at auxiliary cooling fan control relay connector C141. | Test lamp lights.         | CHECK for short in LT GRN (37) wire from auxiliary cooling fan control relay connector C141 to auxiliary cooling fan control temperature switch connector C139. |
|                                                                                                                                                                                   | Test lamp does not light. | REPLACE auxiliary cooling fan control relay.                                                                                                                    |

**AUXILIARY COOLING FAN DOES NOT OPERATE**

| TEST                                                                                                                                                                                                                                            | RESULT                    | ACTION                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect auxiliary cooling fan control temperature switch connector C139. Connect fused jumper from LT GRN (37) wire at auxiliary cooling fan control temperature switch connector C140 to ground.                                         | Cooling fan does not run. | GO to step 2.                                                                                                                                         |
|                                                                                                                                                                                                                                                 | Cooling fan runs.         | REPLACE auxiliary cooling fan control temperature switch.                                                                                             |
| 2. Disconnect auxiliary cooling fan control relay connector C141. Connect test lamp from PNK/BLK (39) wire at auxiliary cooling fan control relay connector C141 to ground.                                                                     | Test lamp lights.         | GO to step 3.                                                                                                                                         |
|                                                                                                                                                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire from auxiliary cooling fan control relay connector C141 to splice S115 or from splice S115 to fuse block. |
| 3. Connect fused jumper from LT GRN (37) wire at auxiliary cooling fan control temperature switch connector C139 to ground. Connect test lamp from PNK/BLK (39) wire to LT GRN (37) wire at auxiliary cooling fan control relay connector C141. | Test lamp lights.         | GO to step 4.                                                                                                                                         |
|                                                                                                                                                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in LT GRN (37) wire between fan control temperature switch connector C139 and fan control relay connector C141.                |

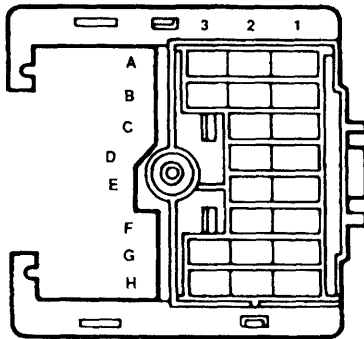
## 8A-31-4 AUXILIARY COOLING FAN

### AUXILIARY COOLING FAN DOES NOT OPERATE (CONTINUED)

| TEST                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 4. Connect test lamp from RED (2) wire at auxiliary cooling fan control relay connector C141 to ground.                                                                           | Test lamp lights.         | GO to step 5.                                                                                                                                 |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between auxiliary cooling fan control relay connector C141 and battery junction block.                 |
| 5. Connect 30 amp, fused jumper from RED (2) wire to BLK/RED (702) at the auxiliary cooling fan control relay connector C141.                                                     | Cooling fan does not run. | GO to step 6.                                                                                                                                 |
|                                                                                                                                                                                   | Cooling fan runs.         | REPLACE auxiliary cooling fan control relay.                                                                                                  |
| 6. Leave 30 amp, fused jumper connected. Disconnect auxiliary cooling fan connector C140. Connect test lamp from BLK/RED (702) at auxiliary cooling fan connector C140 to ground. | Test lamp lights.         | GO to step 7.                                                                                                                                 |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in BLK/RED (702) wire from auxiliary cooling fan connector C140 to auxiliary cooling fan control relay connector C141. |
| 7. Connect test lamp from BLK/RED (702) to BLK (151) wires at auxiliary cooling fan control connector C140.                                                                       | Test lamp lights.         | REPLACE auxiliary cooling fan.                                                                                                                |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire from auxiliary cooling fan connector C140 to ground terminal G105.                                   |

# AUXILIARY COOLING FAN 8A-31-5

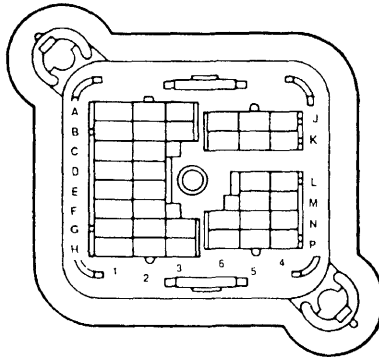
12020183



**GRAY**  
Metri-Pack

**C100**  
Bulkhead Connector – Eng

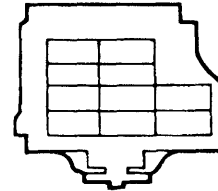
12020184



**GRAY**  
Metri-Pack

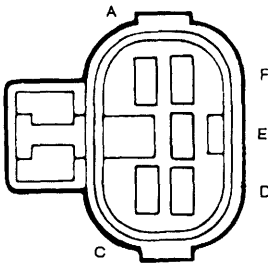
**C100**  
Bulkhead Connector – I/P

12020100



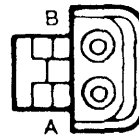
**C102**  
Bulkhead – Forward Lamps

12065169



**MED. GRAY**  
Metri-Pack  
**C141**  
Cooling Fan Relay

12015792



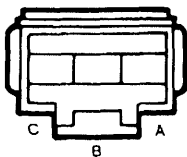
**BLACK**  
Weather Pack  
**C140**  
Cooling Fan

12089501



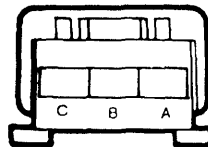
**C131**  
Cooling Fan Temperature Switch

12020398



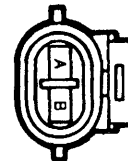
**BLACK**  
Metri-Pack 180  
**C260**  
In-Line I/P to Engine

12020397



**BLACK**  
Metri-Pack 280  
**C260**  
In-Line Engine to I/P

12052643



**RED**  
Metri-Pack 150  
**C145A**  
A/C High Pressure Switch

## 8A-31-6 AUXILIARY COOLING FAN

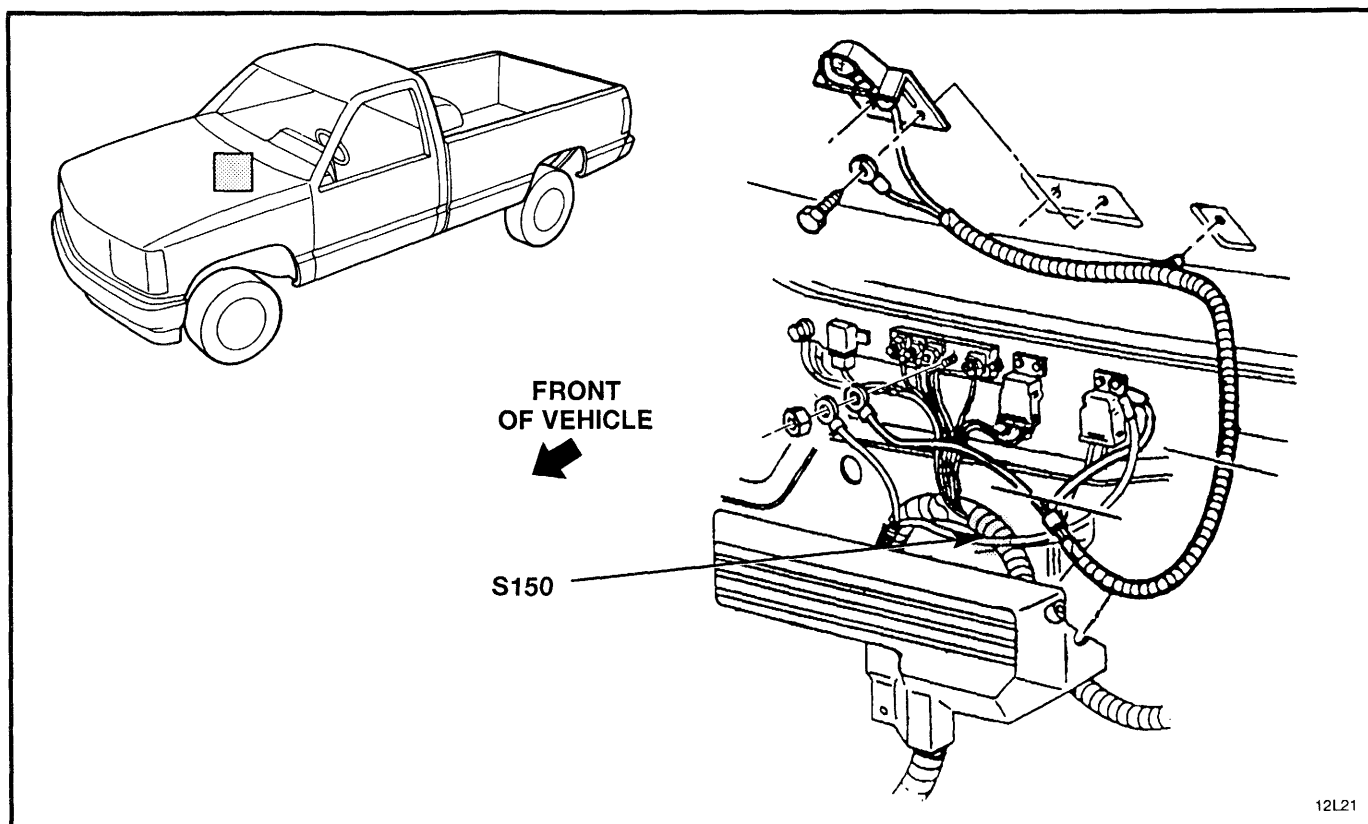


Figure 1 — Battery Junction Block Wiring

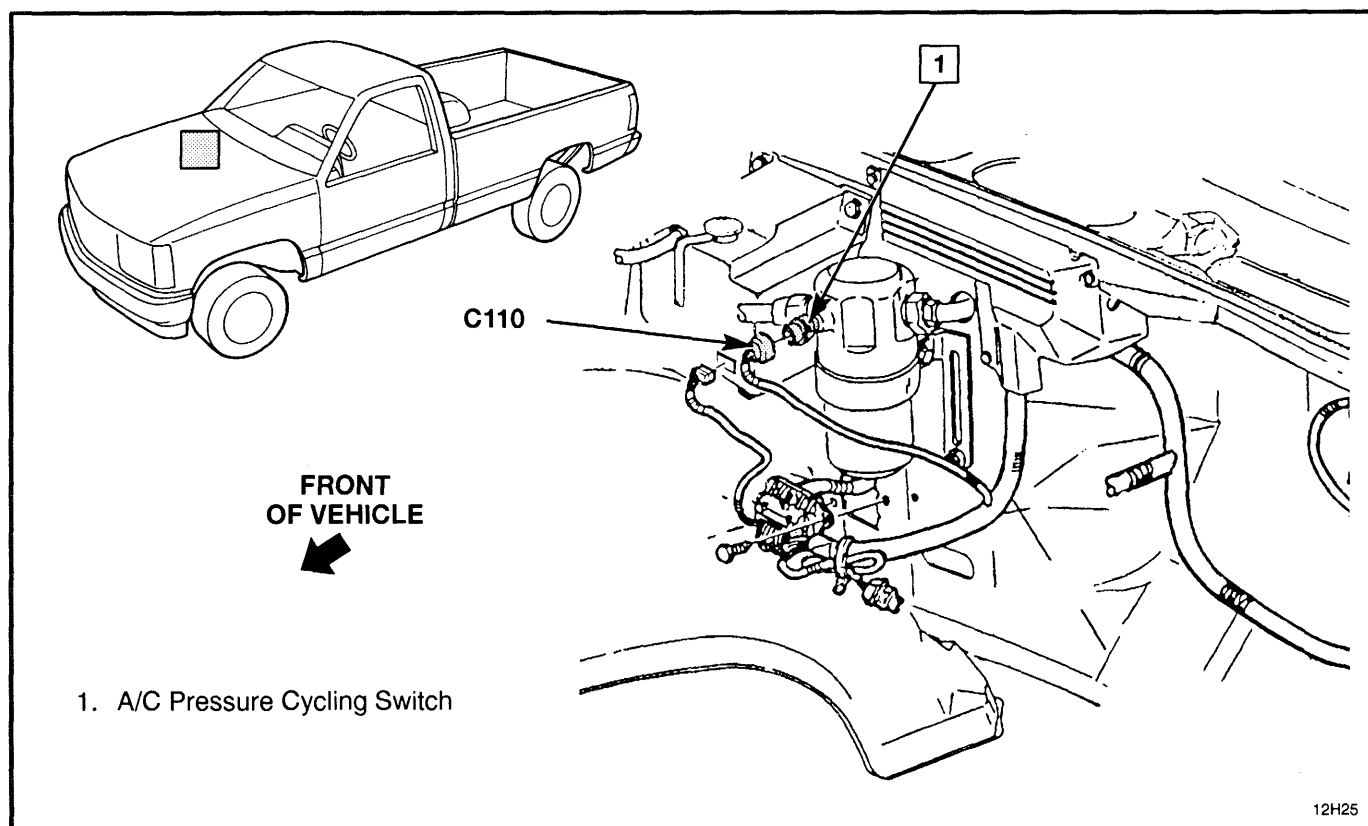


Figure 2 — Cowl Wiring

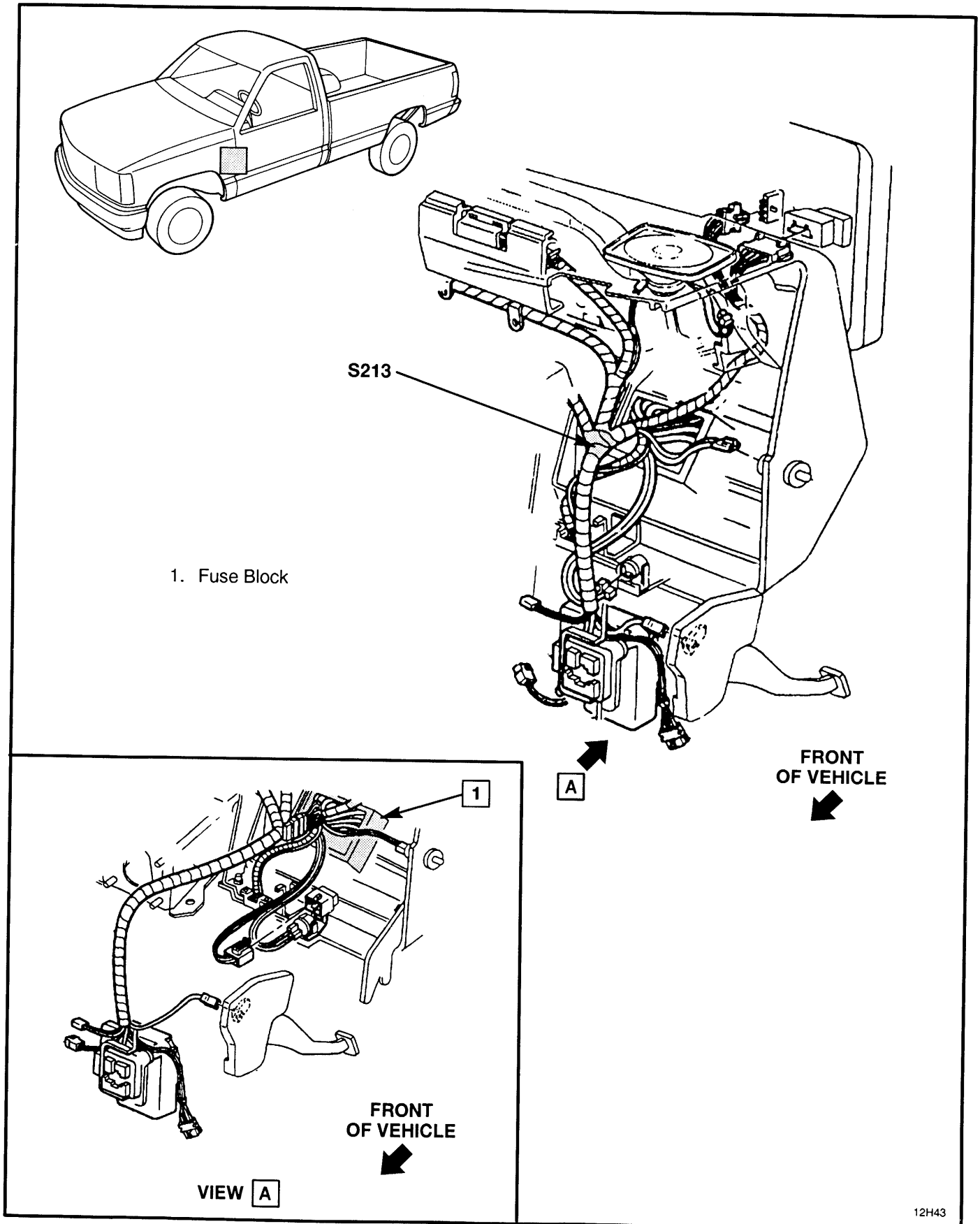


Figure 3 — LH Side of Instrument Panel



## 8A-31-8 AUXILIARY COOLING FAN

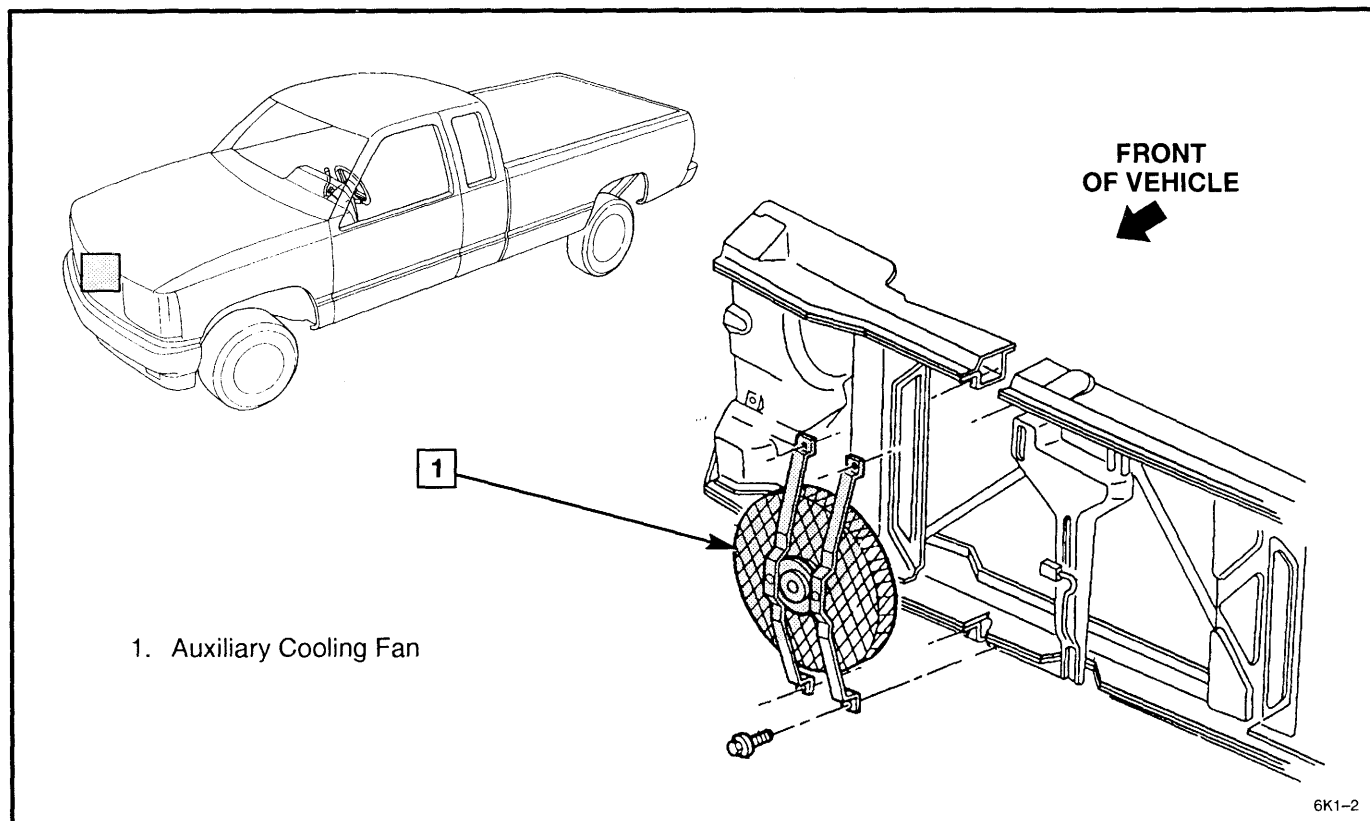


Figure 4 — Auxiliary Cooling Fan

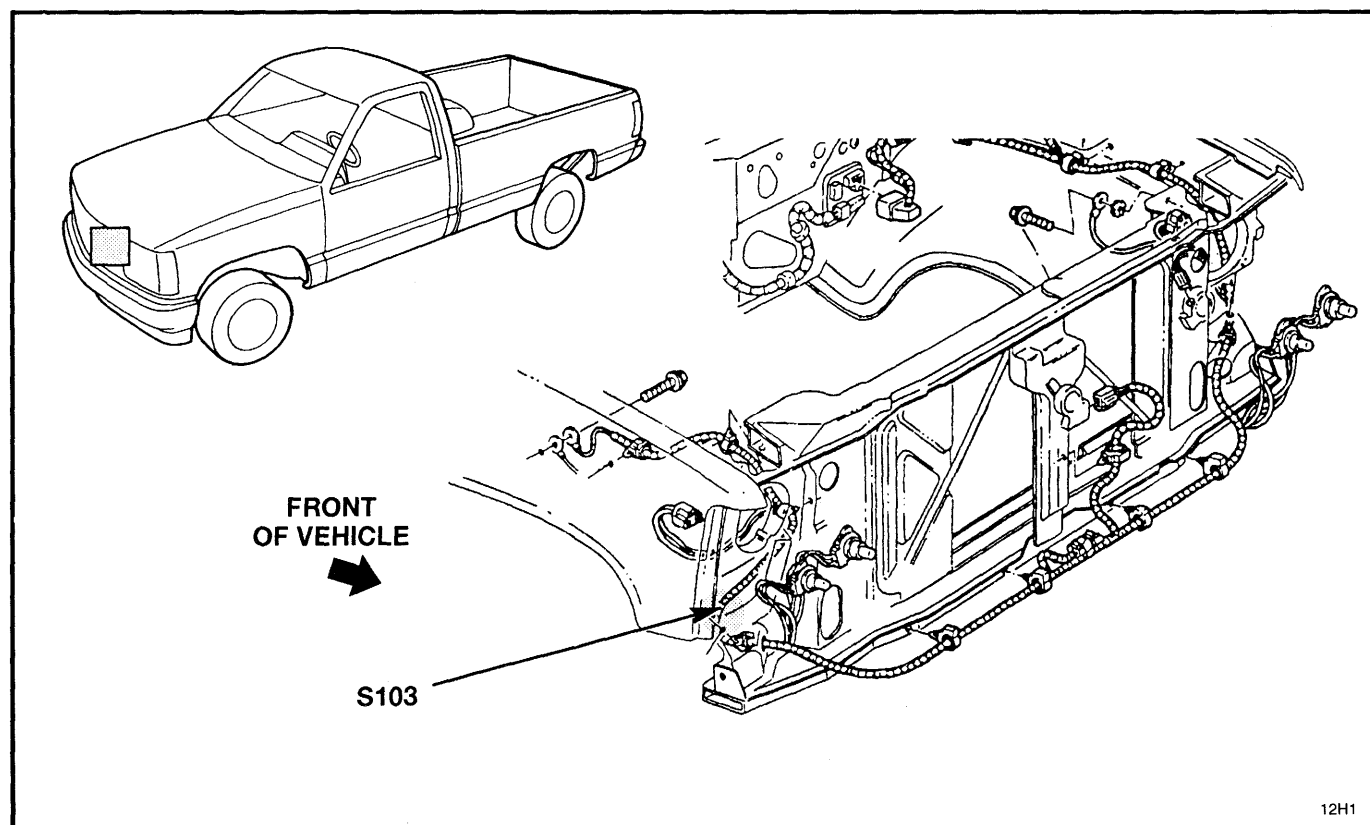


Figure 5 — Forward Lamp Harness, Dual Headlamps — 2 Door Pickup

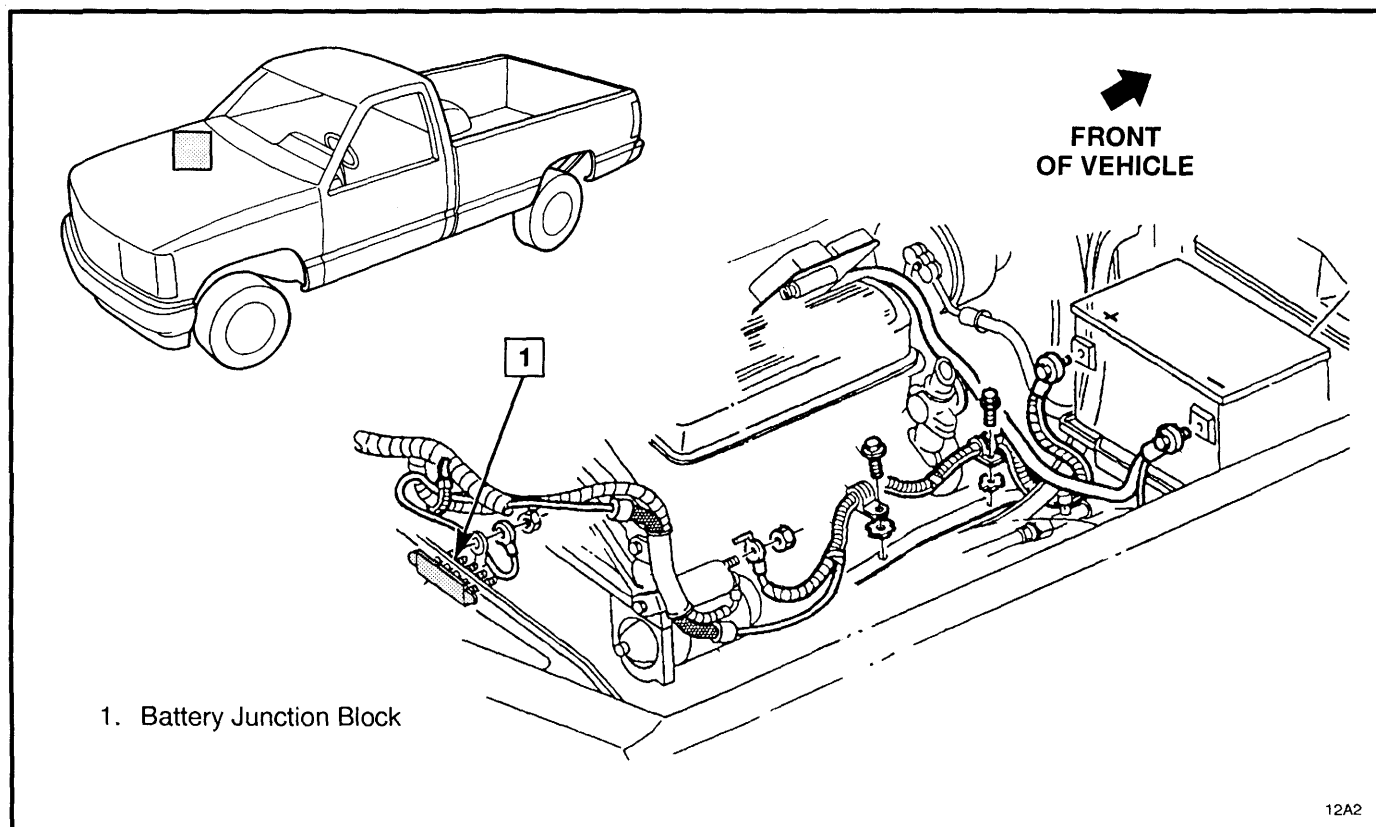


Figure 6 — Battery Wiring, Gasoline Engines

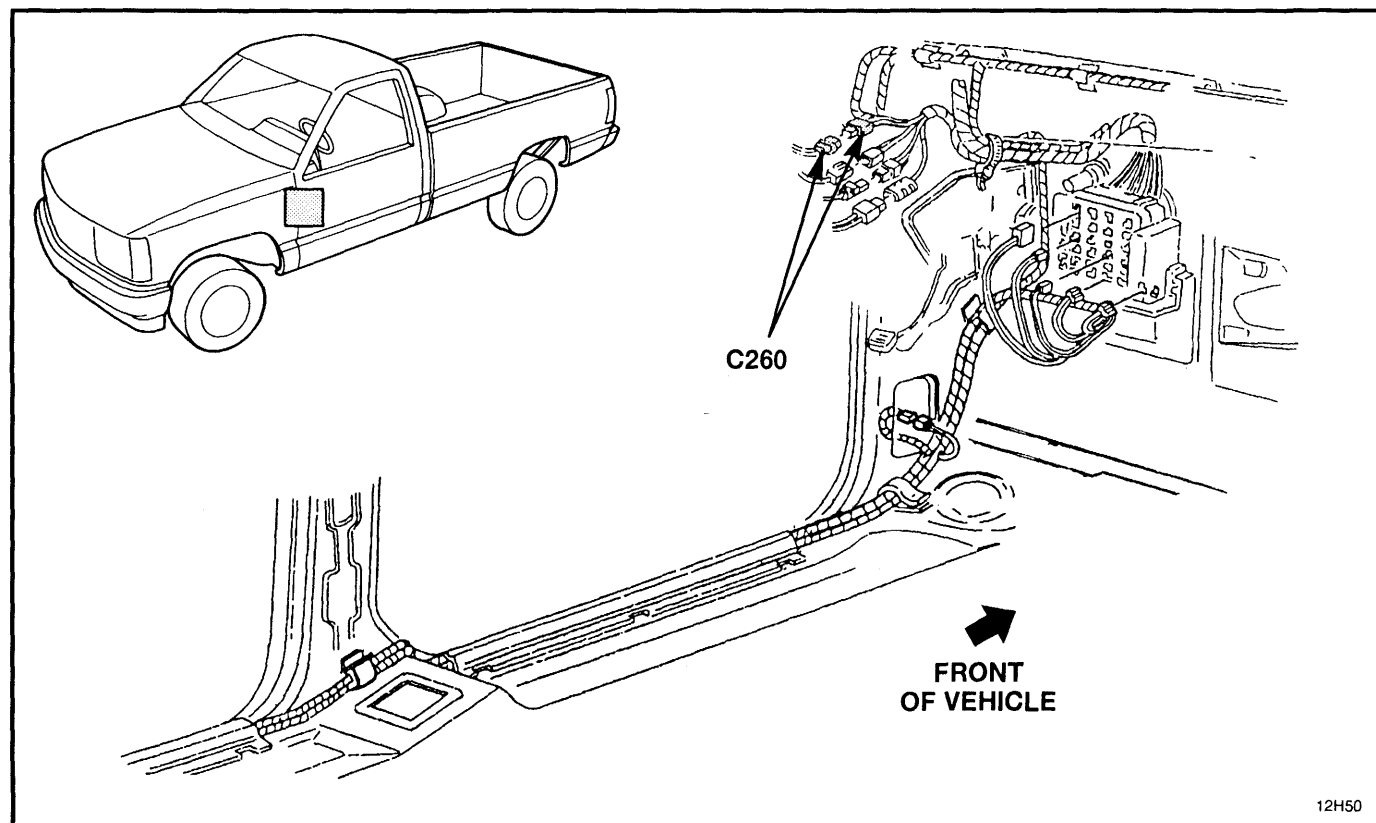


Figure 7 — Body Wiring Harness, Front

## 8A-31-10 AUXILIARY COOLING FAN

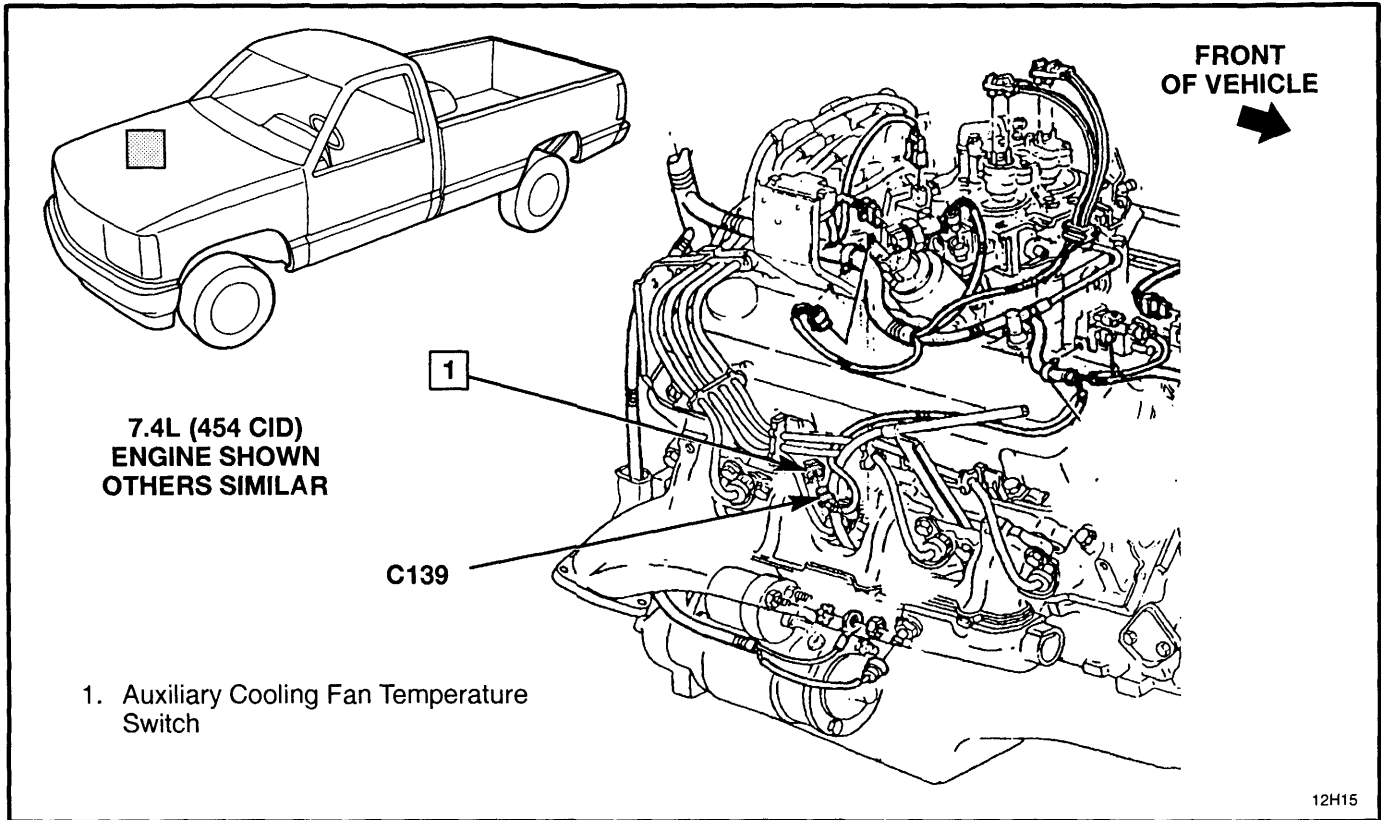


Figure 8 — Auxiliary Cooling Fan Switch

## CIRCUIT OPERATION

The Speedometer/Odometer is electronic and does not require a speedometer cable. The speedometer receives a vehicle speed signal from the Vehicle Speed Sensor Buffer. The Vehicle Speed Sensor Buffer receives an AC voltage signal from the transmission mounted Vehicle Speed Sensor (VSS).

The VSS generates a signal that indicates the speed of the vehicle. The signal is processed by the solid-state Vehicle Speed Sensor Buffer to supply inputs to the Powertrain Control Module (PCM), the Cruise Control Module and the Speedometer.

The VSS is mounted in the transmission. A toothed rotor rotates near a coil, producing voltage pulses in the coil.

The rotor that is attached to the transmission turns four times faster than a standard speedometer cable. The coil near the rotor generates 40 pulses per revolution.

The frequency of the AC voltage coming from this coil depends on the vehicle speed. As the speed increases, so does the number of voltage pulses per second.

The Vehicle Speed Sensor Buffer takes the voltage pulses from the sensor and uses them to close three solid-state output switches. Each output terminal is switched to ground at a rate that is proportional to the speed of the vehicle. The Speedometer is switched by the primary rate of the VSS. The PCM and the Cruise Control use a lower frequency. Their input switches are operated by a circuit that divides the sensor frequency by two.

Different Vehicle Speed Sensor Buffers are used to match the vehicle final drive ratio to the components.

## COMPONENT LOCATION

### Page — Figure

|                             |                              |           |   |
|-----------------------------|------------------------------|-----------|---|
| Convenience Center          | Under LH side of I/P         | 33-12     | 8 |
| Fuse Block                  | Lower LH side of I/P         | 33-8      | 2 |
| Vehicle Speed Sensor (VSS)  | LH rear side of transmission | 33-9      | 4 |
| Vehicle Speed Sensor Buffer | Under RH end of I/P          | Not Shown |   |

## CONNECTORS:

|      |                                         |           |    |
|------|-----------------------------------------|-----------|----|
| C100 | At bulkhead connector                   | Not Shown |    |
| C200 | Under RH side of I/P, near blower motor | 33-13     | 10 |

## GROMMETS:

|      |                                     |       |    |
|------|-------------------------------------|-------|----|
| P101 | RH lower cowl in engine compartment | 33-13 | 10 |
| P102 | LH cowl, above convenience center   | 33-8  | 3  |

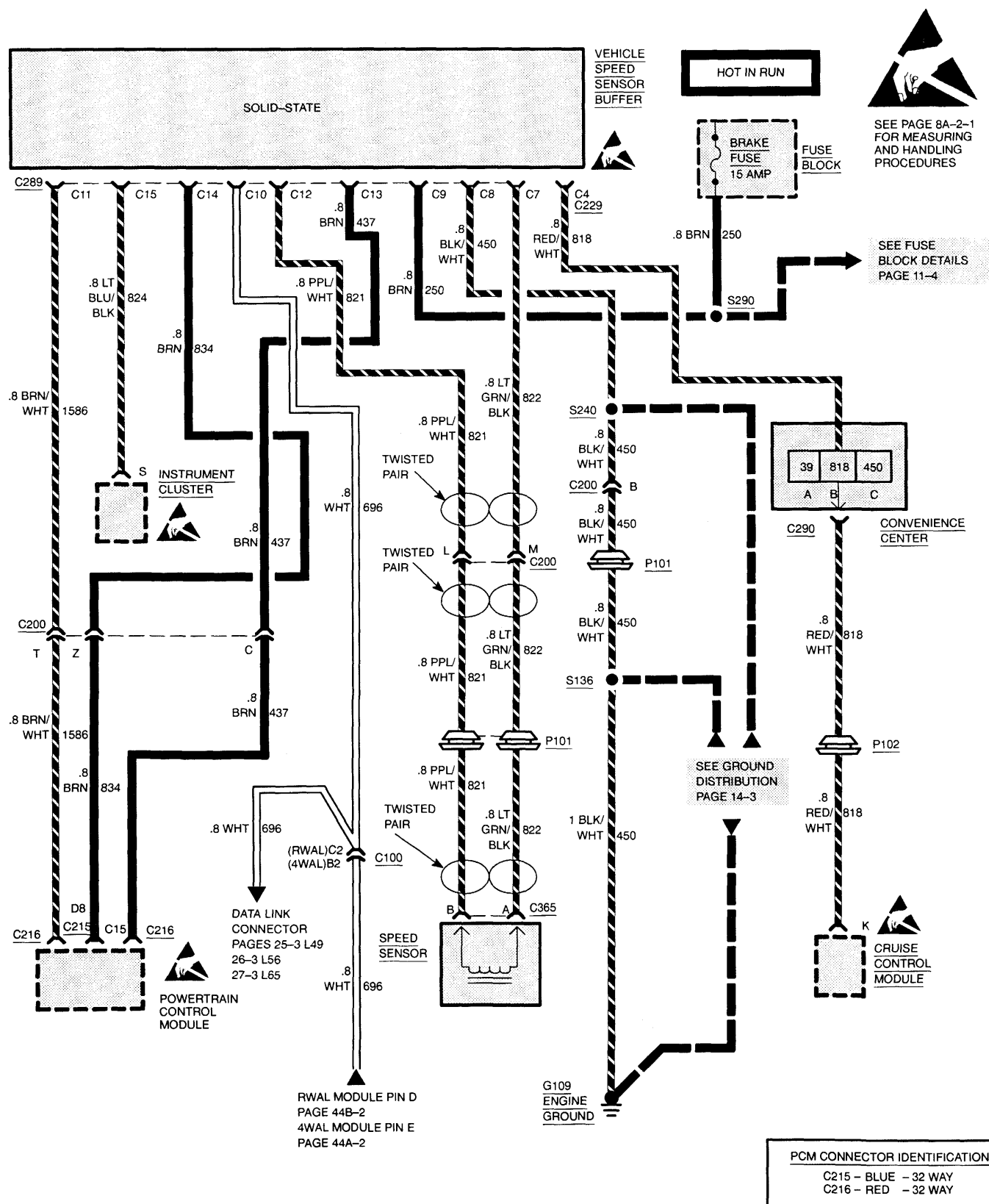
## GROUNDS:

|                 |                            |       |   |
|-----------------|----------------------------|-------|---|
| G109 (Gasoline) | Top front center of engine | 33-10 | 6 |
| G109 (Diesel)   | Rear of RH cylinder head   | 33-9  | 5 |

## SPLICES:

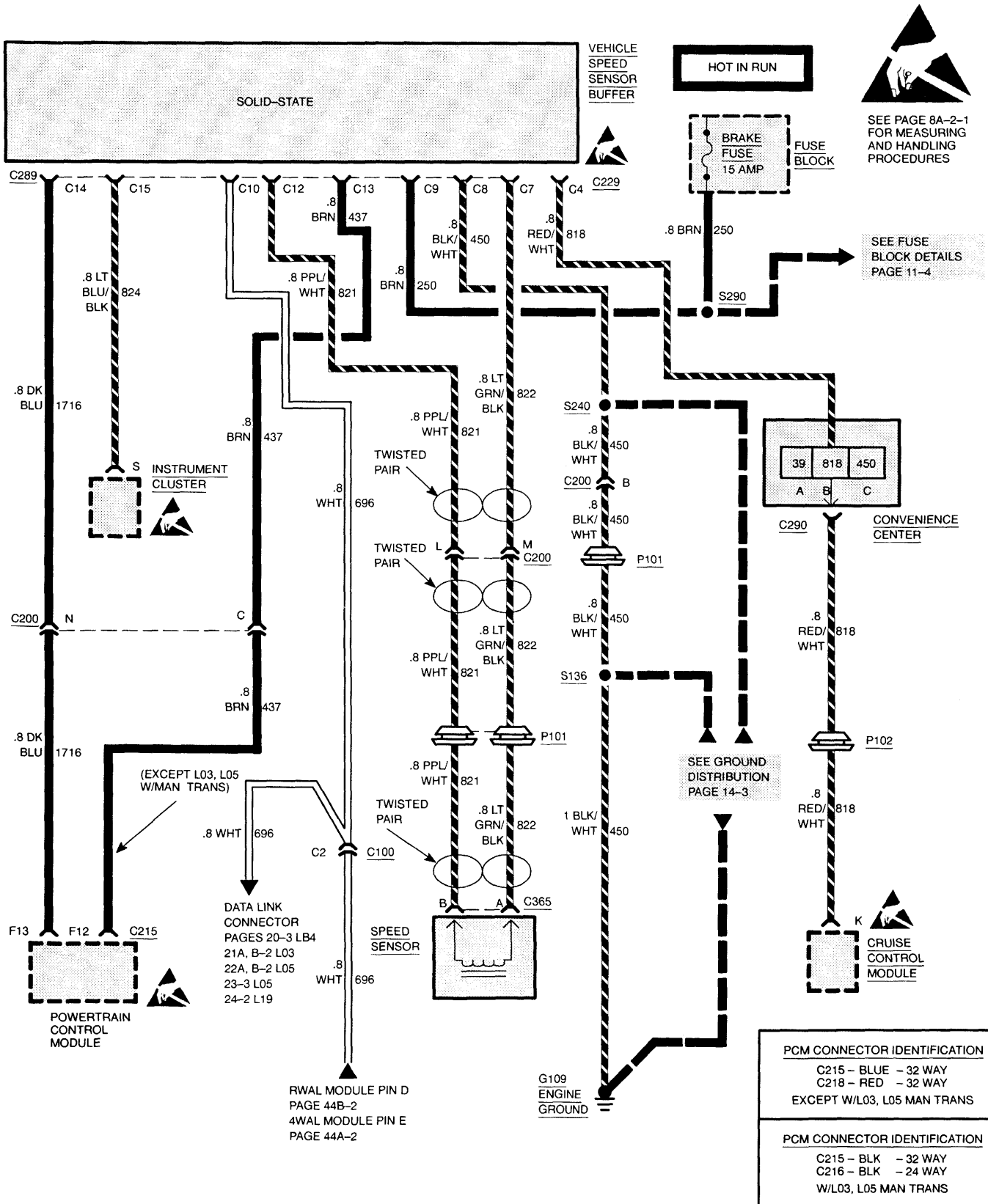
|      |                                         |       |   |
|------|-----------------------------------------|-------|---|
| S136 | Rear of engine compartment, near center | 33-11 | 7 |
| S240 | Behind LH side of I/P                   | 33-7  | 1 |
| S290 | Under LH side of I/P                    | 33-13 | 9 |

## DIESEL ENGINES



# VEHICLE SPEED SENSOR BUFFER 8A-33-3

## GASOLINE ENGINES



## 8A-33-4 VEHICLE SPEED SENSOR BUFFER

### DIAGNOSIS — VEHICLE SPEED SENSOR

#### PRELIMINARY CHECKS:

1. Check condition of BRAKE Fuse. If fuse is blown, locate and repair source of overload.
2. Replace fuse.

**CAUTION: THE FOLLOWING TEST REQUIRES THAT YOU FREE-ROLL THE REAR WHEELS OF THE VEHICLE ON THE HOIST. BE SURE THE WHEELS ARE FREE OF OBSTRUCTIONS AND THAT YOU AND OTHERS STAY CLEAR OF THE WHEELS AT ALL TIMES. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH. DO NOT BRING WHEEL SPEED ABOVE 70 MPH.**

#### SPEEDOMETER AND ODOMETERS DO NOT OPERATE

| TEST                                                                                                                                                                                                                              | RESULT            | ACTION                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Raise vehicle on hoist. Disconnect speed sensor connector C365. Connect AC voltmeter across speed sensor terminals while rolling wheels in high gear.                                                                          | Battery voltage.  | GO to step 2.                                                                                                                                         |
|                                                                                                                                                                                                                                   | No voltage.       | REPLACE VSS.                                                                                                                                          |
| 2. Connect AC voltmeter, check for voltage across PPL/WHT (821) and LT GRN/BLK (822) wires at vehicle speed sensor buffer connector C289.<br>NOTE: Wheels must be rolling in high gear.                                           | Battery voltage.  | GO to step 3.                                                                                                                                         |
|                                                                                                                                                                                                                                   | No voltage.       | LOCATE and REPAIR open in PPL/WHT (821) and/or LT GRN/BLK (822) wires from speed sensor connector C365 to vehicle speed sensor buffer connector C289. |
| 3. Disconnect I/P connector C203 and the connector from the vehicle speed sensor buffer C289. Connect ohmmeter from LT BLU/BLK (824) at cluster connector C203 to LT BLU/BLK (824) at vehicle speed sensor buffer connector C289. | More than 0 ohms. | LOCATE and REPAIR open in LT BLU/BLK (824) wire between I/P connector C203 and vehicle speed sensor buffer connector C289.                            |
|                                                                                                                                                                                                                                   | 0 ohms.           | REFER to vehicle speed sensor buffer diagnosis in Section 8C of the 1994 C/K Service Manual.                                                          |

#### CRUISE CONTROL DOES NOT OPERATE PROPERLY

| TEST                                                                                                                                                                                               | RESULT           | ACTION                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and disconnect Vehicle Speed Sensor Buffer connector C289. Connect voltmeter from BRN (250) wire at Vehicle Speed Sensor Buffer connector C289 to ground. | Battery voltage. | GO to step 2.                                                                                                |
|                                                                                                                                                                                                    | No voltage.      | LOCATE and REPAIR open in BRN (250) wire.                                                                    |
| 2. Connect voltmeter from BRN (250) wire to BLK/WHT (450) wire at Vehicle Speed Sensor Buffer connector C289.                                                                                      | Battery voltage. | GO to step 3.                                                                                                |
|                                                                                                                                                                                                    | No voltage.      | LOCATE and REPAIR open in BLK/WHT (450) wire from Vehicle Speed Sensor Buffer connector C289 to ground G109. |

## VEHICLE SPEED SENSOR BUFFER 8A-33-5

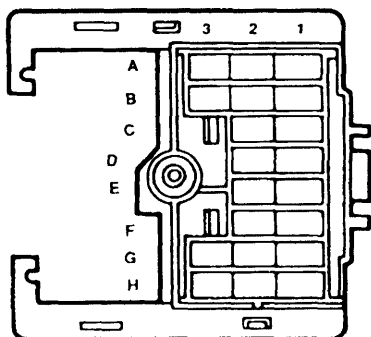
### CRUISE CONTROL DOES NOT OPERATE PROPERLY (CONTINUED)

| TEST                                                                                                                                                                                                                             | RESULT               | ACTION                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3. Properly support vehicle so drive wheels are off the ground. Have engine running and gear selector in DRIVE. Connect A/C voltmeter from PPL/WHT (821) wire to LT GRN/BLK (822) at Vehicle Speed Sensor Buffer connector C289. | A/C voltage reading. | GO to step 4.                                                                                                                         |
|                                                                                                                                                                                                                                  | No voltage.          | CHECK for open in PPL/WHT (821) and LT GRN/BLK (822) wires. If wires are good, REPLACE speed sensor.                                  |
| 4. Connect Vehicle Speed Sensor Buffer connector C289. Connect A/C voltmeter from RED/WHT (818) wire at Vehicle Speed Sensor Buffer connector C279 to BLK/WHT (450) wire at Vehicle Speed Sensor Buffer connector C289.          | A/C voltage reading. | LOCATE and REPAIR open in RED/WHT (818) wire from Vehicle Speed Sensor Buffer connector C279 to cruise control module connector C178. |
|                                                                                                                                                                                                                                  | No voltage.          | REPLACE Vehicle Speed Sensor Buffer.                                                                                                  |



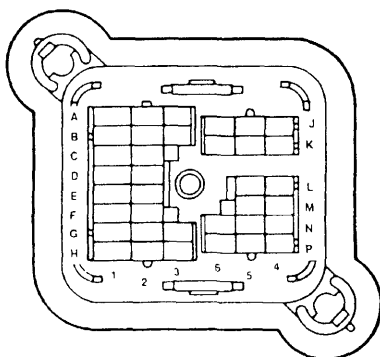
# 8A-33-6 VEHICLE SPEED SENSOR BUFFER

12020183



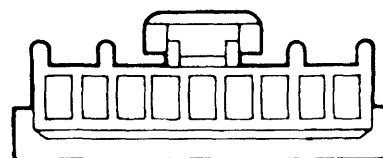
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



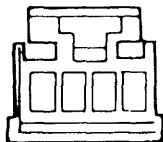
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12066130



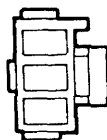
**NATURAL**  
Micro-Pack 100  
**C229**  
Vehicle Speed Sensor Buffer

12066189



**NATURAL**  
Micro-Pack 100  
**C289**  
Vehicle Speed Sensor Buffer

12033698



**C290**  
Cruise Control Connector to  
Convenience Center

12020600



**BLACK**  
Metri-Pack 280  
**C365**  
Vehicle Speed Sensor

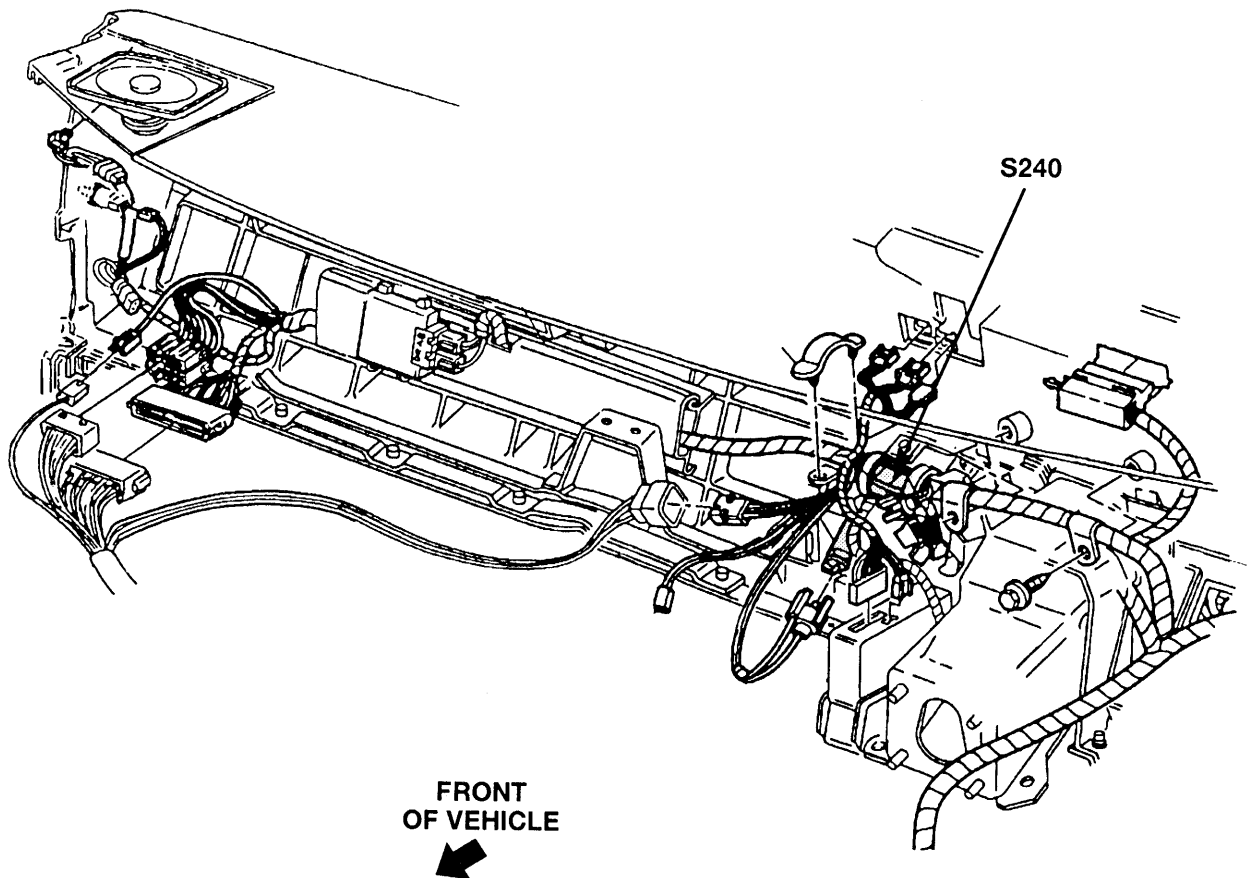
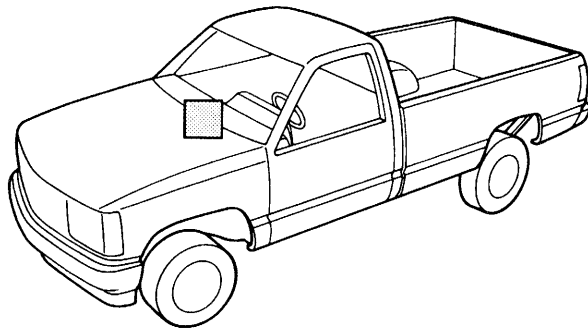


Figure 1 — Instrument Panel Wiring, RH Side

## 8A-33-8 VEHICLE SPEED SENSOR BUFFER

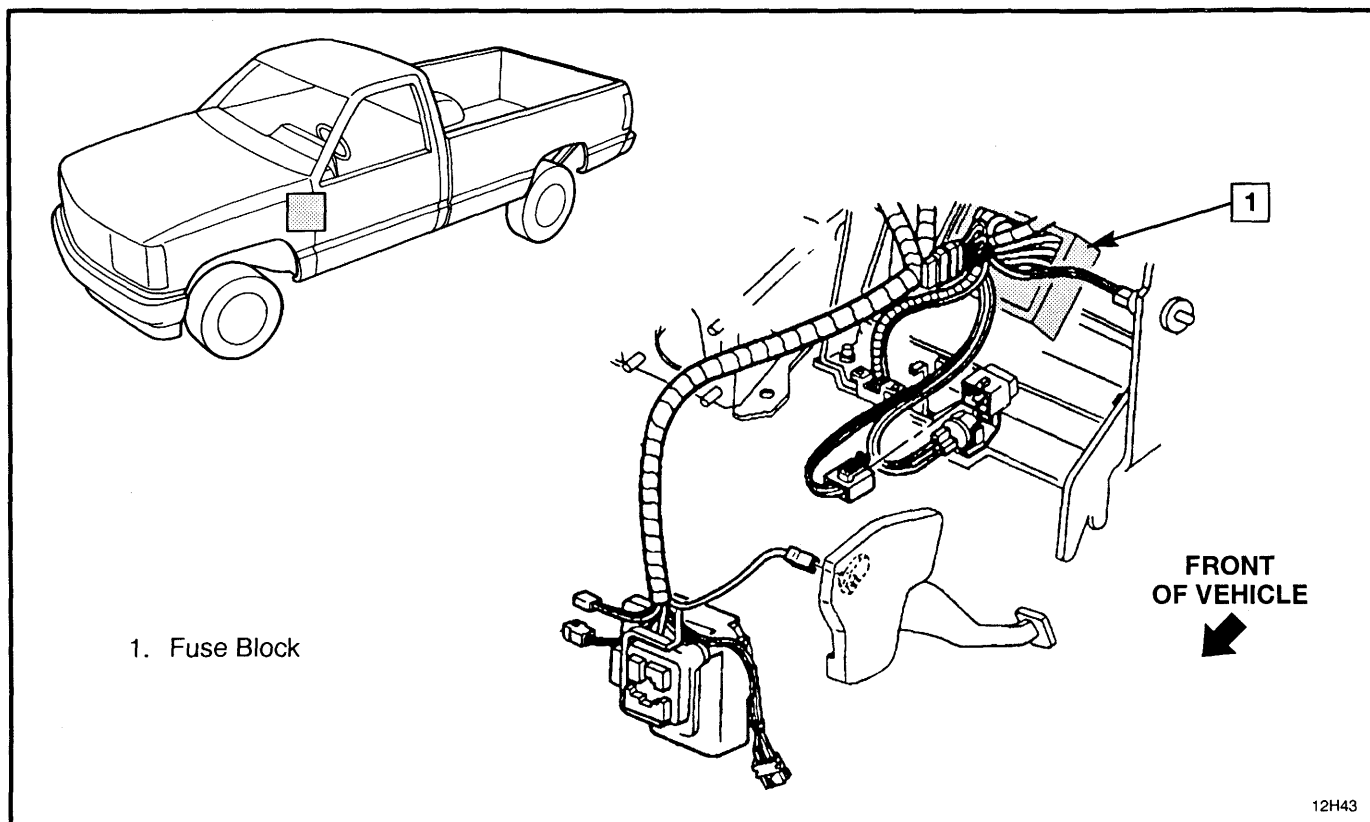


Figure 2 — Instrument Panel Wiring, LH Side

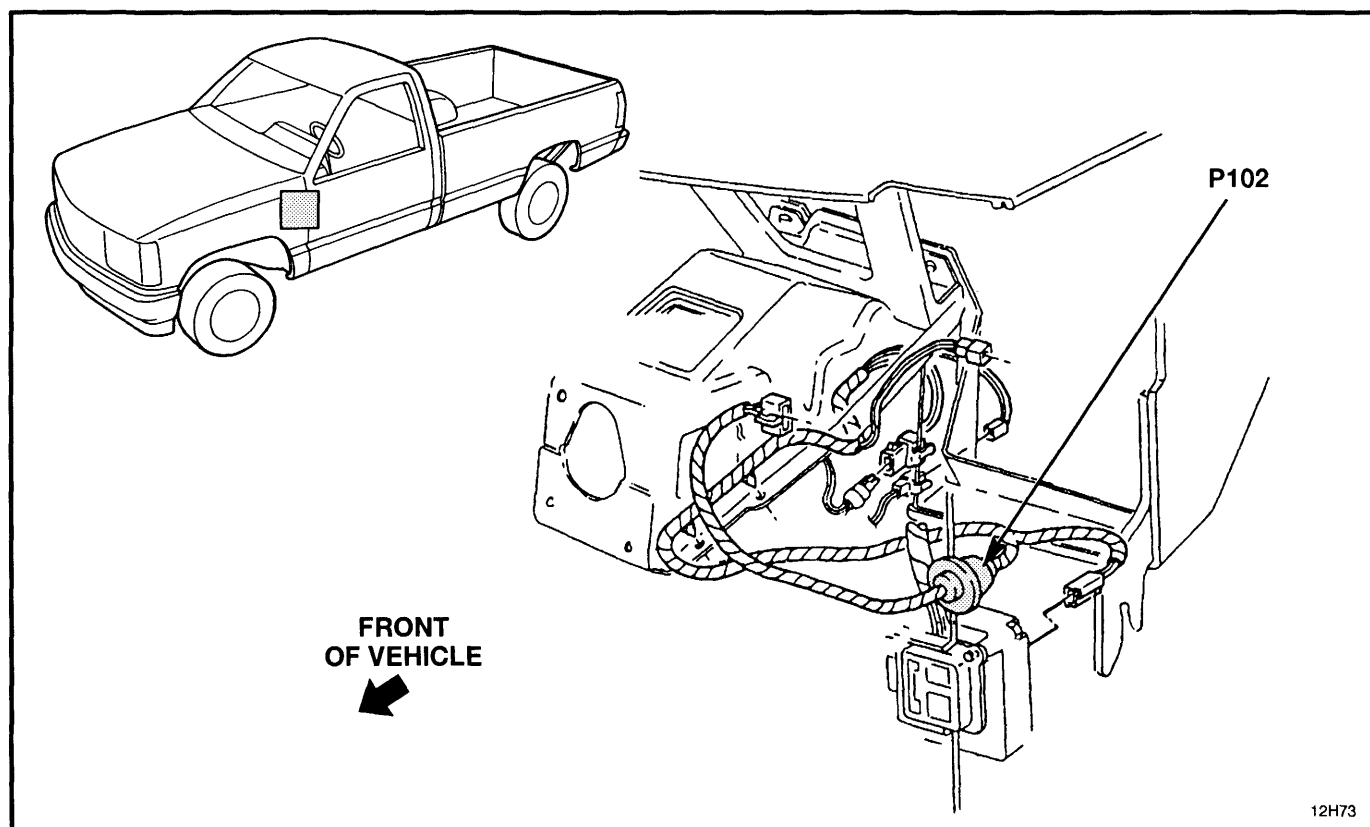


Figure 3 — Cruise Control Wiring

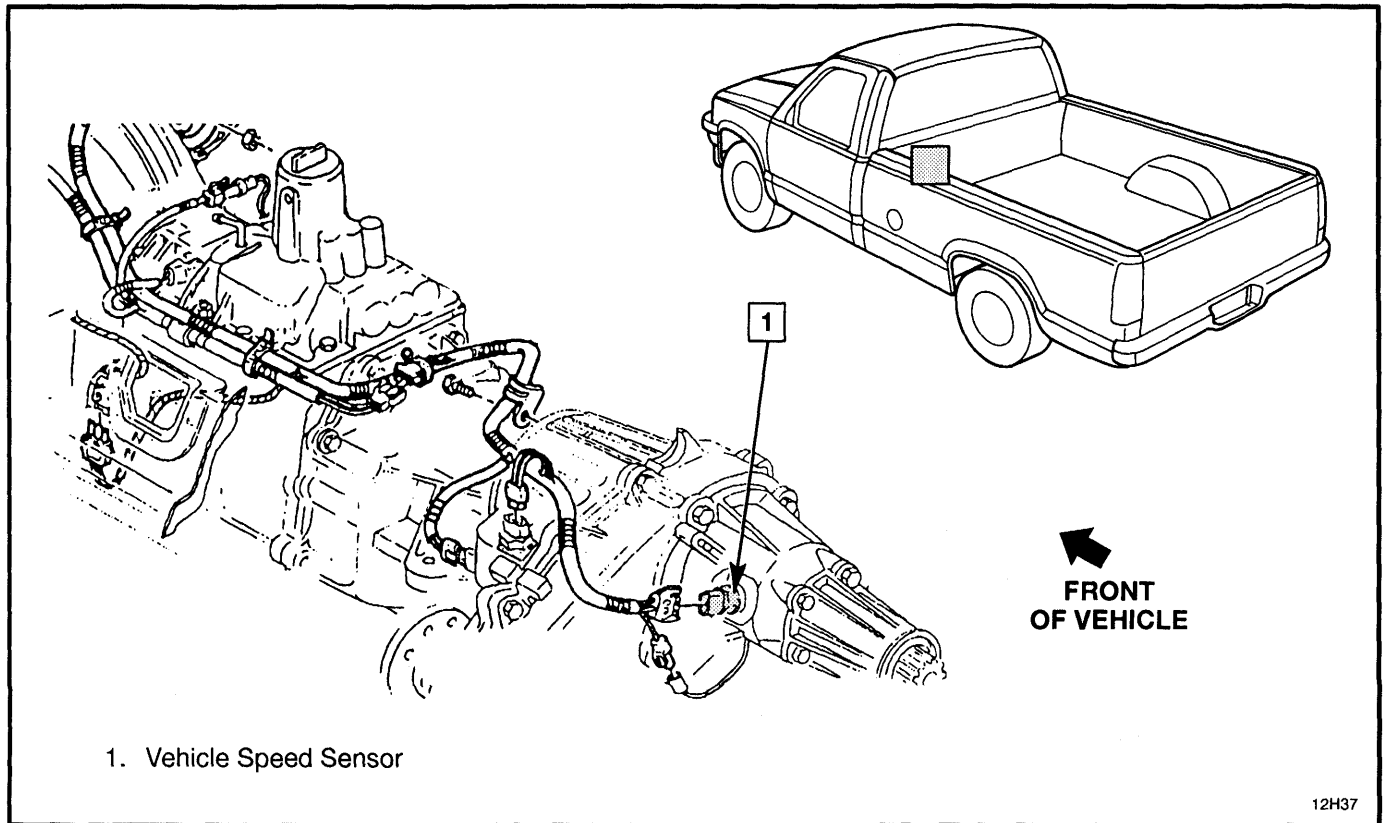


Figure 4 — Transmission Wiring, 5-Speed W/Overdrive

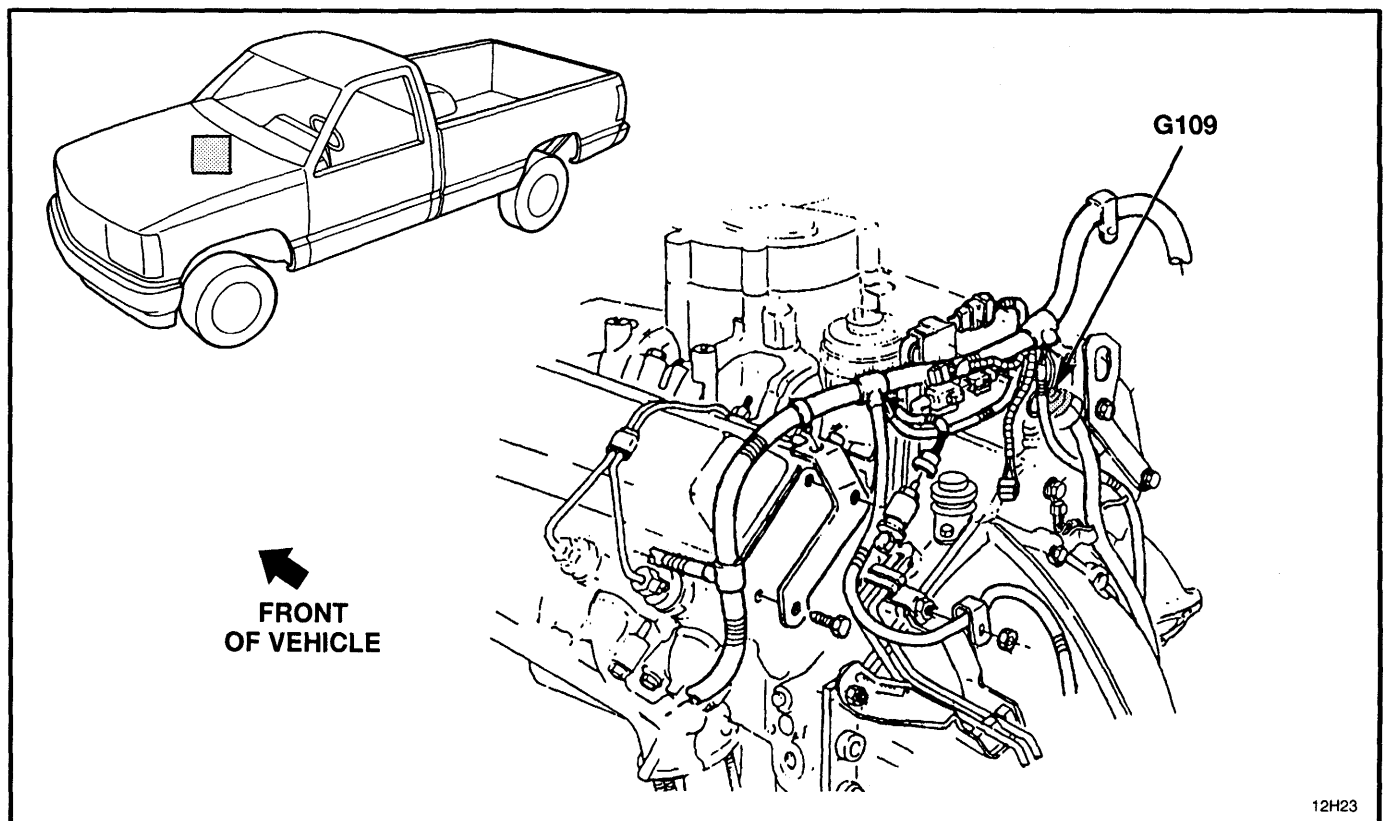


Figure 5 — Engine Wiring, Rear W/6.2L HD VIN J and 6.5L Turbo VIN F

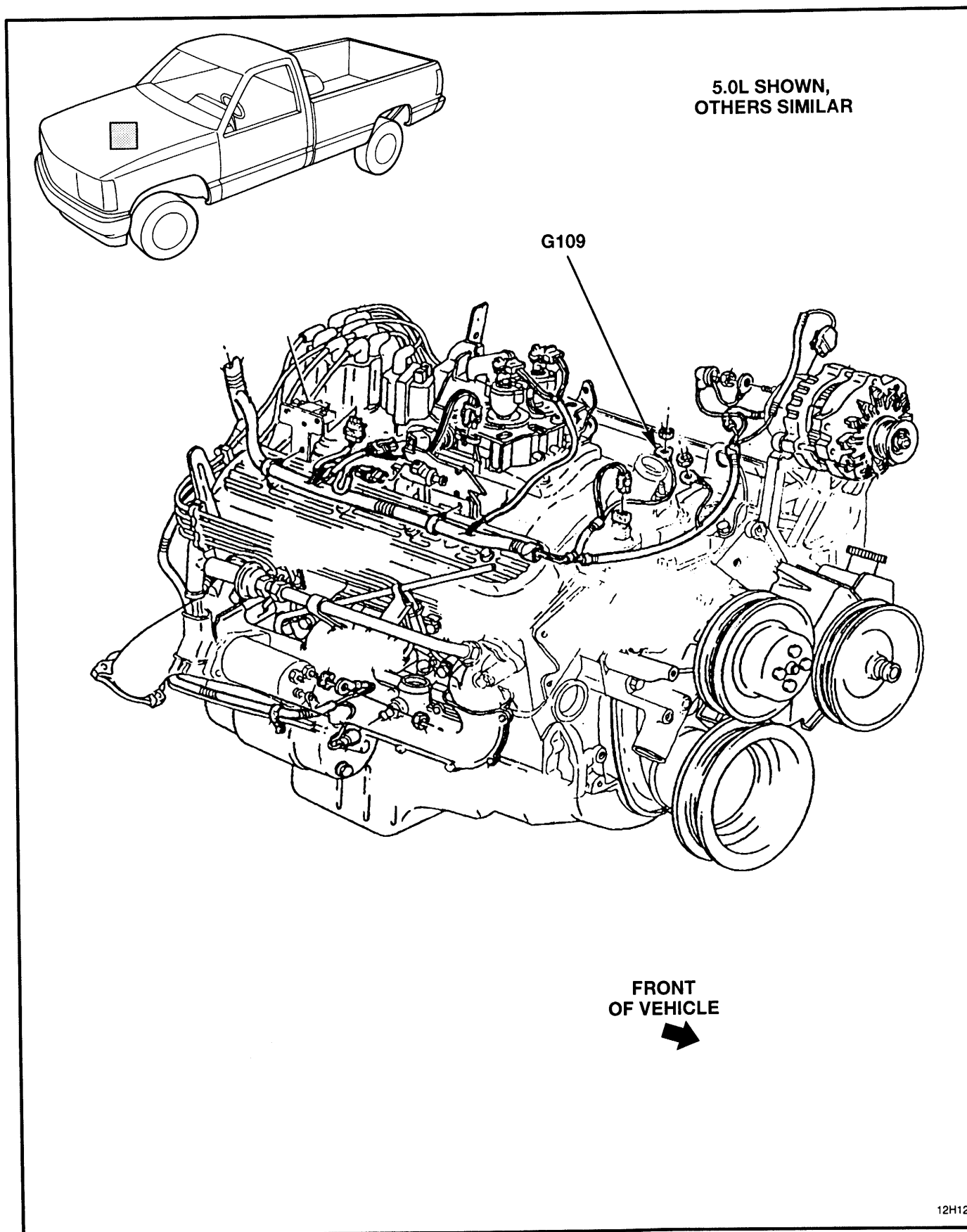
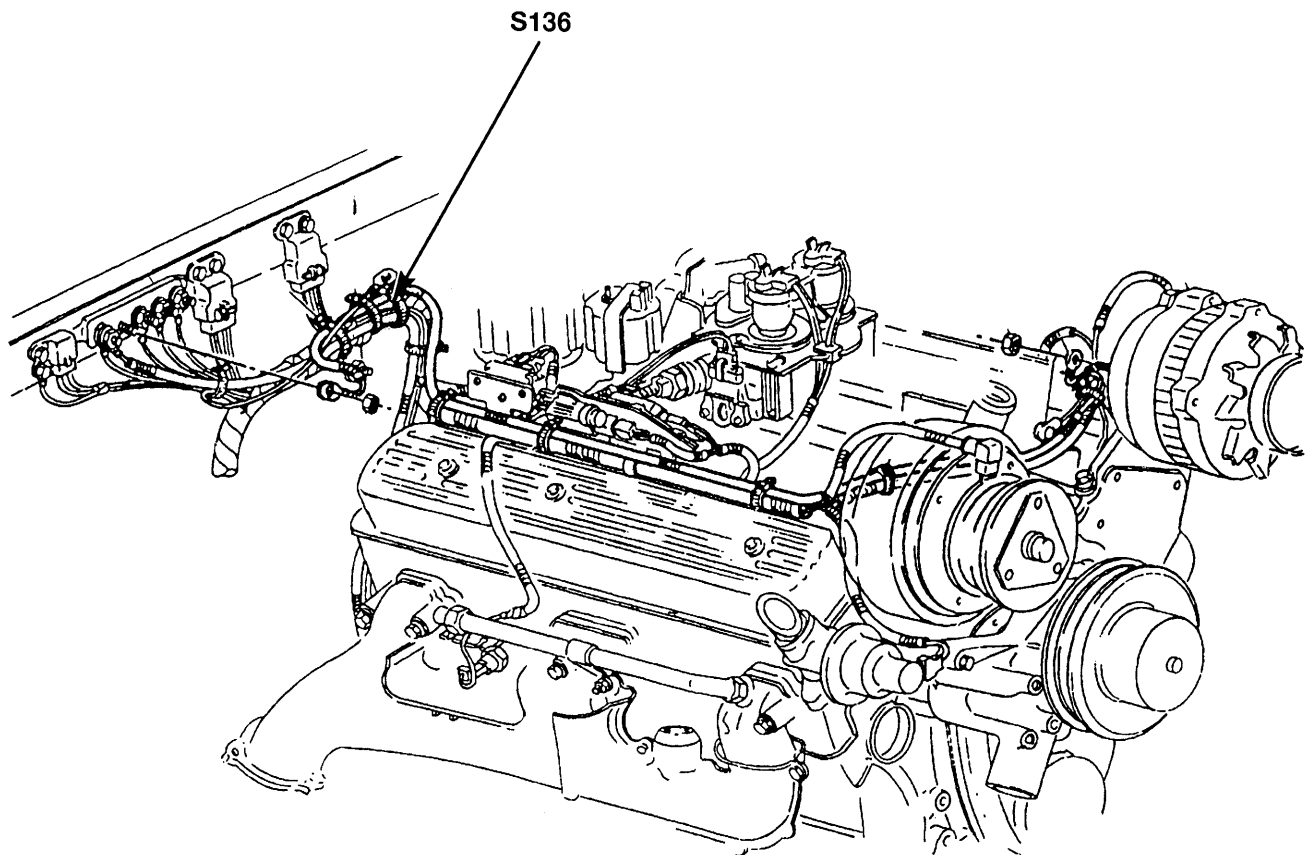
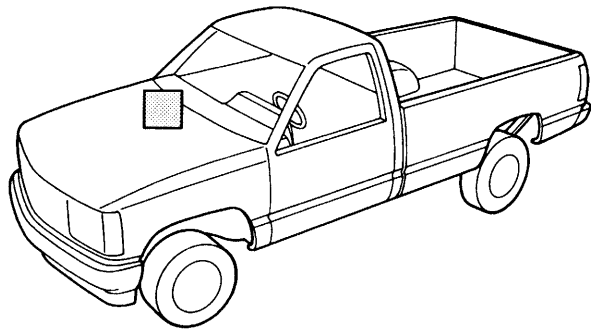


Figure 6 — Engine Wiring



5.7L AND 7.4L ENGINES SHOWN,  
OTHER ENGINES SIMILAR

12H12.1

Figure 7 — Generator Wiring

## 8A-33-12 VEHICLE SPEED SENSOR BUFFER

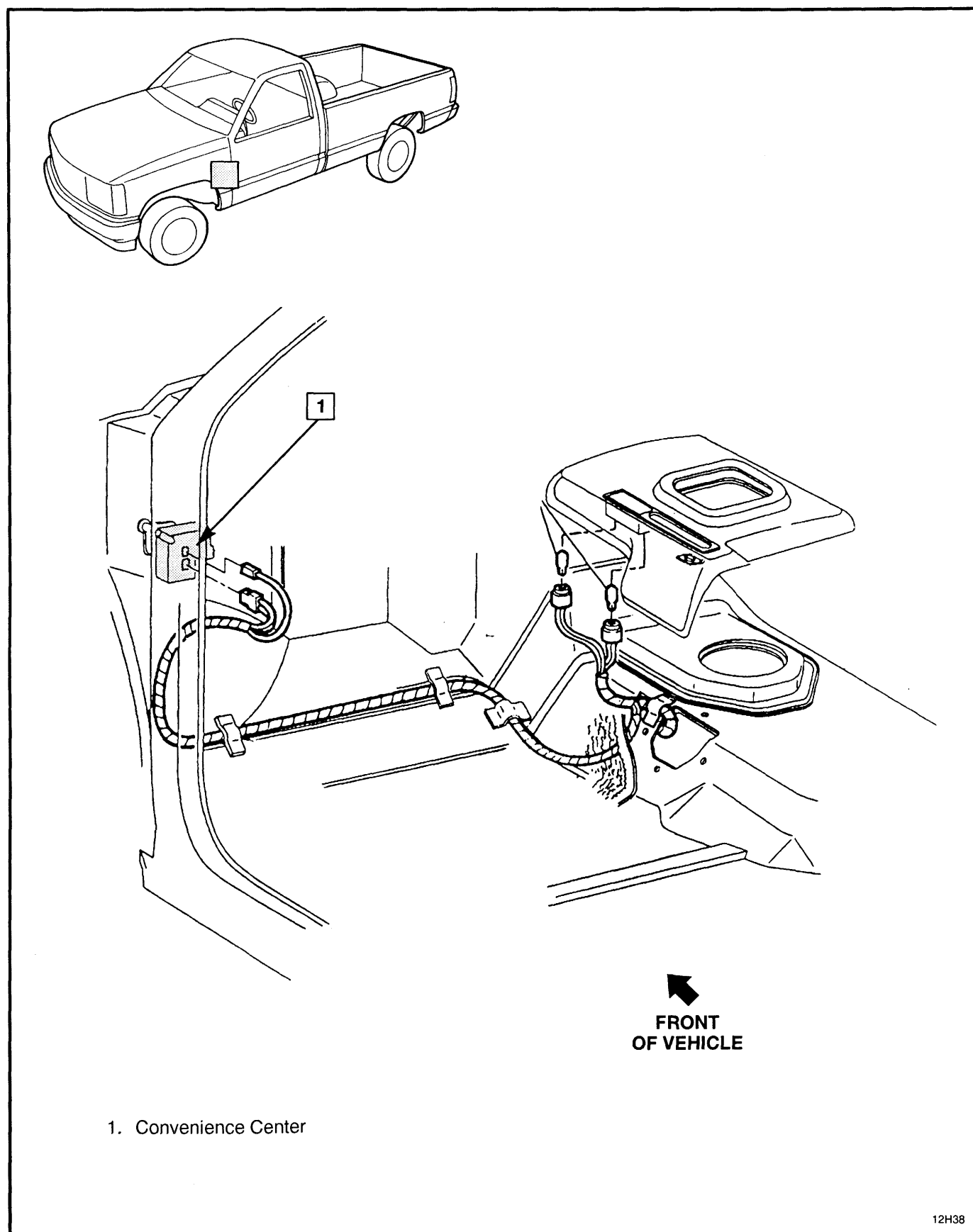


Figure 8 — Four-Wheel Drive Wiring

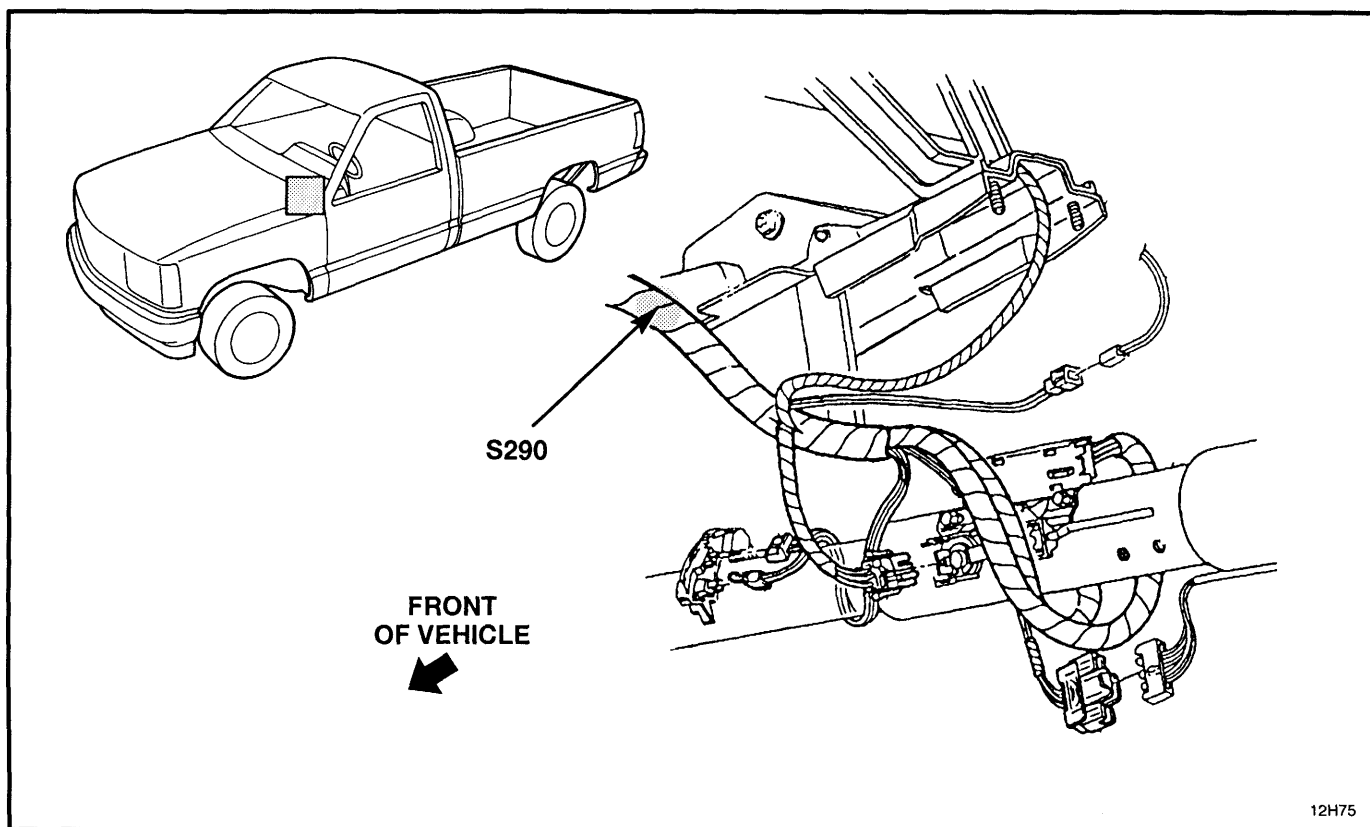


Figure 9 — Steering Column Wiring, LH Side

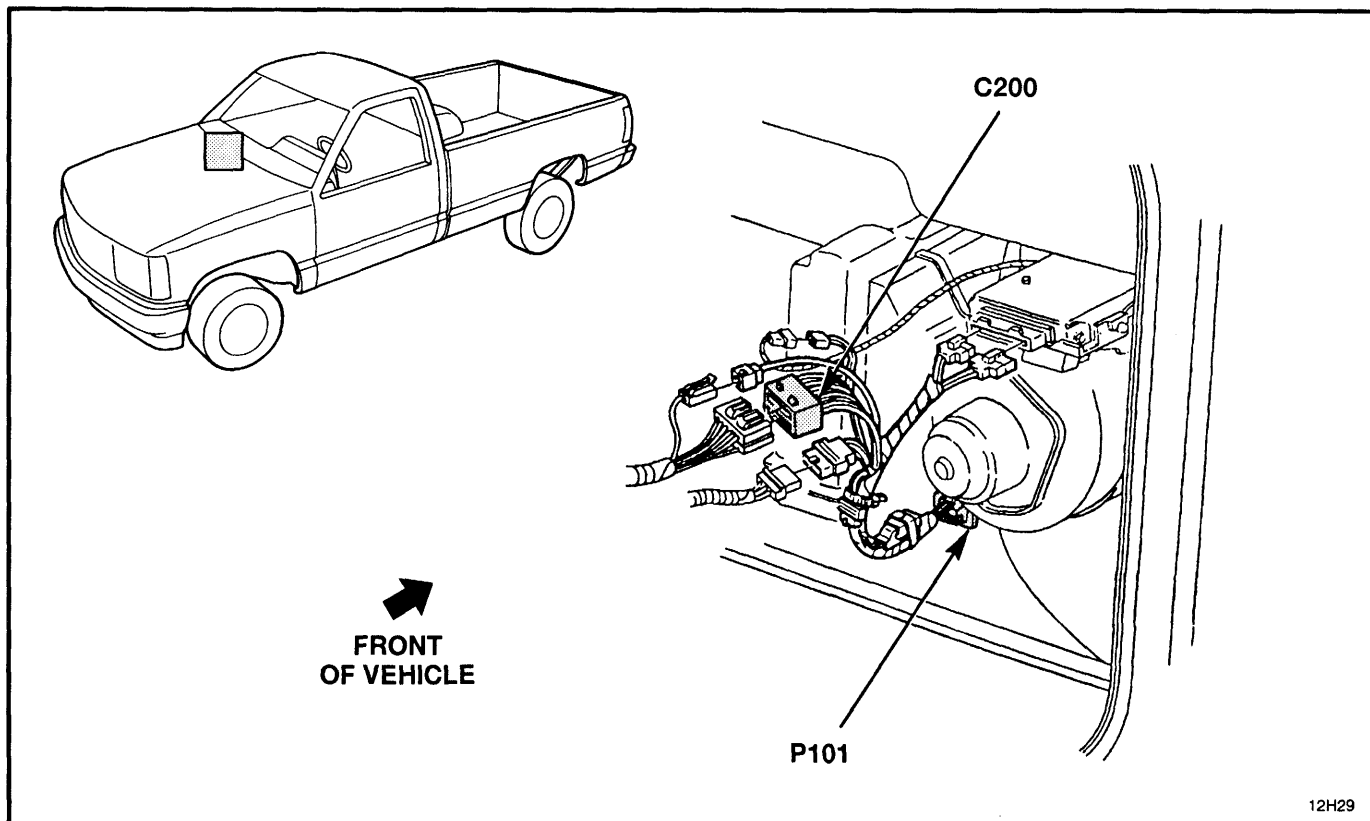


Figure 10 — Behind RH Side of I/P



**BLANK**

## **CIRCUIT OPERATION**

The Cruise Control regulates the speed of the vehicle in response to driver commands.

The Cruise Control Module contains electronic circuitry and a stepper motor. The other system components are as follows:

- Cruise Switch
- Set Switch
- Brake Switch
- Clutch Switch
- Vehicle Speed Sensor

The Cruise Control Module receives voltage from the GAUGES Fuse in RUN or START. A speed signal is received from the Vehicle Speed Sensor Buffer. The driver gives his input to the Cruise Control Module through the system components previously listed. The Cruise Control Module circuitry receives the driver's input and generates electrical pulses. These pulses cause the stepper motor and its output reel to rotate. The throttle is controlled by a cable wound on the output reel. The Cruise Control Module also contains a switch which releases the cable when the Cruise Control System must be shut off. This switch will operate when the Brake Pedal is depressed, the Clutch Pedal is depressed, the Cruise Control System is turned off or the Cruise Control System detects a failure.

## **COMPONENT LOCATION**

### **Page — Figure**

|                             |                                 |           |   |
|-----------------------------|---------------------------------|-----------|---|
| Cruise Control Brake Switch | At top of brake pedal           | Not Shown |   |
| Clutch Switch               | At top of clutch pedal          | 34-6      | 1 |
| Convenience Center          | Under LH side of I/P            | 34-6      | 1 |
| Cruise Control Module       | LH rear side engine compartment | 34-8      | 4 |
| Cruise Control Switch       | At turn signal lever            | 34-6      | 1 |
| Fuse Block                  | Below LH side of I/P            | 34-8      | 3 |

## **CONNECTORS:**

|      |                                          |           |   |
|------|------------------------------------------|-----------|---|
| C200 | Under RH side of I/P, near blower motor  | 34-10     | 7 |
| C267 | Behind RH side of I/P, near blower motor | Not Shown |   |
| C290 | At convenience center                    | 34-6      | 1 |

## **GROMMETS:**

|      |                                         |       |   |
|------|-----------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment)      | 34-10 | 7 |
| P102 | Lower LH cowl, above convenience center | 34-6  | 1 |

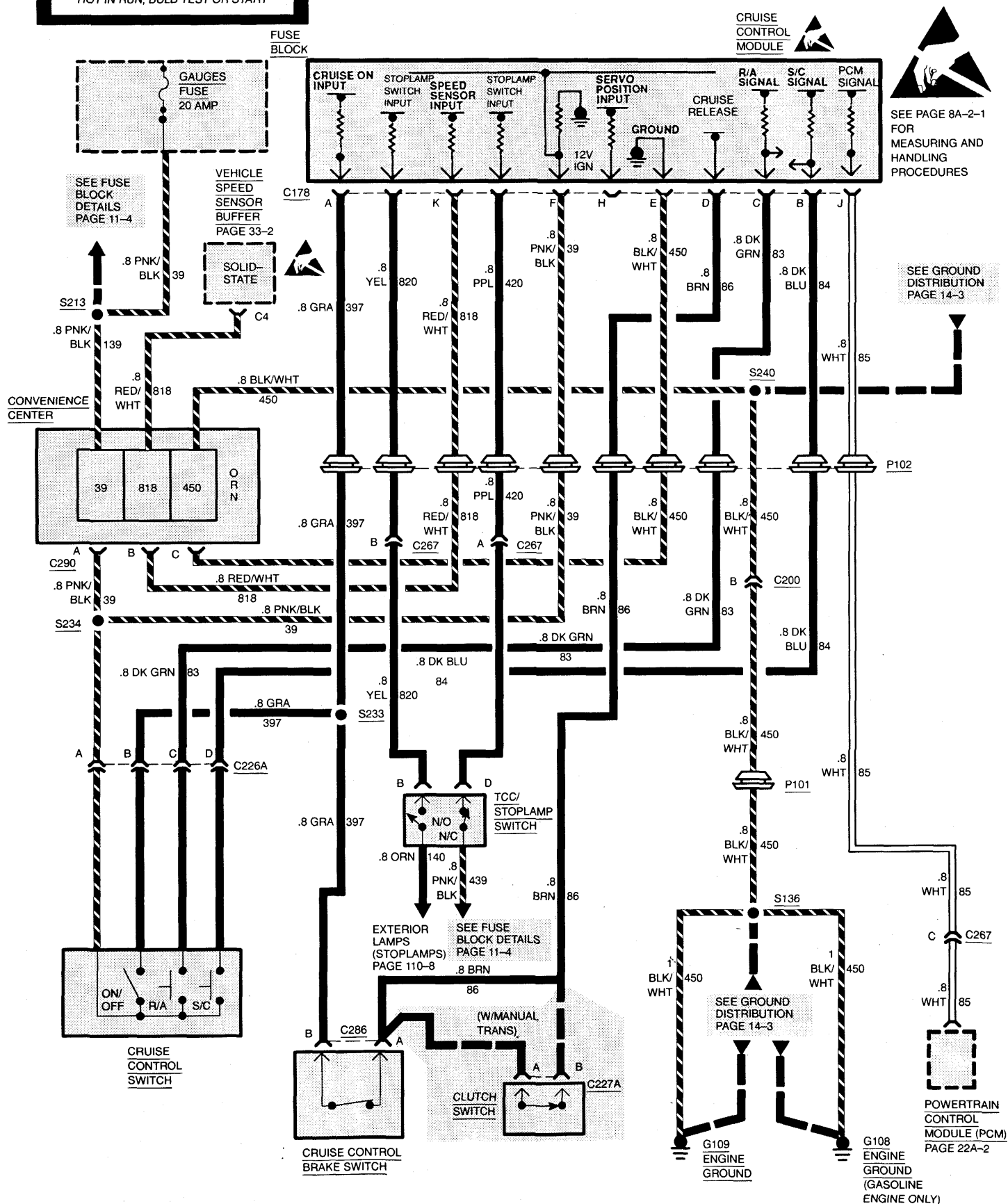
## **GROUND:**

|                 |                            |       |   |
|-----------------|----------------------------|-------|---|
| G108            | LH top front of engine     | 34-9  | 5 |
| G109 (Diesel)   | Top front center of engine | 34-10 | 6 |
| G109 (Gasoline) | Top front center of engine | 34-9  | 5 |

## **SPLICES:**

|      |                                                      |      |   |
|------|------------------------------------------------------|------|---|
| S136 | Rear of engine compartment, near center              | 34-9 | 5 |
| S213 | Under LH side of I/P                                 | 34-7 | 2 |
| S233 | Cruise control harness, near cruise brake switch     | 34-6 | 1 |
| S234 | Cruise control harness, near convenience center lead | 34-6 | 1 |
| S240 | Behind LH side of I/P                                | 34-7 | 2 |

HOT IN RUN, BULB TEST OR START



## DIAGNOSIS — CRUISE CONTROL

### PRELIMINARY CHECKS:

1. Check condition of GAUGES Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

#### CRUISE CONTROL DOES NOT DISENGAGE WHEN CLUTCH OR BRAKE PEDAL(S) IS DEPRESSED

| TEST                                                                                                                                                                          | RESULT                    | ACTION                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and cruise control switch to ON. Depress brake pedal. Connect test lamp from BRN (86) wire at brake switch connector C286 to ground. | Test lamp does not light. | REPLACE control module.                                                                                                                         |
|                                                                                                                                                                               | Test lamp lights.         | CHECK adjustment of brake switch. If adjustment cannot be corrected, REPLACE brake switch. If vehicle is equipped with man trans, GO to step 2. |
| 2. Connect test lamp from BRN (86) wire at clutch switch connector C227A to ground. Depress clutch.                                                                           | Test lamp does not light. | REPLACE control module.                                                                                                                         |
|                                                                                                                                                                               | Test lamp lights.         | CHECK adjustment of clutch switch. If adjustment cannot be corrected, REPLACE clutch switch.                                                    |

#### CRUISE CONTROL DOES NOT OPERATE

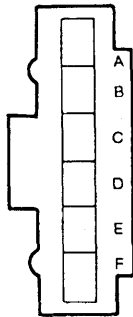
| TEST                                                                                                                                                                                                                  | RESULT                    | ACTION                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and cruise control switch to ON. Connect test lamp from PNK/BLK (39) wire at cruise control switch connector C226A to ground and then cruise control module connector C178 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                |
|                                                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire from cruise control switch connector C226A or cruise module connector C178 to convenience center connector C290 or from convenience center to fuse block.        |
| 2. Connect test lamp from GRA (397) wire at cruise control switch connector C226A to ground.                                                                                                                          | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                |
|                                                                                                                                                                                                                       | Test lamp does not light. | REPLACE cruise control switch.                                                                                                                                                                               |
| 3. Connect test lamp from GRA (397) wire at cruise control module connector C178 to ground.                                                                                                                           | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                |
|                                                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in GRA (397) wire from cruise control module connector C178 to cruise control switch connector C226A.                                                                                 |
| 4. Connect test lamp from GRA (397) wire to BLK/WHT (450) wire at cruise control module connector C178.                                                                                                               | Test lamp lights.         | GO to step 5.                                                                                                                                                                                                |
|                                                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in BLK/WHT (450) wire from cruise control module connector C178 to convenience center connector C290 or from convenience center C225 to ground G108, G109, (Gasoline), G109 (Diesel). |

## 8A-34-4 CRUISE CONTROL

### CRUISE CONTROL DOES NOT OPERATE (CONTINUED)

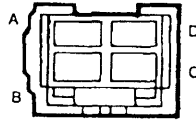
| TEST                                                                                                            | RESULT                    | ACTION                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------|
| 5. Connect test lamp from GRA (397) wire at brake switch connector C286 to ground.                              | Test lamp lights.         | GO to step 6.                                                                                                      |
|                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in GRA (397) wire from brake switch connector C286 to splice S233.                          |
| 6. Connect test lamp from BRN (86) wire at brake switch connector C286 to ground. Depress brake pedal.          | Test lamp lights.         | GO to step 7 if vehicle is equipped with man trans.<br>GO to step 8 if vehicle is equipped with auto trans.        |
|                                                                                                                 | Test lamp does not light. | CHECK adjustment of brake switch. If properly adjusted, REPLACE brake switch.                                      |
| 7. Connect test lamp from BRN (86) wire at clutch switch connector C227A to ground. Depress brake pedal.        | Test lamp lights.         | GO to step 8.                                                                                                      |
|                                                                                                                 | Test lamp does not light. | CHECK adjustment of clutch switch. If properly adjusted, REPLACE clutch switch.                                    |
| 8. Connect test lamp from BRN (86) wire at cruise control module connector C178 to ground. Depress brake pedal. | Test lamp lights.         | REPLACE cruise control module.                                                                                     |
|                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in BRN (86) wire from cruise control module connector C178 to brake switch connector C235A. |

**12065427**



**C178**  
**Cruise Control Module**

**12020651**



**C266A**  
**Cruise Control Switch**

**12034417**



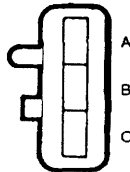
**C227A**  
**Clutch Switch**

**12033709**



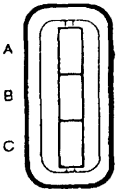
**BLACK**  
**Metri-Pack 280**  
**C286**  
**Brake Switch**

**12047781**



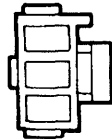
**BLACK**  
**Metri-Pack 150**  
**C267**  
**In-Line Module to PCM**

**12047782**



**BLACK**  
**Metri-Pack 150**  
**C267**  
**In-Line PCM to Module**

**12033698**



**C290**  
**Cruise Module to Convenience**  
**Center**

## 8A-34-6 CRUISE CONTROL

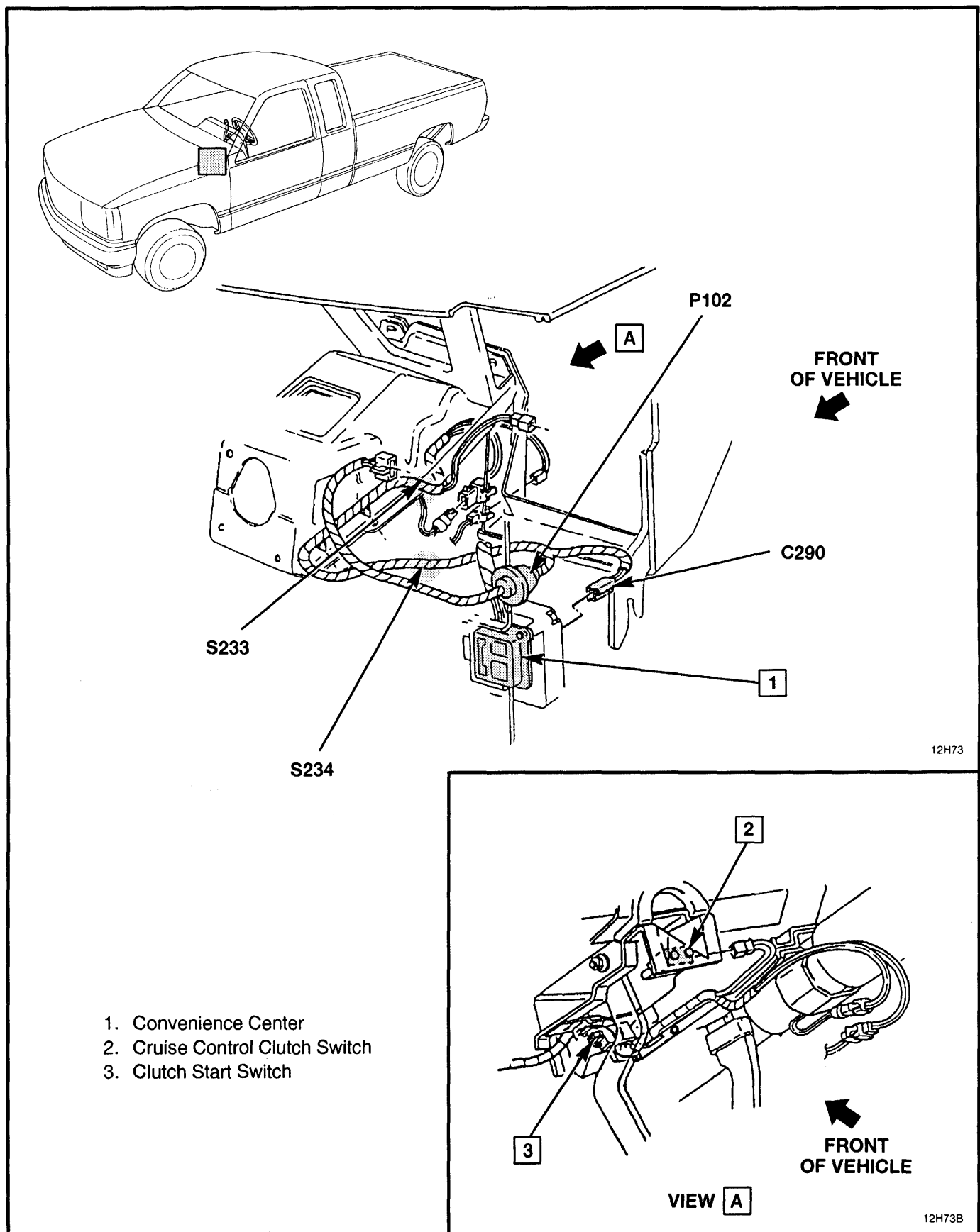
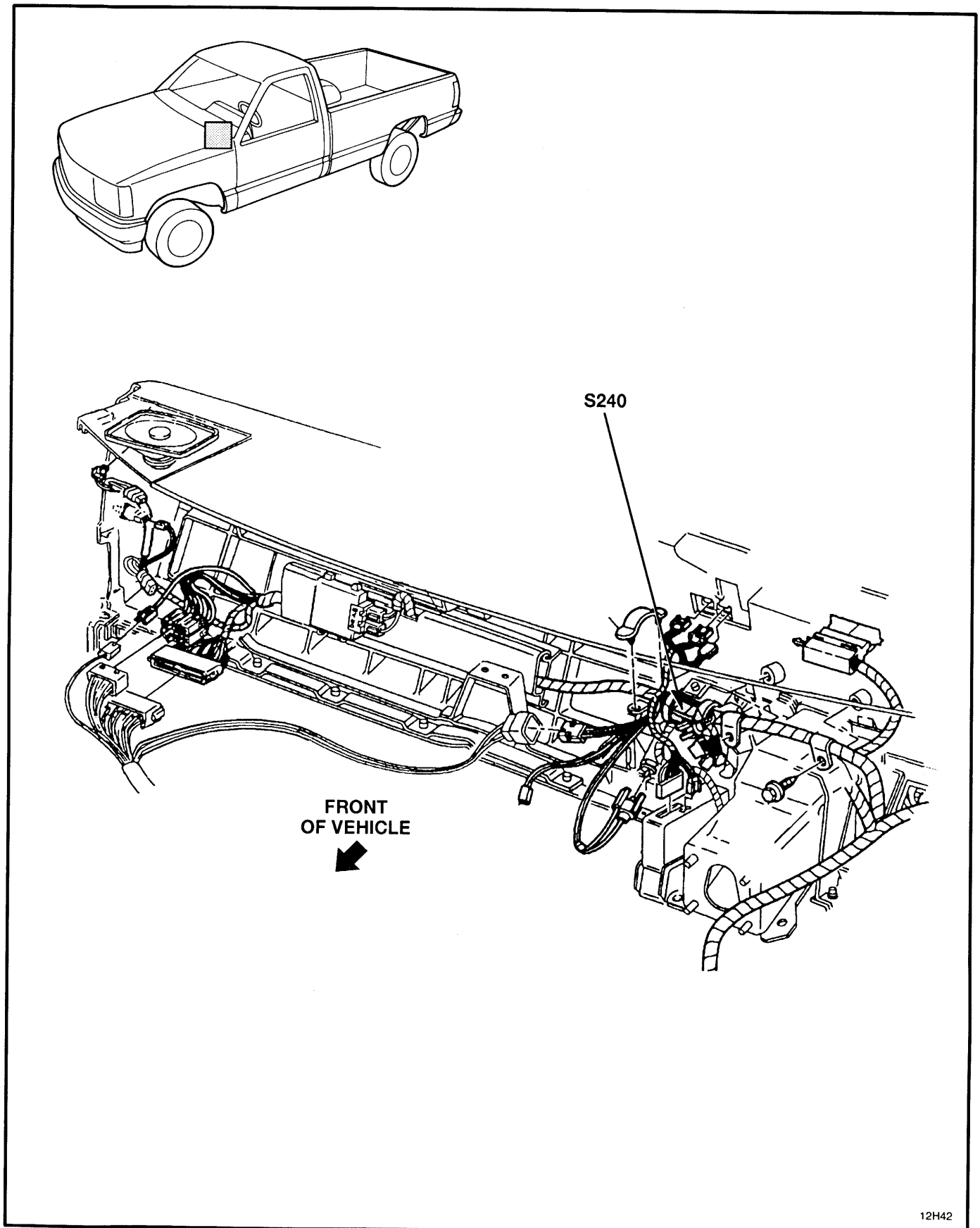


Figure 1 — Cruise Control Wiring



12H42

Figure 2 — Instrument Panel Wiring, LH Side



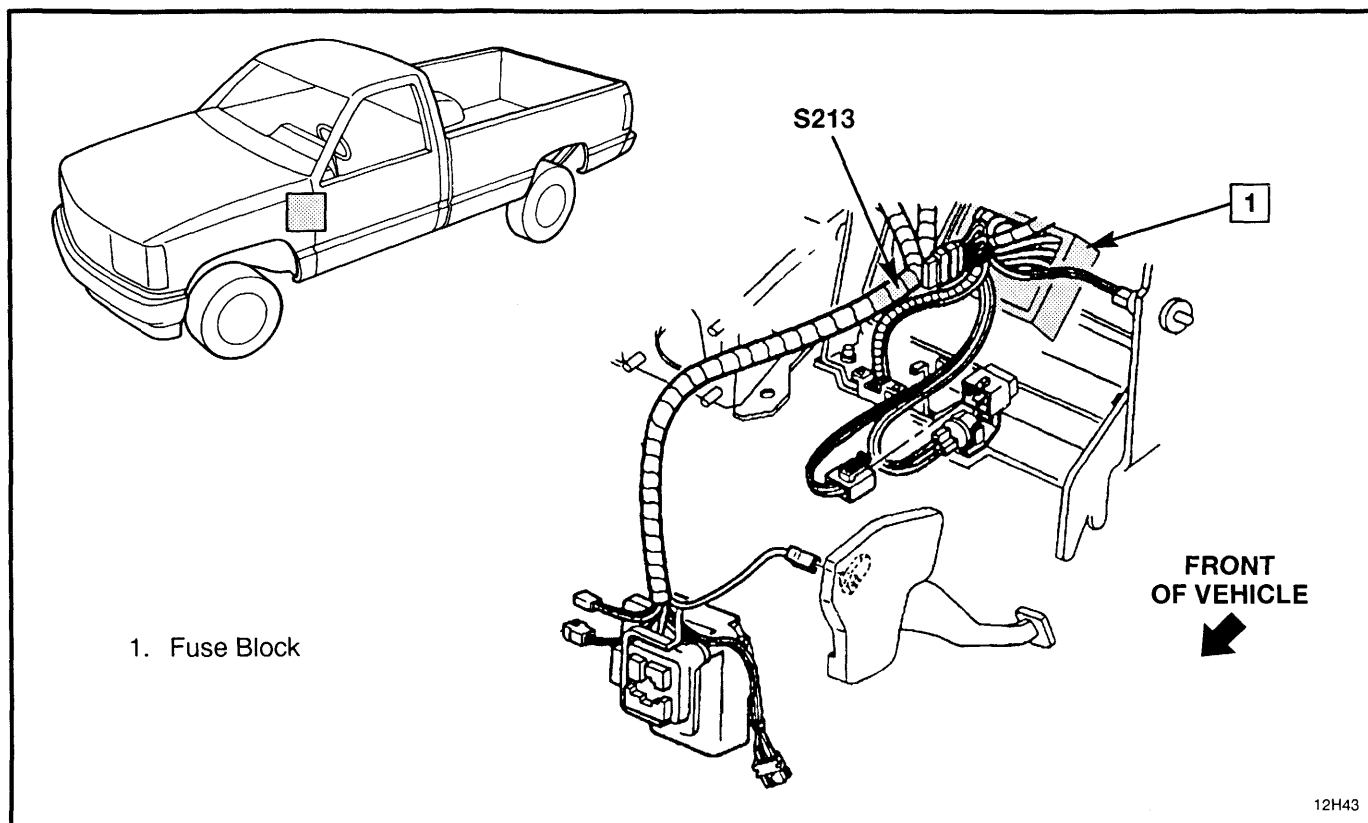


Figure 3 — Instrument Panel, LH Side

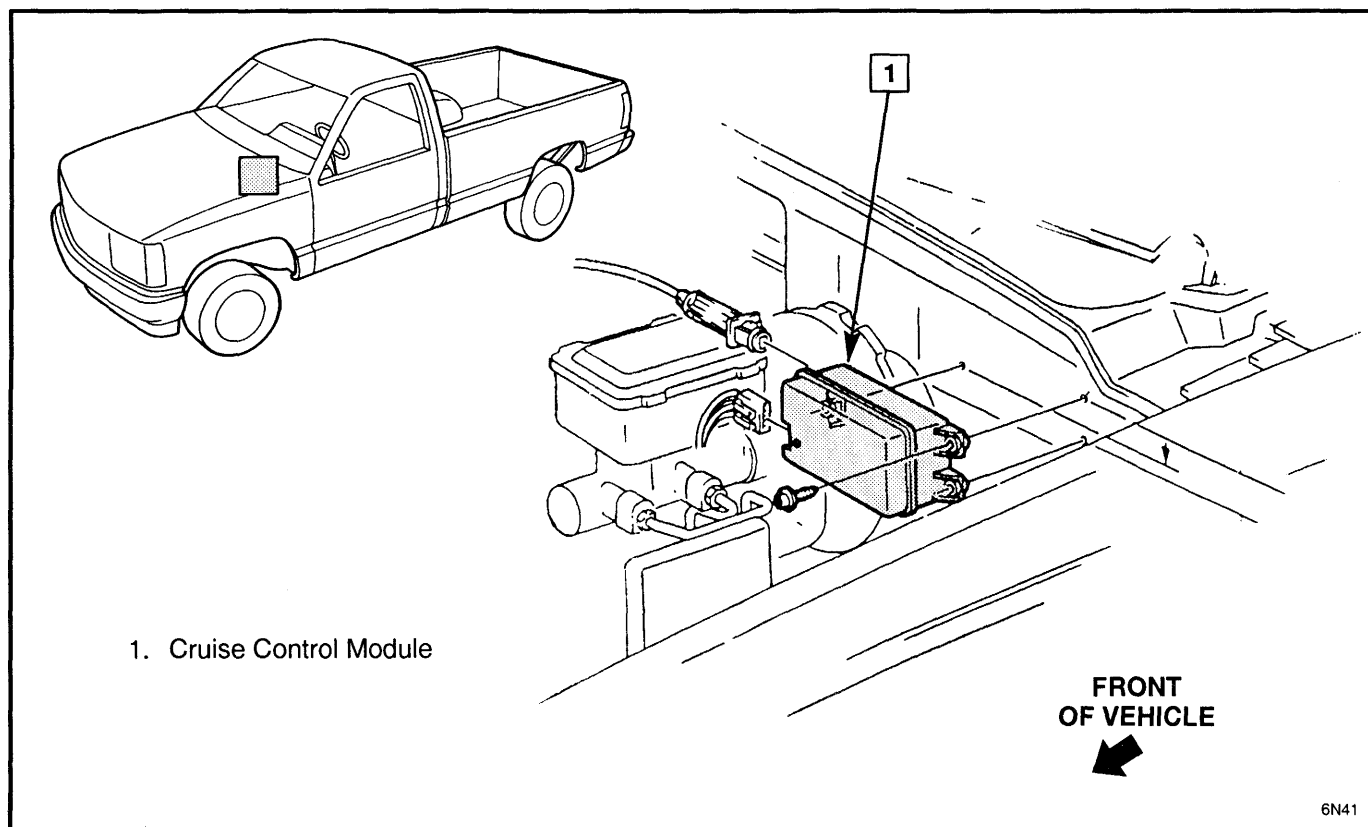
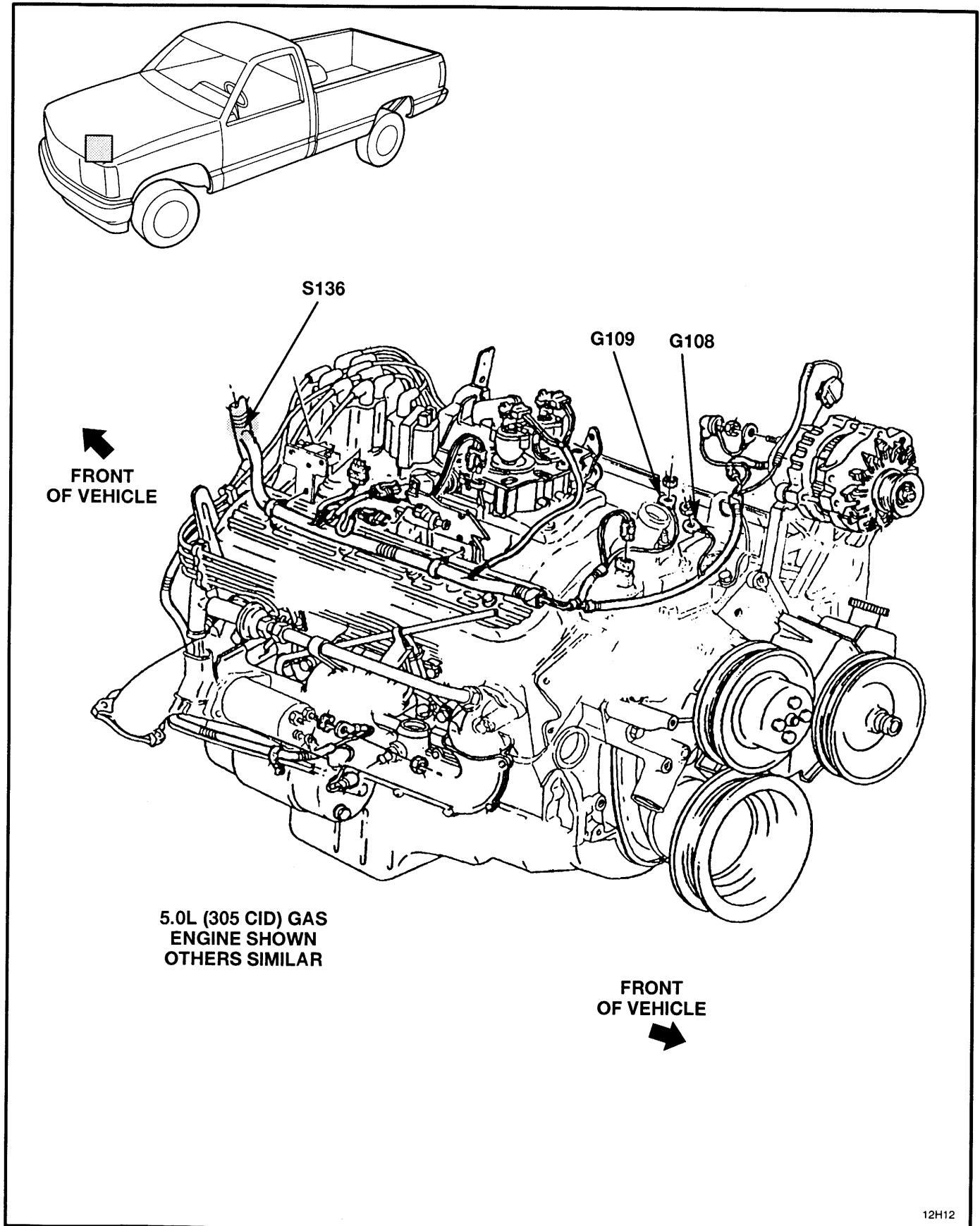


Figure 4 — Cruise Control Module



12H12

Figure 5 — RH Side of Engine, 5.0L (305 CID) Engine — Gasoline

## 8A-34-10 CRUISE CONTROL

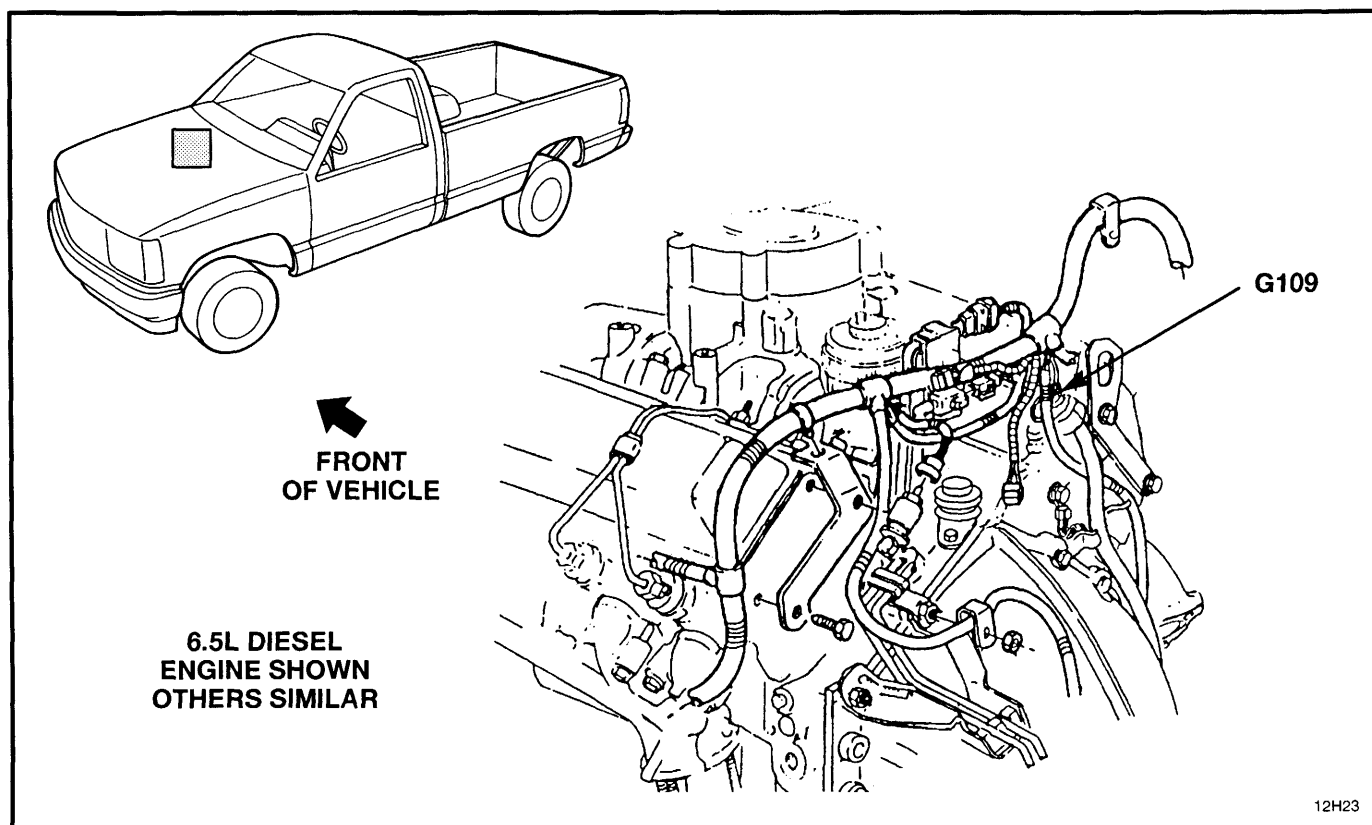


Figure 6 — Engine Wiring, Rear — Diesel

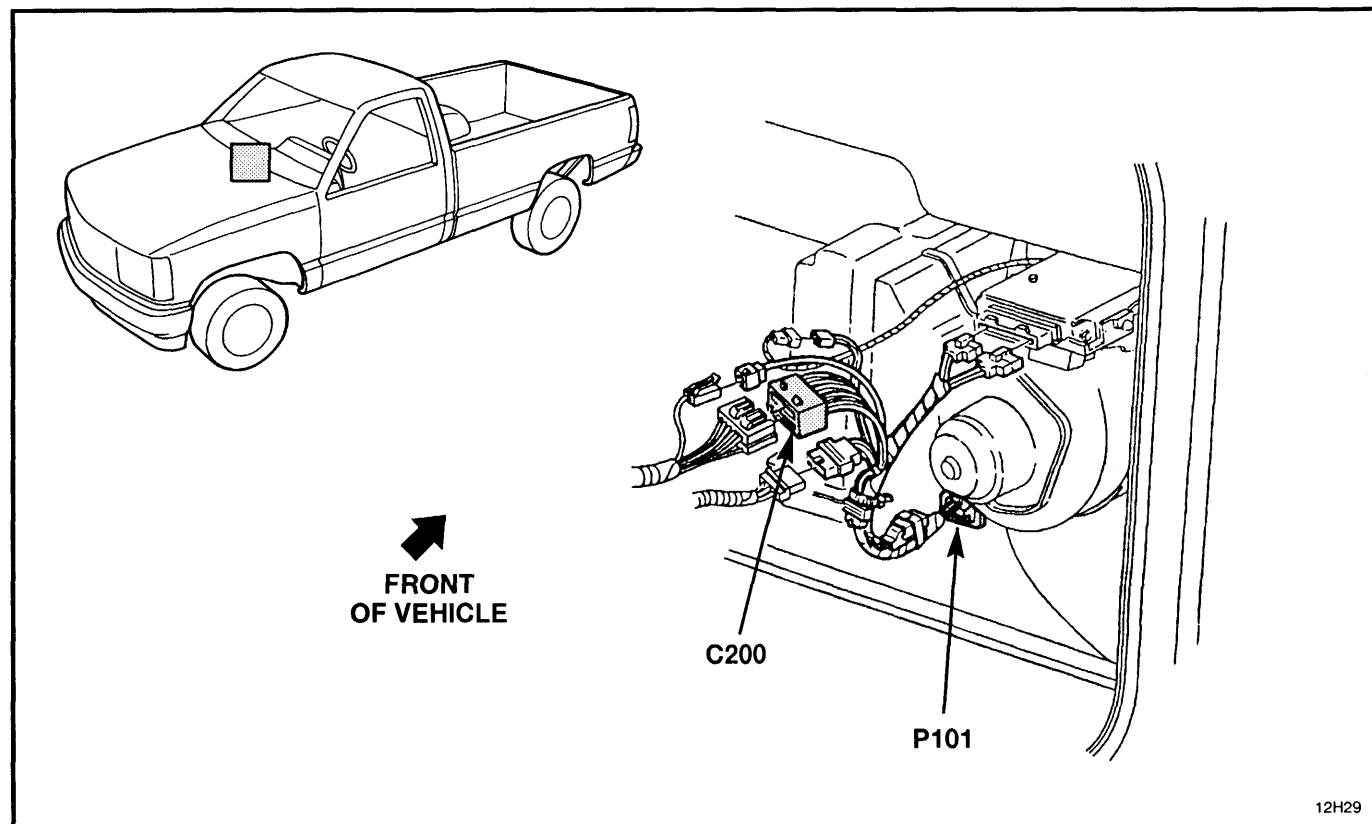


Figure 7 — Behind RH Side of I/P

## **CIRCUIT OPERATION**

When the Ignition Switch is in RUN and the four-wheel drive control lever is engaged, the transfer case switch closes and battery voltage is supplied across the front axle actuator. The front axle actuator energizes and the four-wheel drive gears are meshed. This meshing action of the four-wheel drive gears closes the front axle switch, and battery voltage is supplied through the PPL (420) wire across the four-wheel drive indicator lighting the bulb.

Battery voltage is also supplied through the front axle switch contacts and PPL (420) or BRN/WHT (650) wires to

the rear-wheel or four-wheel antilock brake module. This will modify the antilock braking system operation in 4WD mode.

A transfer case relay is used on one-ton vehicles with four-wheel drive. This relay is energized when the vehicle is in 4WD mode. From the transfer case relay, voltage is supplied to the transfer case synchronizer.

## **COMPONENT LOCATION**

### **Page — Figure**

|                                                |                                                                     |       |   |
|------------------------------------------------|---------------------------------------------------------------------|-------|---|
| Convenience Center .....                       | Under LH side of I/P .....                                          | 38-10 | 5 |
| Four-Wheel Drive Indicator Lamp ..             | I/P cluster .....                                                   | 38-10 | 5 |
| Front Axle Actuator .....                      | RH side of front drive axle .....                                   | 38-7  | 1 |
| Front Axle Solenoid Switch .....               | RH rear side of front drive axle .....                              | 38-7  | 1 |
| Fuse Block .....                               | Behind LH side of I/P .....                                         | 38-9  | 4 |
| Transfer Case Shift Illumination<br>Lamp ..... | At transfer case selector lever .....                               | 38-10 | 5 |
| Transfer Case Relay .....                      | RH rear of engine compartment, near battery<br>junction block ..... | 38-7  | 1 |
| Transfer Case Switch .....                     | LH top of transfer case .....                                       | 38-11 | 6 |

## **CONNECTORS:**

|             |                                                |       |   |
|-------------|------------------------------------------------|-------|---|
| C152 .....  | Under floor at transmission case control ..... | 38-11 | 6 |
| C160 .....  | Center rear of engine .....                    | 38-8  | 2 |
| C215A ..... | At convenience center .....                    | 38-10 | 5 |
| C216A ..... | At convenience center .....                    | 38-10 | 5 |

## **GROMMETS:**

|            |                                          |           |
|------------|------------------------------------------|-----------|
| P101 ..... | RH lower cowl (engine compartment) ..... | Not Shown |
|------------|------------------------------------------|-----------|

## **GROUND:**

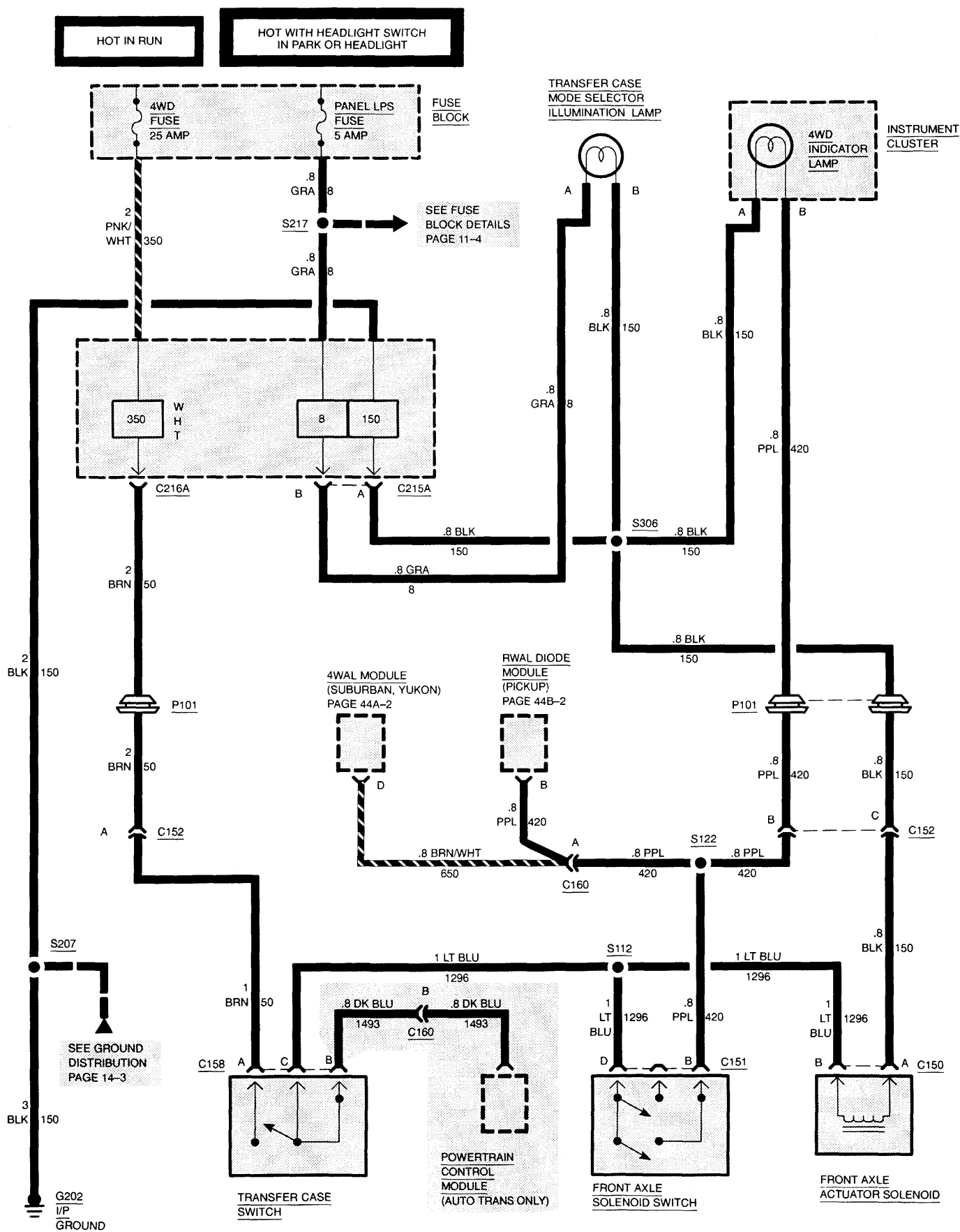
|            |                        |      |   |
|------------|------------------------|------|---|
| G202 ..... | At DLC connector ..... | 38-8 | 3 |
|------------|------------------------|------|---|

## **SPLICES:**

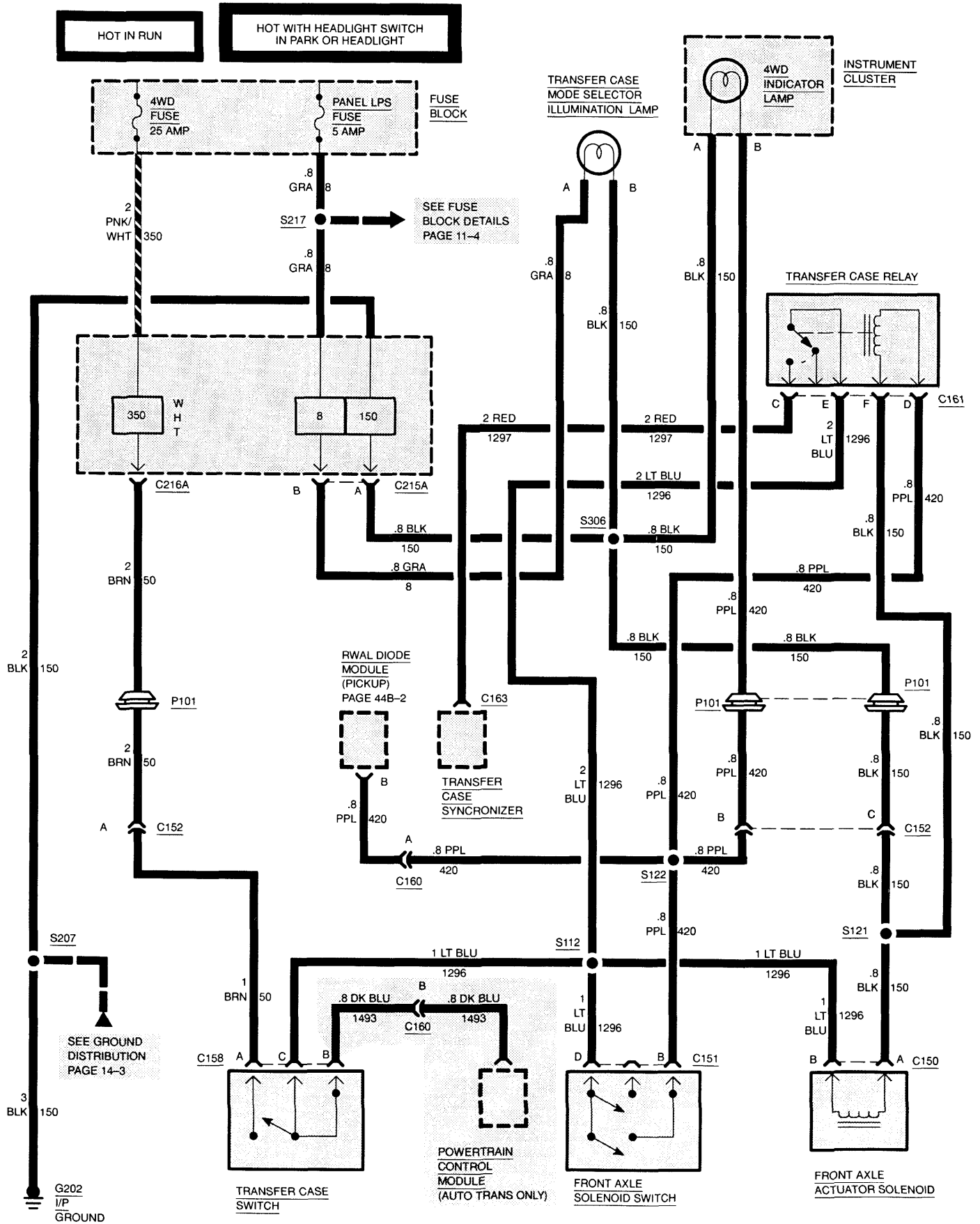
|                        |                                                                    |       |   |
|------------------------|--------------------------------------------------------------------|-------|---|
| S112 (K300 Only) ..... | LH top side of transmission .....                                  | 38-7  | 1 |
| S121 .....             | 4-wheel drive indicator extension harness, near<br>C160 lead ..... | 38-11 | 6 |
| S122 (K300 Only) ..... | 4-wheel drive indicator extension harness, near<br>C160 lead ..... | 38-11 | 6 |
| S207 .....             | Under LH side of I/P .....                                         | 38-9  | 4 |
| S217 .....             | Under LH side of I/P .....                                         | 38-9  | 4 |
| S306 .....             | Left of shift console .....                                        | 38-10 | 5 |

# 8A-38-2 FOUR WHEEL DRIVE INDICATOR

ALL EXCEPT K300 W/MANUAL OR AUTOMATIC TRANSMISSION



**FOUR WHEEL DRIVE INDICATOR 8A-38-3**  
**K300 W/MANUAL OR AUTOMATIC TRANSMISSION**



## 8A-38-4 FOUR WHEEL DRIVE INDICATOR

### DIAGNOSIS — FOUR-WHEEL DRIVE

#### PRELIMINARY CHECKS:

1. Make sure all mechanical components are operative before diagnosing electrical portion of four-wheel drive system.
2. To determine whether vehicle is two-wheel drive or four-wheel drive, lift it up so wheels can spin freely.
3. Check to see that 4WD and PANEL LPS fuses are not blown. If blown, locate and repair source of overload and replace fuse.
4. While performing the following diagnostic procedures, Ignition Switch must be in RUN and 4WD Control Lever must be in 4WD ENGAGED position.

#### FOUR-WHEEL DRIVE WILL NOT DISENGAGE

| TEST                                               | RESULT                  | ACTION                                             |
|----------------------------------------------------|-------------------------|----------------------------------------------------|
| 1. Disconnect transfer case switch connector C158. | 4WD disengages.         | REPLACE transfer case switch.                      |
|                                                    | 4WD does not disengage. | CHECK for mechanical problem within transfer case. |

#### FOUR-WHEEL DRIVE INDICATOR LAMP WILL NOT TURN OFF

| TEST                                                     | RESULT                       | ACTION                              |
|----------------------------------------------------------|------------------------------|-------------------------------------|
| 1. Disconnect front axle solenoid switch connector C151. | 4WD indicator lamp goes off. | REPLACE front axle solenoid switch. |

#### FOUR-WHEEL DRIVE WILL NOT ENGAGE

| TEST                                                                                                                                         | RESULT                    | ACTION                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from BRN (50) wire at transfer case switch connector C158 to ground.                                                    | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                  |
|                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire from transfer case switch connector C158 to convenience center connector C216A. If wiring is good, LOCATE and REPAIR open in PNK/WHT (350) wire from convenience center to fuse block. |
| 2. Connect test lamp from LT BLU (1296) wire at transfer case switch connector C158 to ground.                                               | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                                  |
|                                                                                                                                              | Test lamp does not light. | REPLACE transfer case switch.                                                                                                                                                                                                  |
| 3. Disconnect front axle actuator connector C150. Connect test lamp from LT BLU (1296) wire at front axle actuator connector C150 to ground. | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                                  |
|                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in LT BLU (1296) wire from front axle actuator connector C150 to transfer case switch connector C158.                                                                                                   |

## FOUR WHEEL DRIVE INDICATOR 8A-38-5

### FOUR-WHEEL DRIVE WILL NOT ENGAGE (CONTINUED)

| TEST                                                                                                                                                                                  | RESULT                    | ACTION                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4. Connect test lamp from LT BLU (1296) to BLK (150) wires at front axle actuator connector C150.                                                                                     | Test lamp lights.         | REPLACE front axle actuator. GO to step 5 for one-ton vehicles equipped with dual wheels.                                                                           |
|                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from front axle actuator connector C150 to ground terminal G202.                                                           |
| 5. Disconnect transfer case synchronizer connector C163. Connect test lamp from RED (1297) wire at transfer case synchronizer connector C163 to ground. (With dual rear wheels only.) | Test lamp lights.         | REPLACE transfer case synchronizer.                                                                                                                                 |
|                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in RED (1297) wire between transfer case synchronizer connector C163 and transfer case relay connector C161. If wire is good, REPLACE relay. |

### FOUR-WHEEL DRIVE ENGAGES BUT 4WD INDICATOR LAMP WILL NOT LIGHT

| TEST                                                                                                                | RESULT                    | ACTION                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Remove 4WD indicator lamp. Connect test lamp from PPL (420) wire at 4WD indicator lamp connector C305 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                        |
|                                                                                                                     | Test lamp does not light. | GO to step 3.                                                                                                                                                        |
| 2. Connect test lamp from PPL (420) to BLK (150) wires at 4WD indicator lamp connector C305.                        | Test lamp lights.         | REPLACE 4WD indicator lamp.                                                                                                                                          |
|                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from 4WD indicator lamp to ground terminal G202.                                                                            |
| 3. Connect test lamp from PPL (420) wire at front axle solenoid switch connector C151 to ground.                    | Test lamp lights.         | LOCATE and REPAIR open in PPL (420) wire between solenoid switch connector C151 and indicator lamp connector C305.                                                   |
|                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in LT BLU (1296) wire between front axle solenoid switch connector C151 and splice S122. If wire is good, REPLACE front axle solenoid switch. |



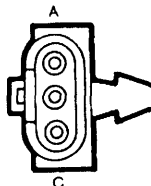
# 8A-38-6 FOUR WHEEL DRIVE INDICATOR

12033713



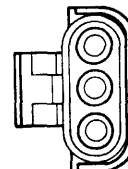
**C215A**  
4WD Illumination Lamp to  
Convenience Center

12033852



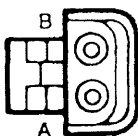
**BLACK**  
Weather-Pack  
**C152**  
In-Line I/P to Transfer Case

12020829



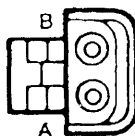
**BLACK**  
Weather-Pack  
**C152**  
In-Line Transfer Case to I/P

12015792



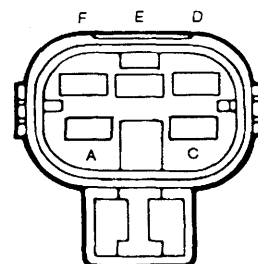
**BLACK**  
Weather Pack  
**C158**  
Transfer Case Switch W/K300

12015792



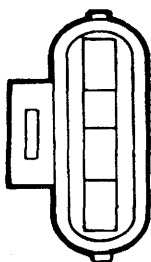
**BLACK**  
Weather Pack  
**C150**  
Front Axle Actuator

12052287



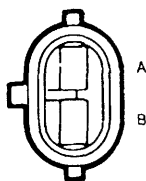
**BLACK**  
Metri-Pack  
**C161**  
Transfer Case Relay

12047950



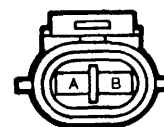
**BLACK**  
Metri-Pack 150  
**C160**  
Transfer Case to I/P W/MT1

12052647



**BLACK**  
Metri-Pack  
**C160**  
I/P to Transfer Case W/O MT1

12052641



**BLACK**  
Metri-Pack 150  
**C160**  
Transfer Case to I/P W/O MT1

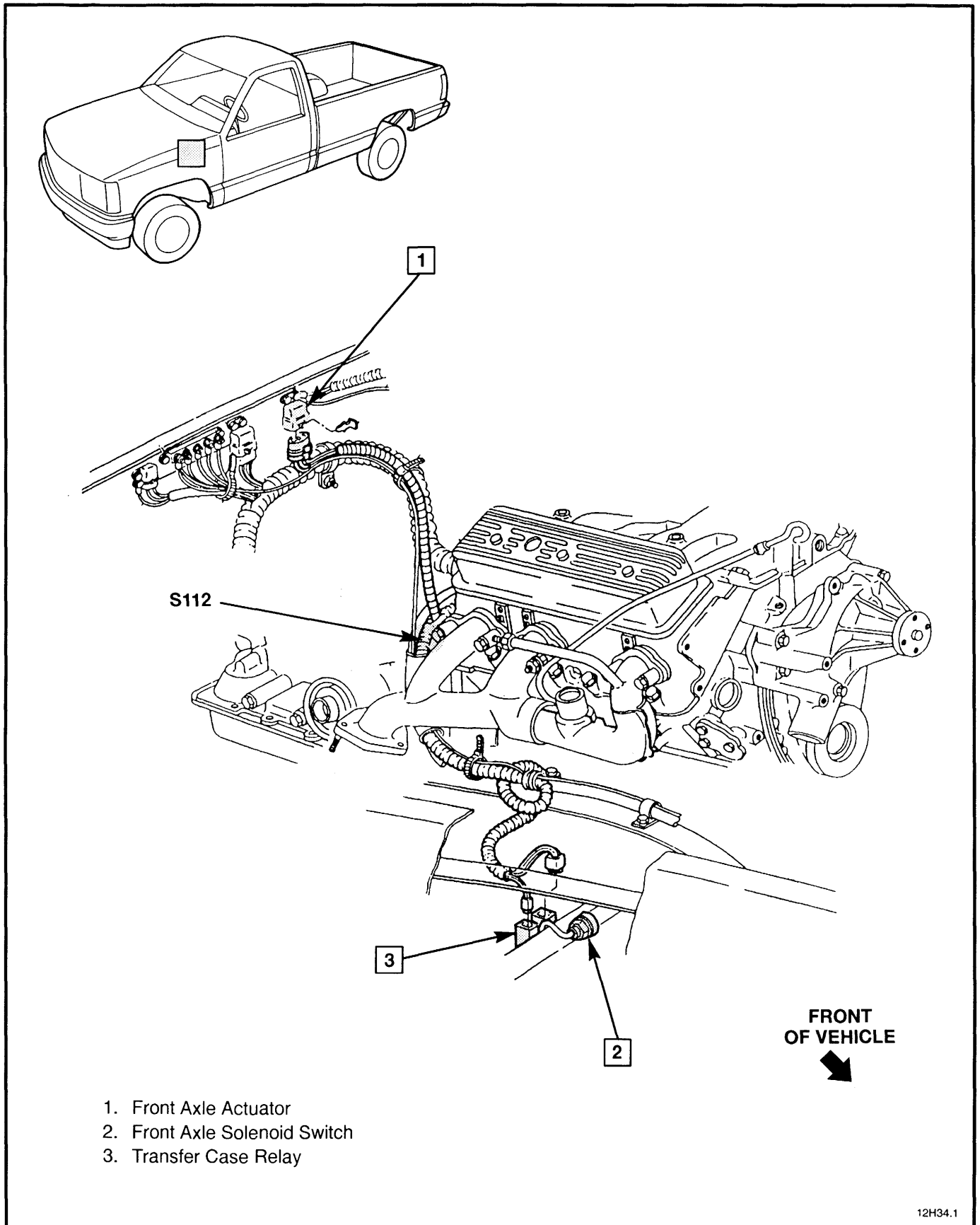


Figure 1 — Four-Wheel Drive Axle Actuator

## 8A-38-8 FOUR WHEEL DRIVE INDICATOR

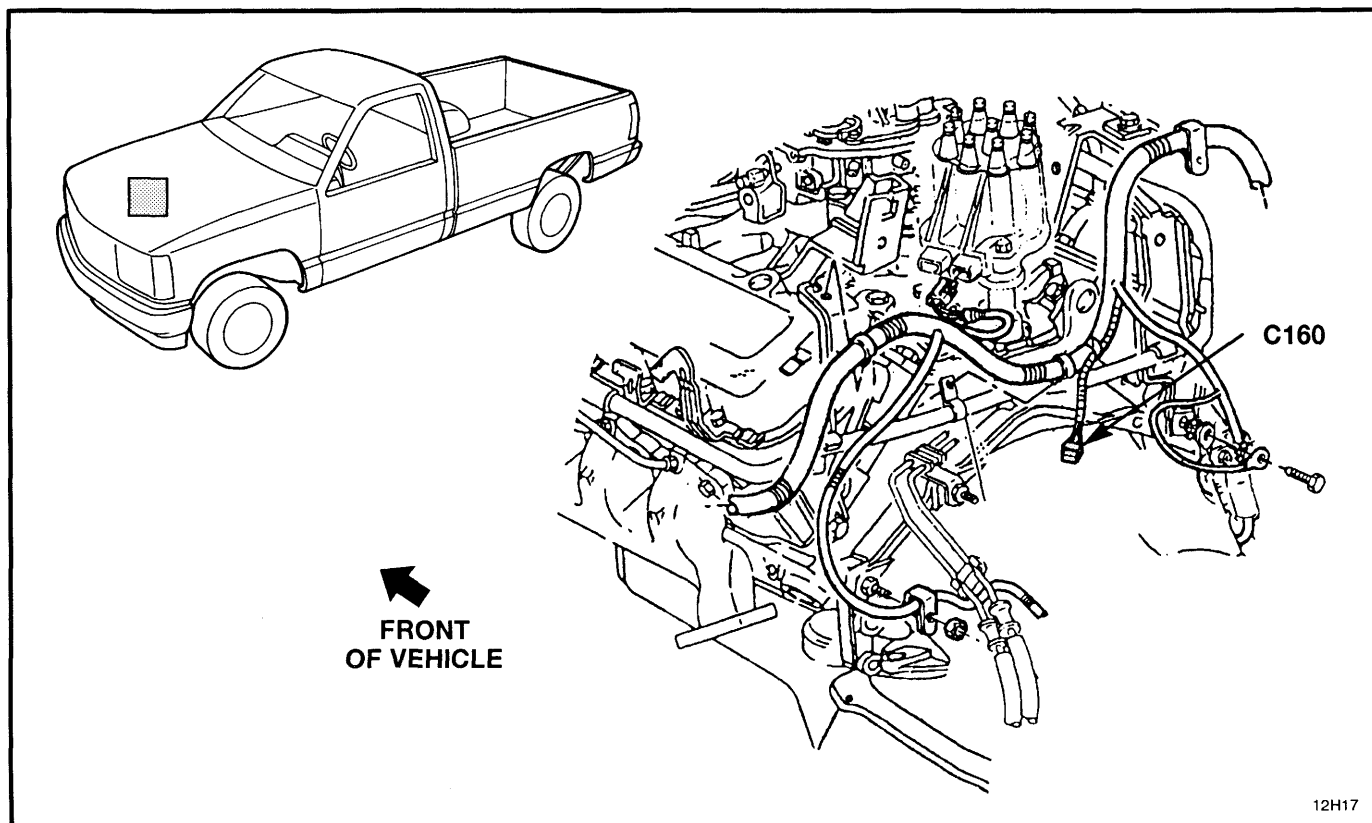


Figure 2 — Four-Wheel Drive Indicator Wiring

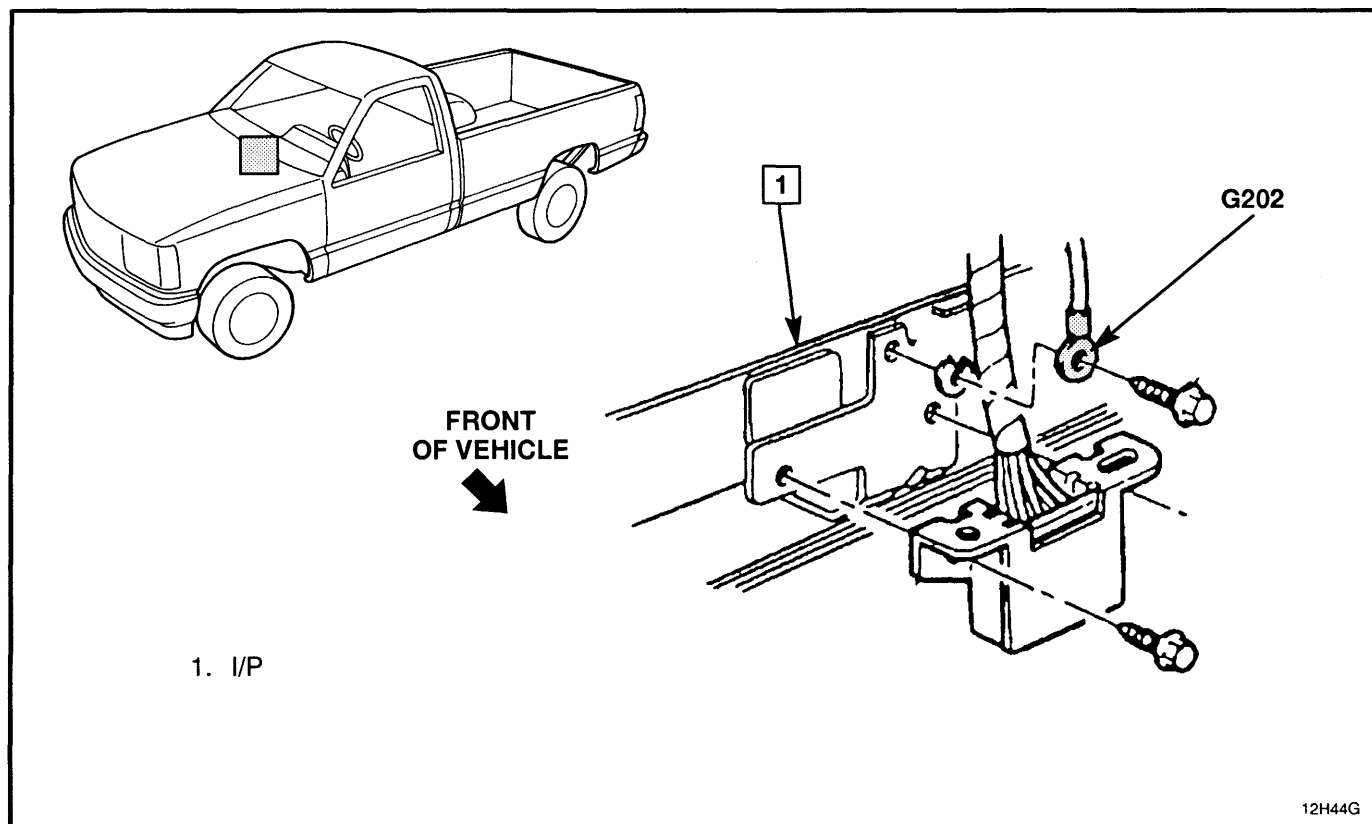


Figure 3 — I/P Ground

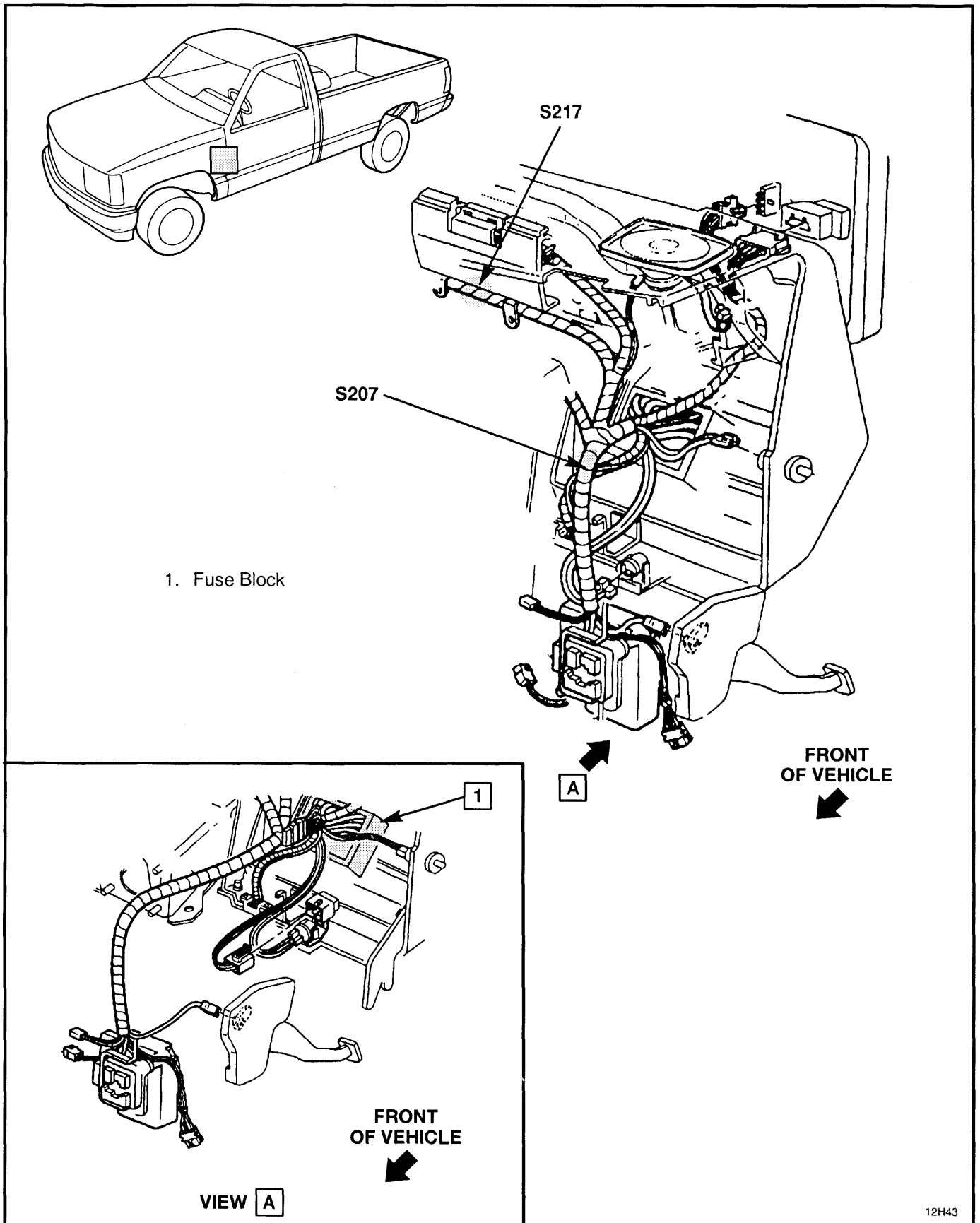
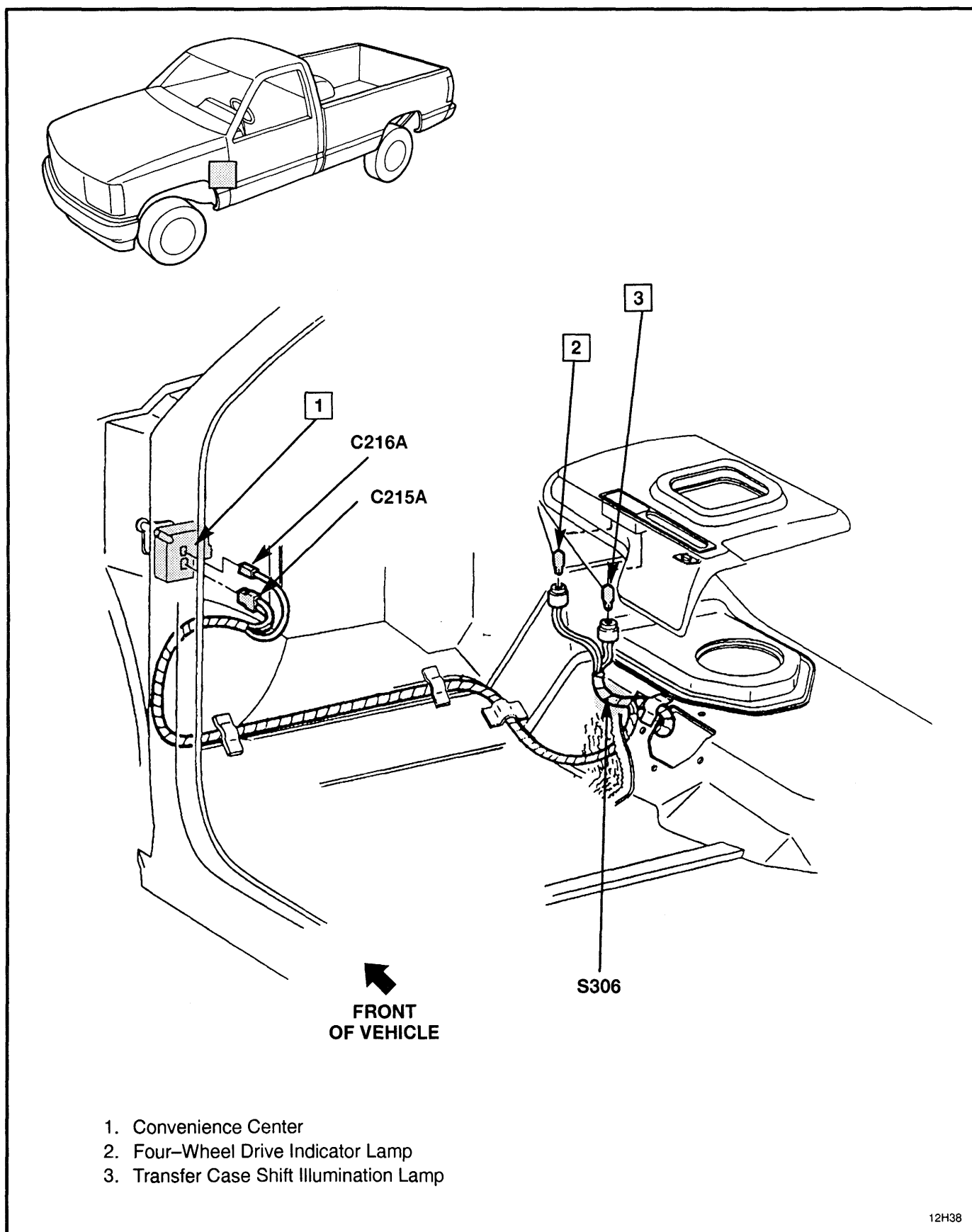


Figure 4 — LH Side of Instrument Panel

## 8A-38-10 FOUR WHEEL DRIVE INDICATOR



12H38

Figure 5 — Four-Wheel Drive Illumination Wiring

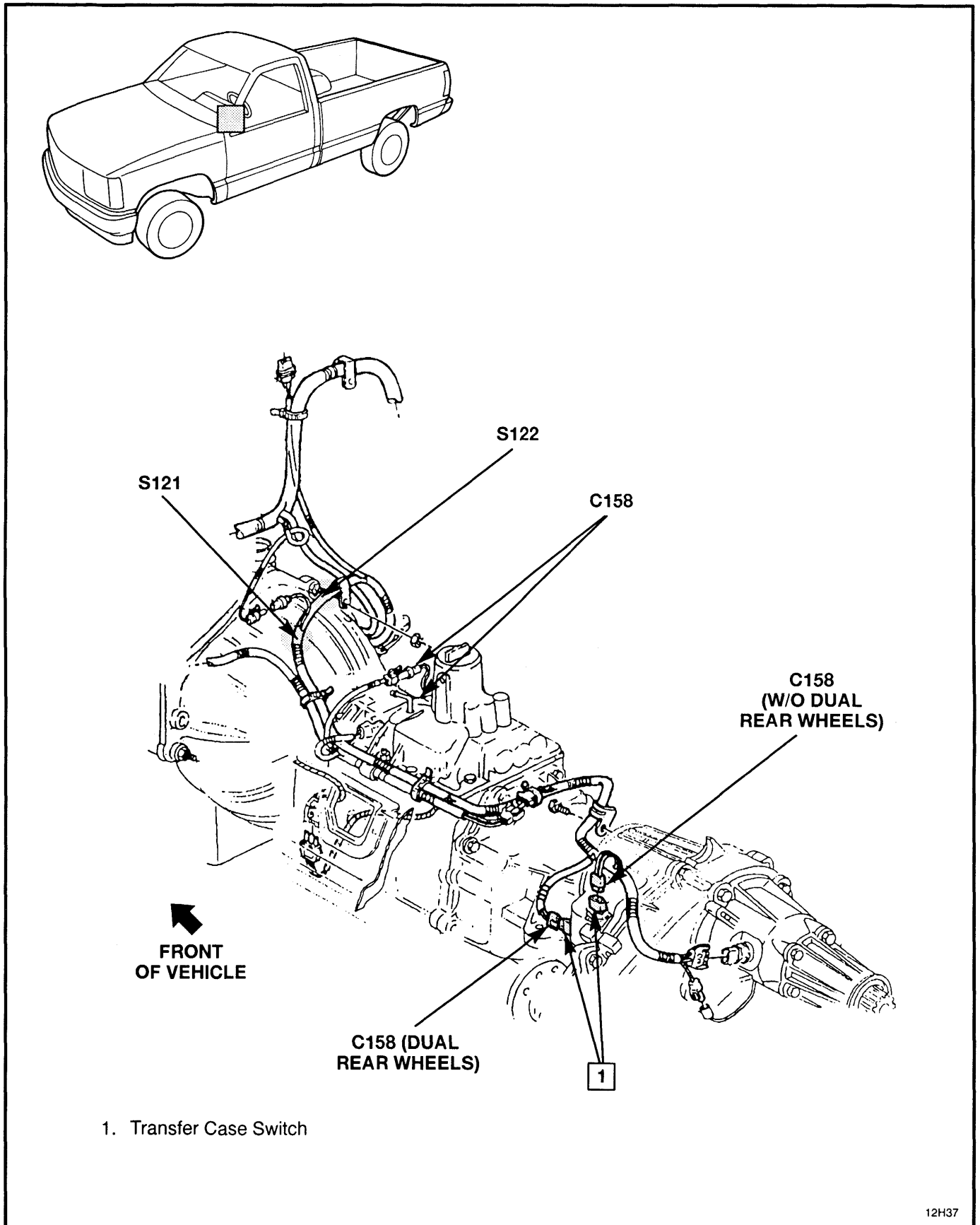


Figure 6 — Transmission Wiring, Heavy Duty — 4-Speed, W/Overdrive Auto Trans

**BLANK**

## CIRCUIT OPERATION

When the Horn Button is depressed, one side of the coil of the Horn Relay is grounded. The relay is energized. Its contacts close and battery voltage is supplied to the Horns.

## COMPONENT LOCATION

### Page — Figure

|                             |                                        |           |   |
|-----------------------------|----------------------------------------|-----------|---|
| Convenience Center .....    | Under LH side of I/P .....             | 40-6      | 3 |
| Horn Relay .....            | At convenience center .....            | 40-6      | 3 |
| Horn, LH .....              | At front of vehicle .....              | 40-5      | 1 |
| Horn, RH .....              | At front of vehicle .....              | 40-5      | 1 |
| Multi-Function Switch ..... | LH upper side of steering column ..... | Not Shown |   |

## CONNECTORS:

|            |                             |      |   |
|------------|-----------------------------|------|---|
| C100 ..... | At bulkhead connector ..... | 40-5 | 2 |
| C102 ..... | At bulkhead connector ..... | 40-5 | 2 |

## GROUNDING:

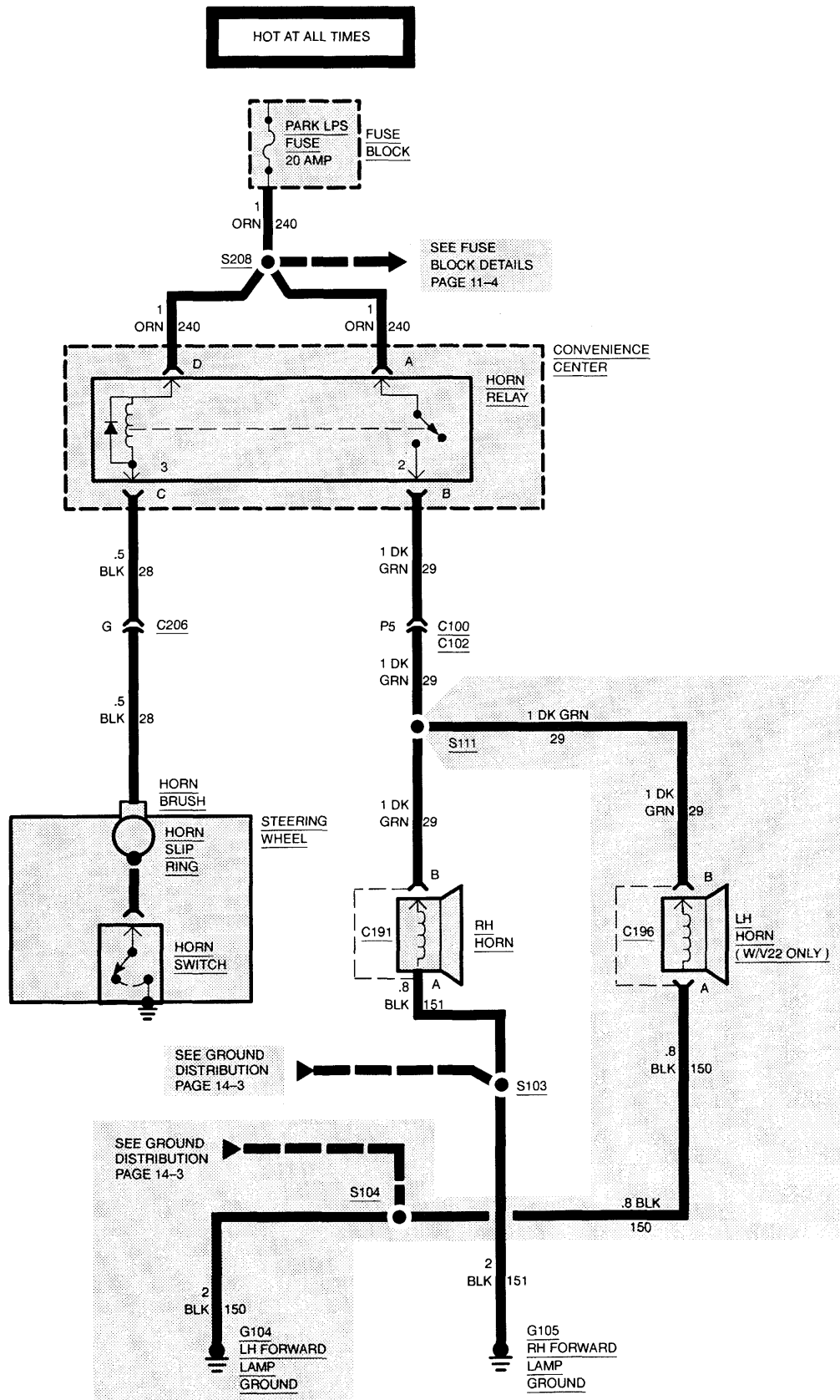
|            |                                         |      |   |
|------------|-----------------------------------------|------|---|
| G104 ..... | On sheet metal, above LH headlamp ..... | 40-5 | 1 |
| G105 ..... | RH inner fender, near battery .....     | 40-5 | 1 |

## SPLICES:

|            |                                                      |           |   |
|------------|------------------------------------------------------|-----------|---|
| S103 ..... | RH side, near headlamp .....                         | 40-5      | 1 |
| S104 ..... | LH side, near headlamp .....                         | 40-5      | 1 |
| S111 ..... | Forward lamp harness, near LH side of radiator ..... | Not Shown |   |
| S208 ..... | Under LH side of I/P .....                           | 40-7      | 4 |



# 8A-40-2 HORN



## DIAGNOSIS — HORNS

### PRELIMINARY CHECKS:

1. Check condition of PARK LPS Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

#### HORN(S) WILL NOT OPERATE

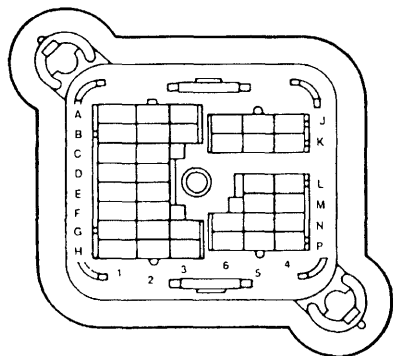
| TEST                                                                                                                                 | RESULT                                              | ACTION                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------|
| 1. Connect test lamp from DK GRN (29) wire at horn connector C191 (C196 dual horn) to ground. Press horn button.                     | Test lamp lights.                                   | GO to step 2.                                                                  |
|                                                                                                                                      | Test lamp does not light.                           | GO to step 3.                                                                  |
| 2. Connect test lamp from DK GRN (29) wire and BLK (150 or 151) at horn connector C191 (C196 dual horn) to ground.                   | Test lamp lights.                                   | REPLACE horn(s).                                                               |
|                                                                                                                                      | Test lamp does not light.                           | LOCATE and REPAIR open in BLK (150 or 151) wire(s).                            |
| 3. Remove horn relay. Connect test lamp from ORN (240) wires at convenience center to ground. Check each wire for voltage.           | Test lamp lights at both connections.               | GO to step 4.                                                                  |
|                                                                                                                                      | Test lamp does not light at one or both connection. | LOCATE and REPAIR open in ORN (240) wire(s).                                   |
| 4. Disconnect multi-function switch connector C206. Use jumper wire to ground BLK (28) wire at multi-function switch connector C206. | Horn does not sound.                                | GO to step 5.                                                                  |
|                                                                                                                                      | Horn sounds.                                        | REPLACE horn button.                                                           |
| 5. Disconnect horn relay. Install jumper wire from ORN (240) terminal to DK GRN (29) terminal at convenience center.                 | Horn sounds.                                        | REPLACE horn relay.                                                            |
|                                                                                                                                      | Horn does not sound.                                | LOCATE and REPAIR open in DK GRN (29) wire from convenience center to horn(s). |

#### HORN SOUNDS CONTINUOUSLY WITHOUT DEPRESSING HORN SWITCH

| TEST                                                                                   | RESULT                   | ACTION                         |
|----------------------------------------------------------------------------------------|--------------------------|--------------------------------|
| 1. Disconnect multi-function switch connector C206.                                    | Horn stops.              | REPLACE horn button.           |
|                                                                                        | Horn continues to sound. | GO to step 2.                  |
| 2. Disconnect horn relay. Check for short to ground in DK GRN (29) and BLK (28) wires. | No short(s) found.       | REPLACE relay.                 |
|                                                                                        | Short(s) found.          | REPAIR or REPLACE as required. |

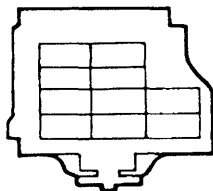
8A-40-4 HORN

12020184



GRAY  
Metri-Pack  
C100  
Bulkhead Connector – I/P

12020100



C102  
Bulkhead – Forward Lamps

12052644



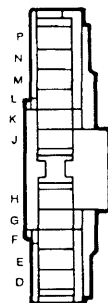
GRAY  
Metri-Pack 150  
C191  
RH Horn

12052644



GRAY  
Metri-Pack 150  
C196  
LH Horn

12004147



BLACK  
Pac/on  
C206  
I/P to Multi-Function Switch

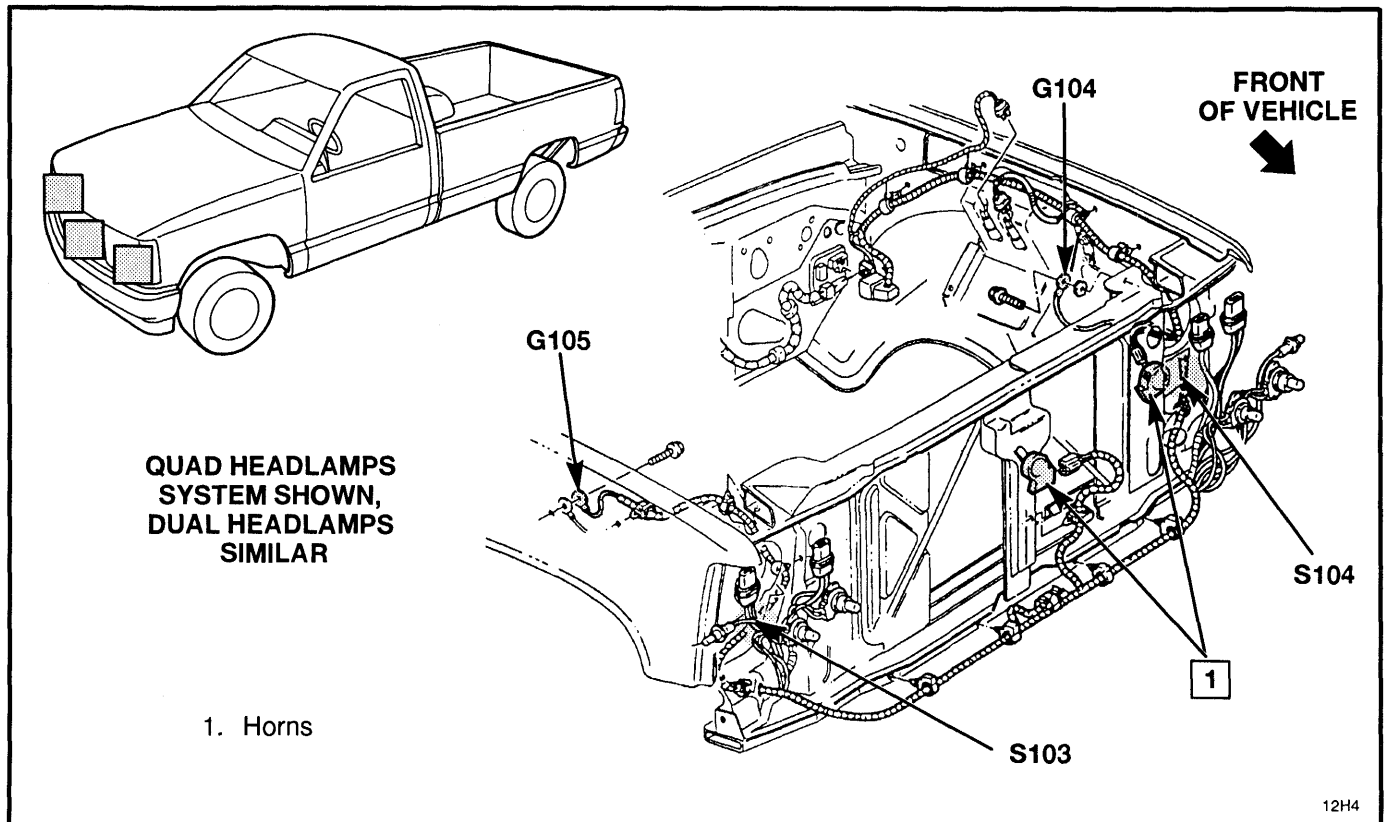


Figure 1 — Forward Lamp Harness, Quad Headlamps

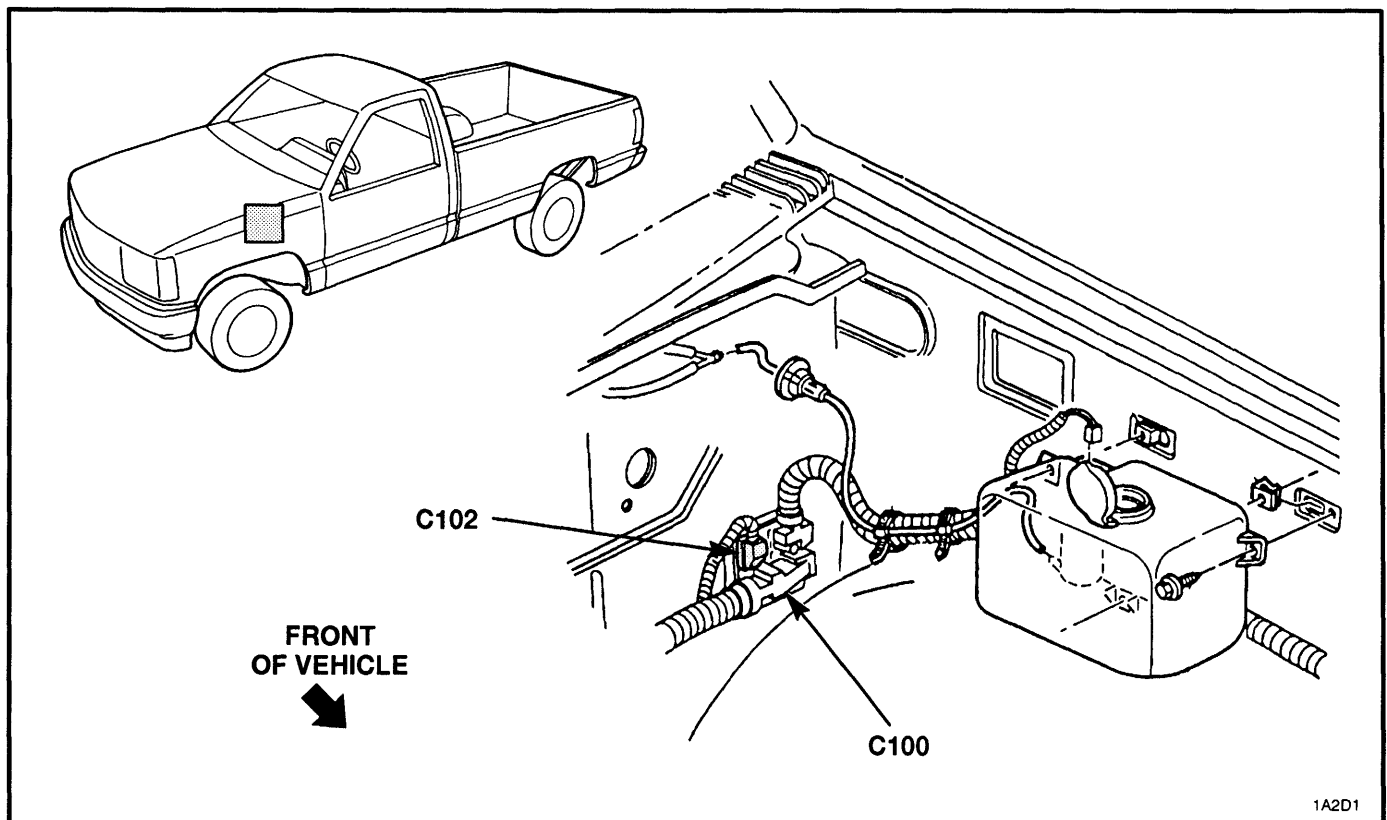


Figure 2 — I/P Wiring

## 8A-40-6 HORN

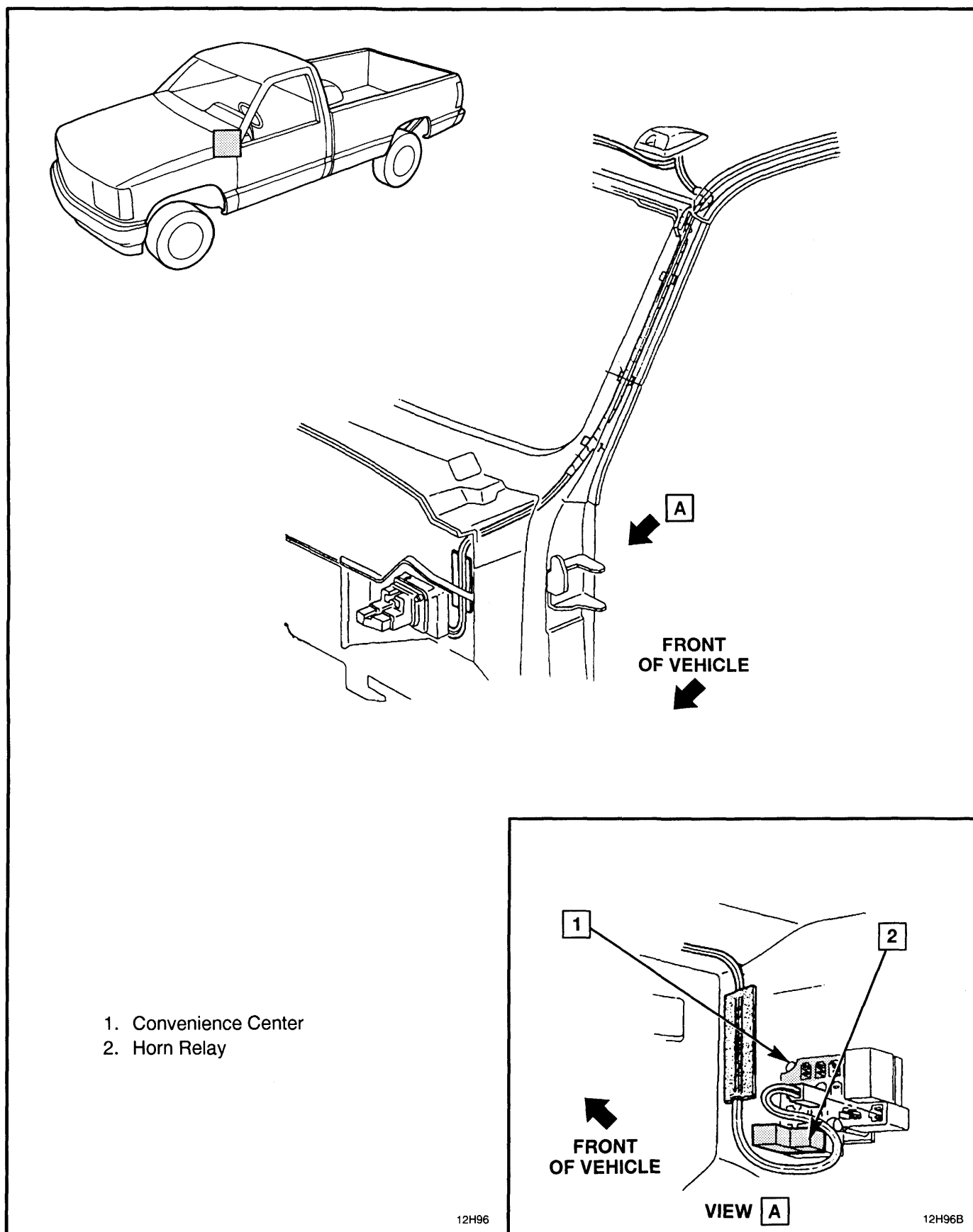


Figure 3 — Convenience Center Wiring

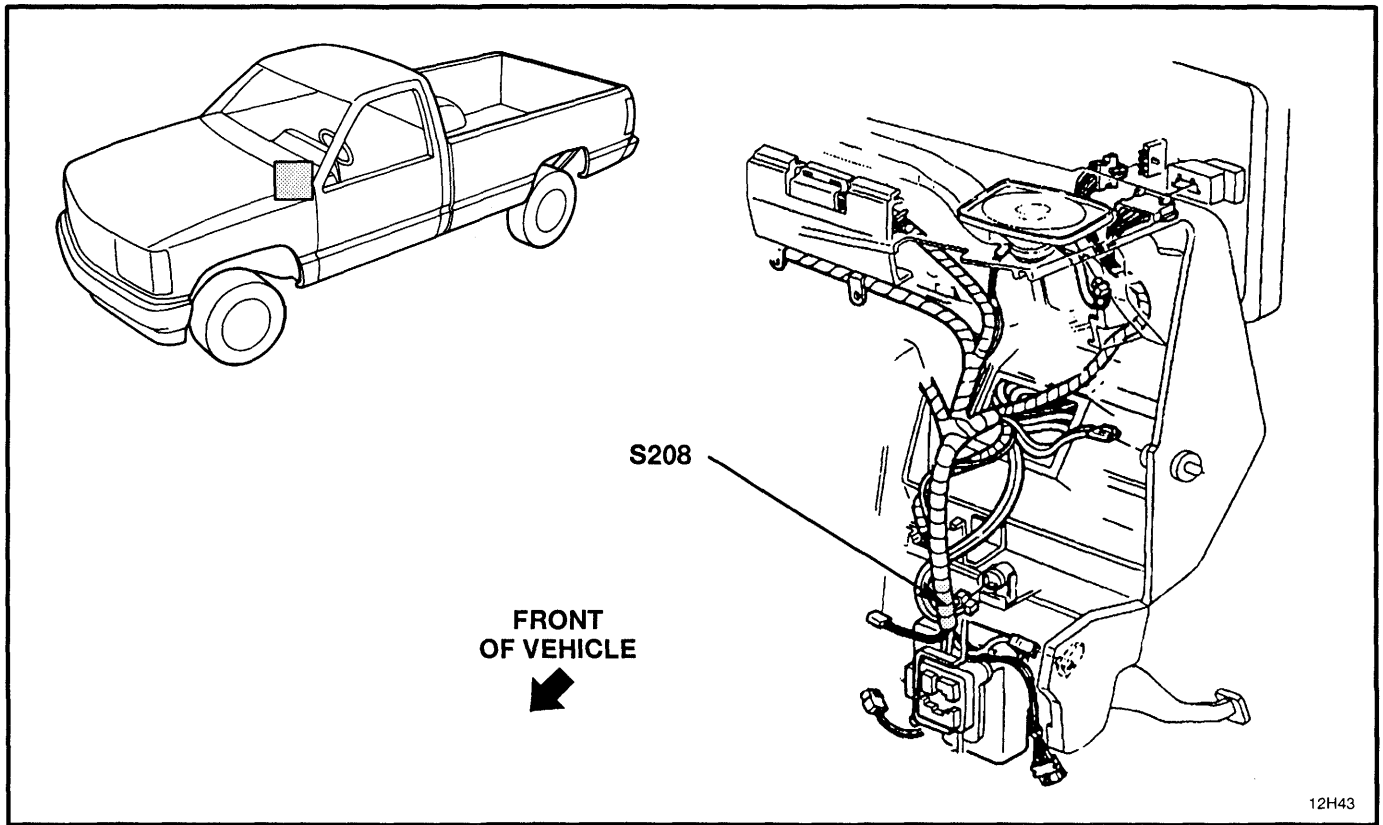


Figure 4 — LH Side of Instrument Panel

**BLANK**

## **CIRCUIT OPERATION**

Battery voltage is supplied to the BRAKE Indicator when the Ignition Switch is in RUN or START. Three Switches are connected to the BRAKE Indicator. When any one of these Switches closes, ground is provided and the Indicator lights. The BRAKE Indicator is also connected to the Electronic Rear-Wheel and Four-Wheel Brake Control Modules.

The Park Brake Warning Switch provides a ground when the Park Brake is applied. The Park Brake Warning Indicator lights to alert the driver.

When the ignition switch is turned to the BULB TEST Position the Brake Warning Lamp lights.

The Brake Pressure Warning Switch closes to light the Brake Warning Indicator when there is low brake fluid pressure in one of the two hydraulic brake systems. This

could be caused by a leak in one of the brake lines. Refer to Section 5A in the 1994 C/K Service Manual for switch reset procedure. This can only be accomplished after the faulty system has been repaired.

The Electronic Rear-Wheel Brake Control Module grounds the BRAKE Indicator when the Module senses a fault in the Antilock Brake System. For Rear-Wheel Anti-lock Brake Diagnosis refer to Section 5E3 in the 1994 C/K Service Manual.

The Electronic Four-Wheel Antilock Brake Control Module grounds the brake warning indicator and the Antilock brake warning indicator lamps when the module senses a fault in the Antilock Brake System. For Four-Wheel Antilock Brake Diagnosis refer to Section 5E1 in the 1994 Service Manual.

## **COMPONENT LOCATION**

### **Page — Figure**

|                                       |                                                       |           |   |
|---------------------------------------|-------------------------------------------------------|-----------|---|
| Brake Pressure Warning Switch . . . . | Below master cylinder, at combination valve . . . . . | Not Shown |   |
| Park Brake Warning Switch . . . . .   | At park brake, under LH end of I/P . . . . .          | 41-8      | 3 |
| Ignition Switch . . . . .             | Lower LH side of steering column . . . . .            | 41-7      | 2 |
| I/P Cluster . . . . .                 | LH side of I/P . . . . .                              | Not Shown |   |

## **CONNECTORS:**

|                |                                 |      |   |
|----------------|---------------------------------|------|---|
| C100 . . . . . | At bulkhead connector . . . . . | 41-8 | 3 |
|----------------|---------------------------------|------|---|

## **DIODES:**

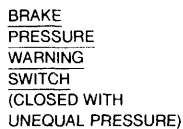
|                |                                 |      |   |
|----------------|---------------------------------|------|---|
| D200 . . . . . | Behind LH side of I/P . . . . . | 41-8 | 3 |
| D201 . . . . . | Behind LH side of I/P . . . . . | 41-8 | 3 |

## **SPLICES:**

|                |                                                              |           |   |
|----------------|--------------------------------------------------------------|-----------|---|
| S118 . . . . . | Engine harness, near cowl LH rear engine compartment . . . . | 41-7      | 1 |
| S133 . . . . . | LH rear engine compartment, near bulkhead connector . . . .  | Not Shown |   |
| S202 . . . . . | Under LH side of I/P . . . . .                               | 41-7      | 2 |
| S213 . . . . . | Under LH side of I/P . . . . .                               | 41-8      | 3 |
| S250 . . . . . | At in-line diode, near bulkhead connector . . . . .          | 41-8      | 3 |
| S252 . . . . . | At in-line diode, near bulkhead connector . . . . .          | 41-8      | 3 |
| S253 . . . . . | Under LH side of I/P . . . . .                               | 41-8      | 3 |
| S254 . . . . . | Under LH side of I/P . . . . .                               | 41-8      | 3 |



**WITH DAYTIME RUNNING LAMPS**



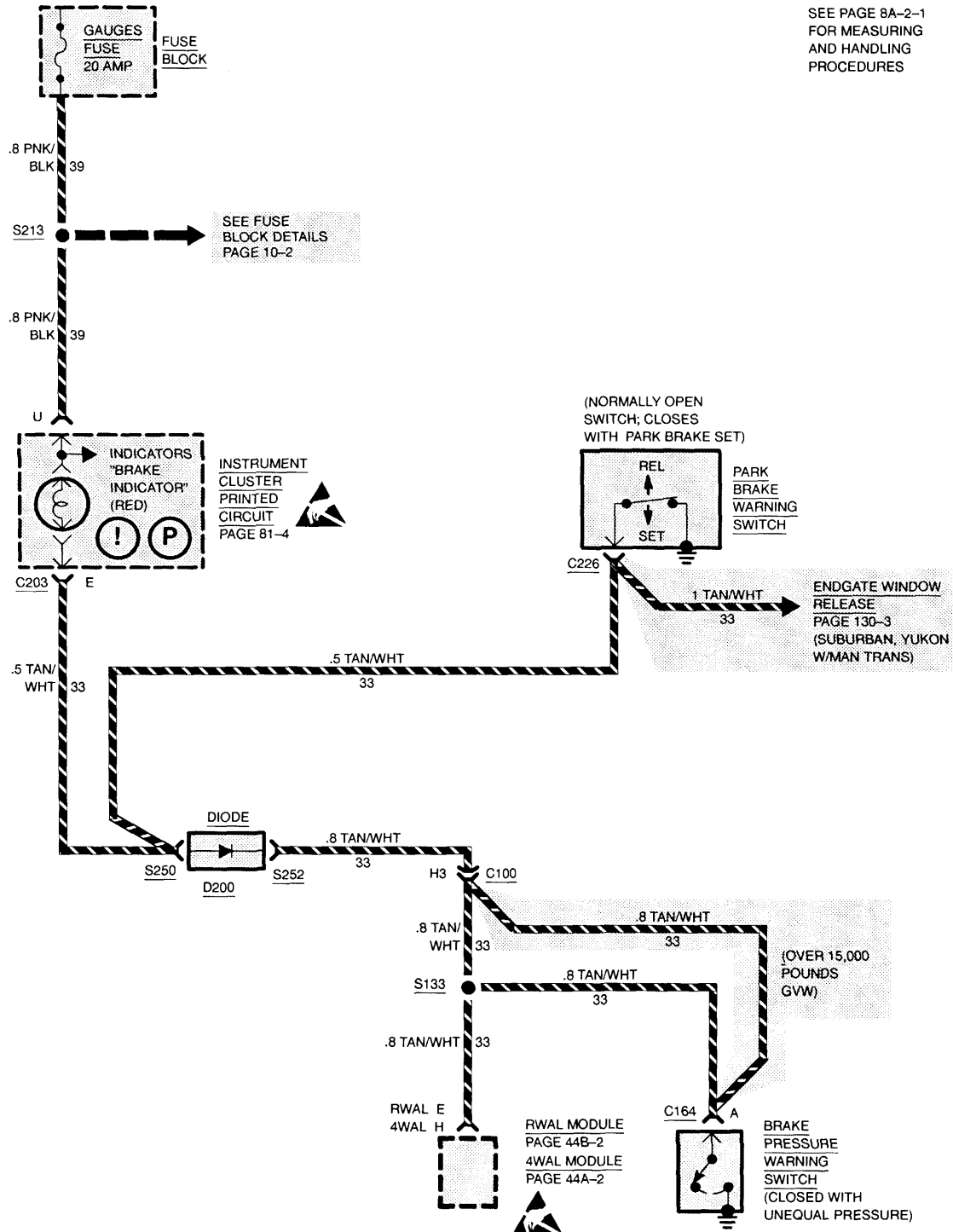
# BRAKE WARNING SYSTEM 8A-41-3

## WITHOUT DAYTIME RUNNING LAMPS

HOT IN RUN, BULB TEST OR START



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## 8A-41-4 BRAKE WARNING SYSTEM

### DIAGNOSIS — BRAKE SYSTEMS

#### PRELIMINARY CHECKS:

1. Check condition of GAUGES Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

#### BRAKE INDICATOR REMAINS ON WITH IGNITION SWITCH IN RUN AND PARK BRAKE OFF

| TEST                                                                                   | RESULT                                 | ACTION                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect park brake switch connector C226.                                        | Brake indicator lamp does not go out.  | GO to step 2.                                                                                                                                                                                                                                                                                                                      |
|                                                                                        | Brake indicator lamp goes out.         | CHECK adjustment of park brake switch. If adjustment cannot be corrected, REPLACE brake switch.                                                                                                                                                                                                                                    |
| 2. Disconnect brake pressure warning switch connector C164.                            | Brake indicator lamp does not go out.  | GO to step 3.                                                                                                                                                                                                                                                                                                                      |
|                                                                                        | Brake indicator lamp goes out.         | CHECK for a possible leak or loss of fluid in the brake system.                                                                                                                                                                                                                                                                    |
| 3. Disconnect electronic four-wheel or rear-wheel brake control module connector C159. | Brake indicator lamp does not go out.  | LOCATE and REPAIR short in TAN/WHT (33) wire between four-wheel or rear-wheel antilock module connector C159 or brake pressure warning switch connector C164 and splice S133 or between splice S133 and in-line diode splice S252 or between diode splice S250 and park brake switch connector C226 or I/P cluster connector C203. |
|                                                                                        | Brake warning indicator lamp goes out. | CHECK for an inoperative antilock brake system. Refer to Section 5A in the 1994 C/K Service Manual for circuit diagnosis.                                                                                                                                                                                                          |

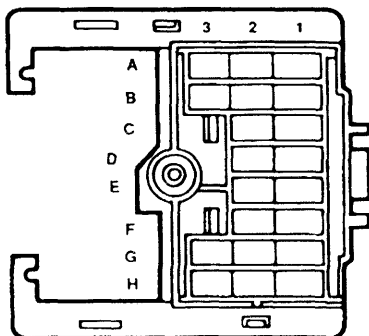
## BRAKE WARNING SYSTEM 8A-41-5

### BRAKE INDICATOR DOES NOT LIGHT DURING A WARNING CONDITION OR DURING THE ANTILOCK SYSTEM CHECK

| TEST                                                                                                                                                                            | RESULT                                 | ACTION                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect park brake warning switch connector C226. Connect fused jumper from park brake switch connector C226 to ground.                                                   | Brake indicator lamp does not come on. | GO to step 2.                                                                                                                                                                                                                                                                                                             |
|                                                                                                                                                                                 | Brake indicator lamp does come on.     | CHECK adjustment of park brake warning switch. If adjustment cannot be corrected, REPLACE park brake warning switch.                                                                                                                                                                                                      |
| 2. Disconnect brake pressure warning switch connector C164. Connect fused jumper from TAN/WHT (33) wire at park brake warning switch connector C226 to ground.                  | Brake indicator lamp does not come on. | GO to step 3.                                                                                                                                                                                                                                                                                                             |
|                                                                                                                                                                                 | Brake indicator lamp does come on.     | REPLACE brake pressure warning switch.                                                                                                                                                                                                                                                                                    |
| 3. Disconnect electronic four-wheel or rear-wheel brake control module connector C159. Connect fused jumper from TAN/WHT (33) wire at antilock module connector C159 to ground. | Brake indicator lamp does not come on. | LOCATE and REPAIR open in TAN/WHT (33) wire between four-wheel or rear-wheel antilock module connector C159, brake pressure warning switch connector C164 and splice S133 or between splice S133 and in-line diode splice S252 or between splice S250 and park brake switch connector C226 or I/P cluster connector C203. |
|                                                                                                                                                                                 | Brake indicator lamp does come on.     | CHECK for an inoperative antilock brake system. Refer to Section 5A in the 1994 C/K Service Manual for circuit diagnosis.                                                                                                                                                                                                 |

# 8A-41-6 BRAKE WARNING SYSTEM

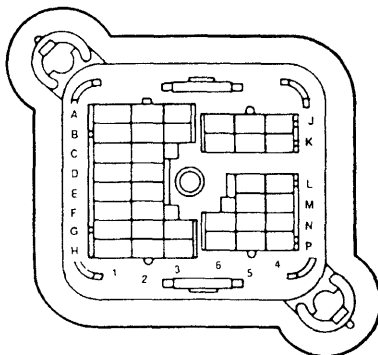
12020183



GRAY  
Metri-Pack

**C100**  
**Bulkhead Connector - Eng**

12020184



GRAY  
Metri-Pack

**C100**  
**Bulkhead Connector - I/P**

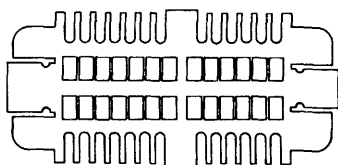
12004635



CREAM  
Molded on

**C164**  
**Brake Pressure Warning Switch**

12089908



BLACK  
Bow Series

**C203**  
**I/P Cluster**

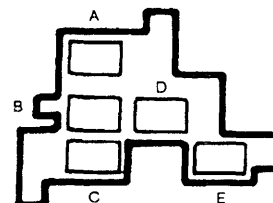
12004267



BLACK  
56 Series

**C226**  
**Park Brake Switch**

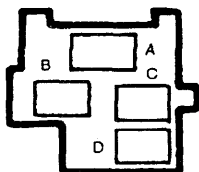
12010966



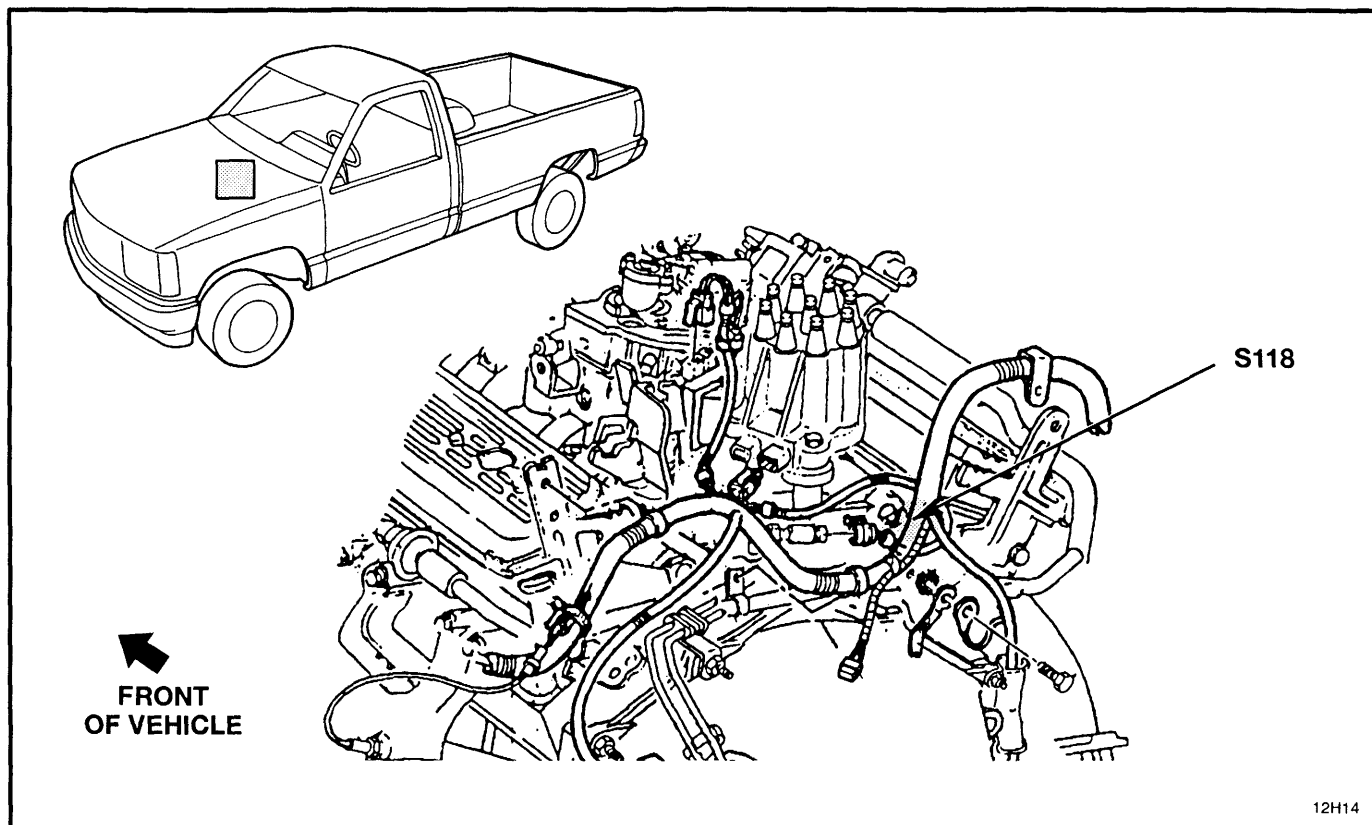
BLUE  
56 Series

**C255**  
**Ignition Switch**

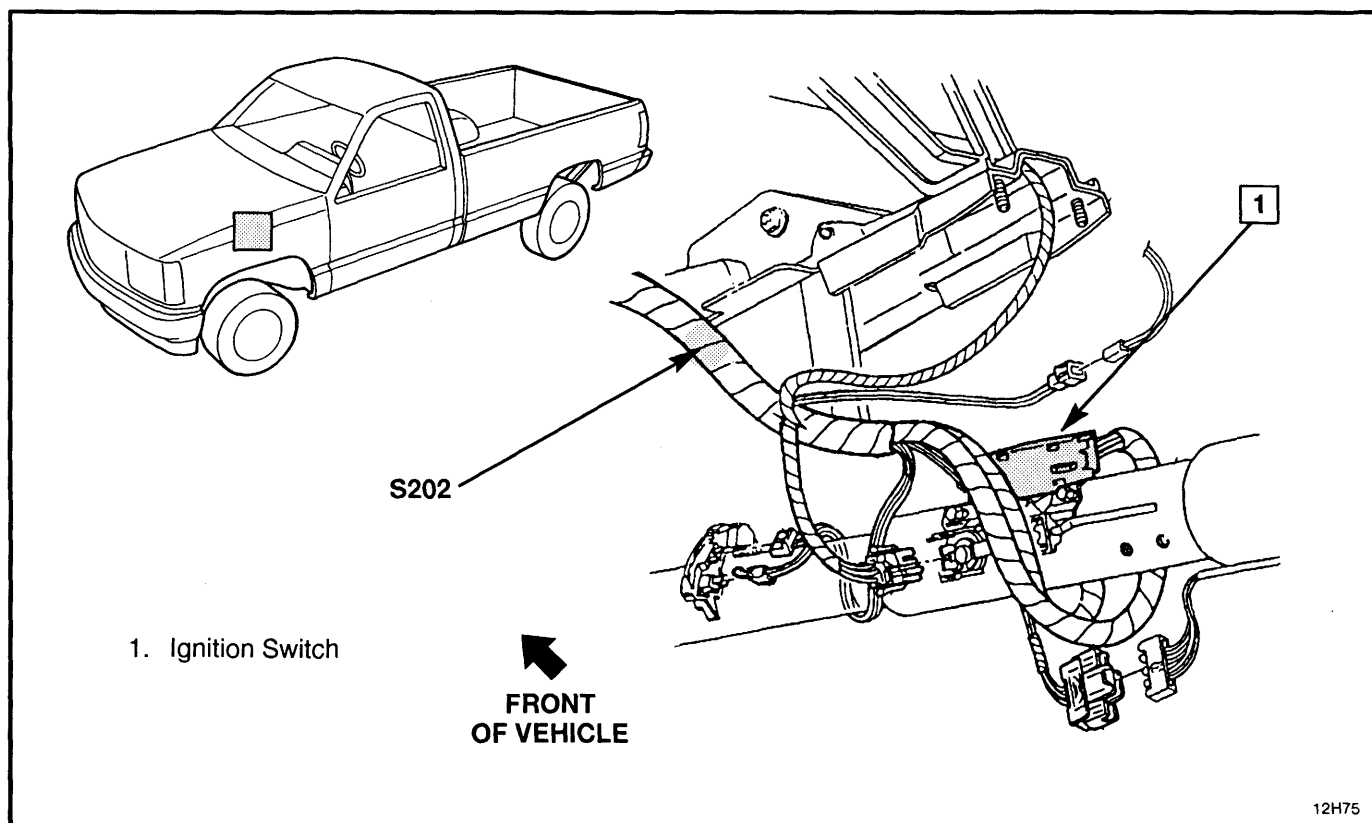
06294641



BLACK  
56 Series  
**C256**  
**Ignition Switch**



**Figure 1 — LH Side of Engine, 5.0L (305 CID) and 5.7L (350 CID) — Gasoline Engines**



**Figure 2 — LH Side of Steering Column Wiring**

## 8A-41-8 BRAKE WARNING SYSTEM

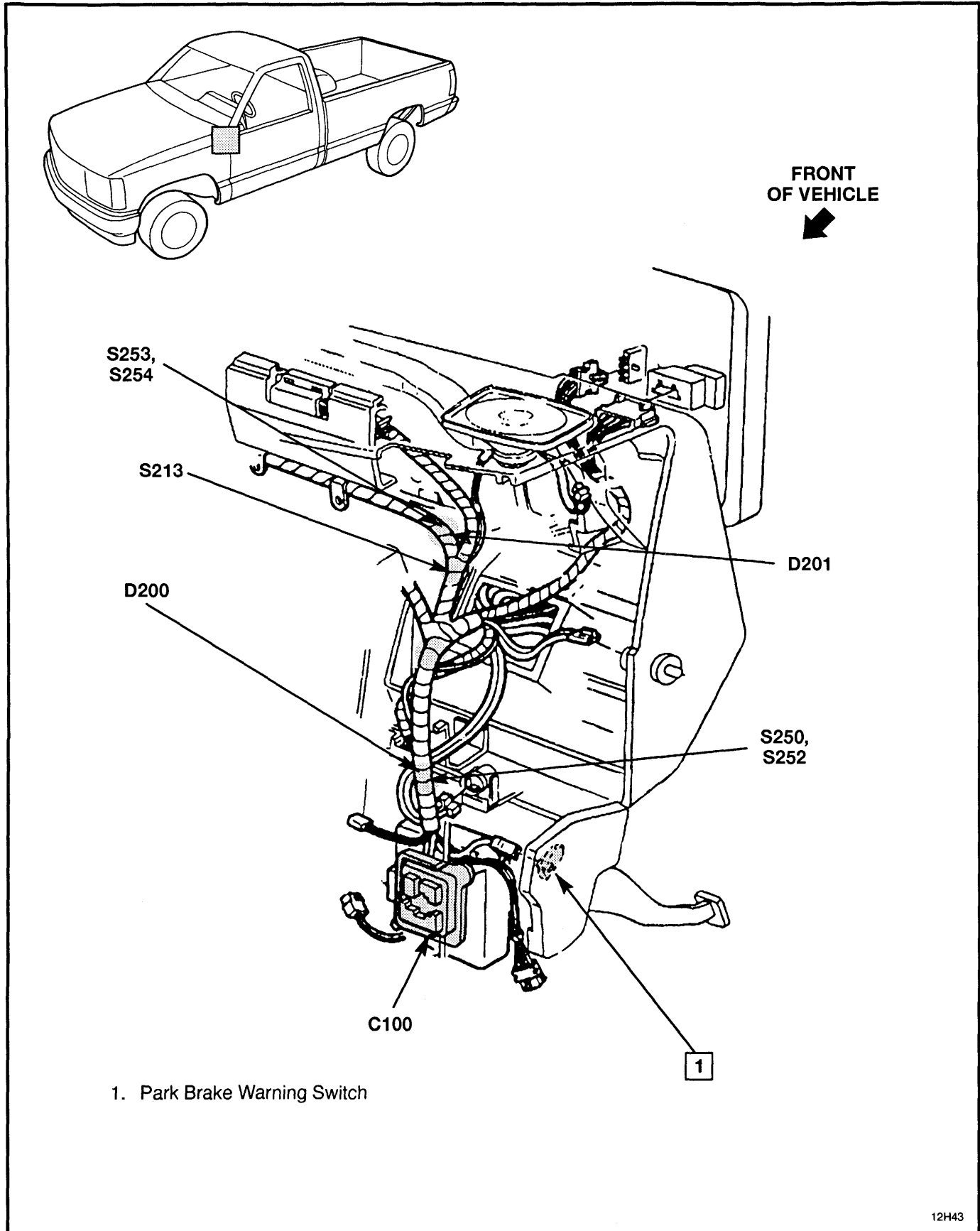


Figure 3 — LH Side of Instrument Panel

# FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM 8A-44A-1

## CIRCUIT OPERATION

Battery voltage is supplied to the BRAKE Indicator when the Ignition Switch is in RUN or START. Three Switches are connected to the BRAKE Indicator. When any one of these Switches closes, ground is provided and the Indicator lights. The BRAKE Indicator is also connected to the Electronic Four-Wheel Brake Control Module.

The Park Brake Warning Indicator Switch provides a ground when the Park Brake is applied. The Park Brake Warning Indicator lights to alert the driver.

When the ignition switch is turned to the BULB TEST Position the Brake Warning Lamp lights.

The Brake Pressure Warning Switch closes to light the Brake Warning Indicator when there is low brake fluid pressure in one of the two hydraulic brake systems. This could be caused by a leak in one of the brake lines. Refer to Section 5A in the 1994 C/K Service Manual for switch reset procedure. This can only be accomplished after the faulty system has been repaired.

The Electronic Four-Wheel Antilock Brake Control Module grounds the brake warning indicator and the Antilock brake warning indicator lamps when the module senses a fault in the Antilock Brake System. For Four-Wheel Antilock Brake Diagnosis refer to Section 5E1 in the 1994 Service Manual.

## COMPONENT LOCATION

### Page — Figure

|                                  |                                             |           |   |
|----------------------------------|---------------------------------------------|-----------|---|
| Battery Junction Block           | RH rear engine compartment, at cowl         | 44A-7     | 3 |
| Brake Pressure Warning Switch    | Below master cylinder, at combination valve | Not Shown |   |
| DLC                              | Under LH side of I/P                        | 44A-8     | 5 |
| Four-Wheel Antilock Brake Module | Near master cylinder                        | Not Shown |   |
| Fuse Block                       | Under LH side of I/P                        | 44A-8     | 5 |
| TCC/Stoplamp Switch              | Top of brake pedal                          | 44A-6     | 2 |
| Wheel Sensor, LH Front           | At LH front wheel                           | Not Shown |   |
| Wheel Sensor, RH Front           | At RH front wheel                           | Not Shown |   |

## CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C100  | At bulkhead connector                   | 44A-8     | 5 |
| C134A | At LH front wheel sensor                | Not Shown |   |
| C135A | At RH front wheel sensor                | Not Shown |   |
| C160  | LH lower side of engine                 | 44A-6     | 1 |
| C200  | Under RH side of I/P, near blower motor | 44A-7     | 4 |
| C267  | Under LH side of I/P                    | 44A-7     | 4 |

## GROMMETS:

|      |         |       |   |
|------|---------|-------|---|
| P101 | RH cowl | 44A-7 | 4 |
|------|---------|-------|---|

## GROUND:

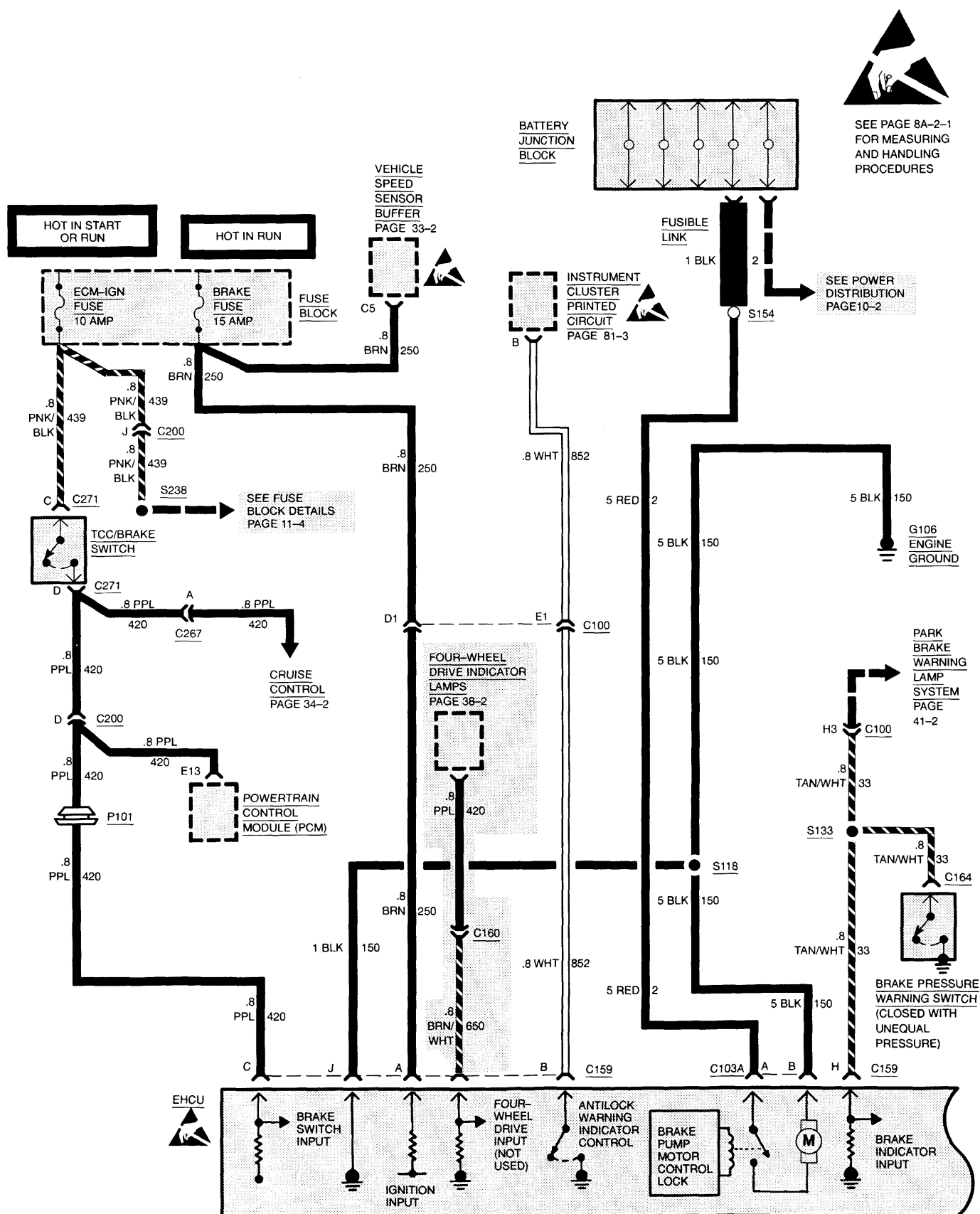
|                    |                          |       |   |
|--------------------|--------------------------|-------|---|
| G106 (All Engines) | Rear of RH cylinder head | 44A-6 | 1 |
|--------------------|--------------------------|-------|---|

## SPLICES:

|      |                                                      |           |   |
|------|------------------------------------------------------|-----------|---|
| S118 | Engine harness, near cowl LH rear engine compartment | 44A-6     | 1 |
| S133 | LH rear engine compartment, near bulkhead connector  | Not Shown |   |
| S154 | Center of cowl, below battery junction block         | 44A-7     | 3 |
| S238 | Under LH side of I/P                                 | 44A-7     | 4 |



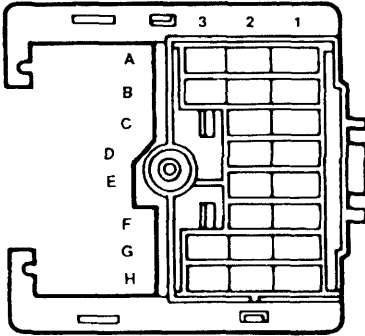
# 8A-44A-2 FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM



The diagram illustrates the wiring for the ECU, showing connections for the Vehicle Speed Sensor Buffer, Left Front Wheel Sensor, and Right Front Wheel Sensor. The ECU is represented by a shaded area at the bottom with terminals F, E, G, B, F, and C. The Vehicle Speed Sensor Buffer is connected to the ECU via a .8 WHT wire (696) and a .8 TAN/WHT wire (799). The Left Front Wheel Sensor is connected to the ECU via a .8 YEL wire (873) and a .8 LT BLU wire (830). The Right Front Wheel Sensor is connected to the ECU via a .8 DK GRN wire (872) and a .8 TAN wire (833). The diagram also shows the Data Link Connector (C2) and the Vehicle Speed Sensor Buffer (C10). The ECU is labeled EHCU.

# 8A-44A-4 FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM

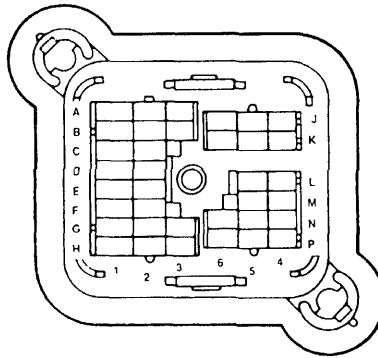
12020183



GRAY  
Metri-Pack

C100  
Bulkhead Connector – Eng

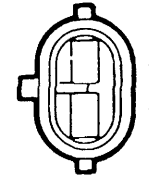
12020184



GRAY  
Metri-Pack

C100  
Bulkhead Connector – I/P

12052647



BLACK  
Metri-Pack

C160  
4WD Indicator In-Line

12052648



GRAY  
Metri-Pack 150

C160  
4WD Indicator In-Line

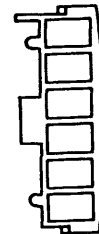
12004635



CREAM  
Molded on

C164  
Brake Pressure Warning Switch

12040551



BLACK  
Metri-Pack 480

C271  
TCC/Brake Switch

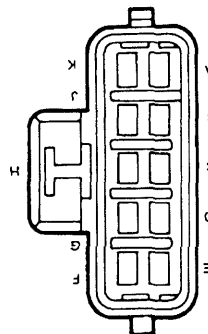
12085030



BLACK  
Metri-Pack

C103A  
4WD Module Pump Motor

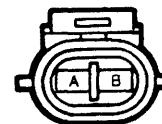
12065425



NATURAL

C159  
4WD Module

12052641



BLACK  
Metri-Pack 150

C134A  
LH Front Wheel Sensor

# FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM 8A-44A-5

12052641



**BLACK**  
Metri-Pack 150  
**C135A**  
**RH Front Wheel Sensor**

## 8A-44A-6 FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM

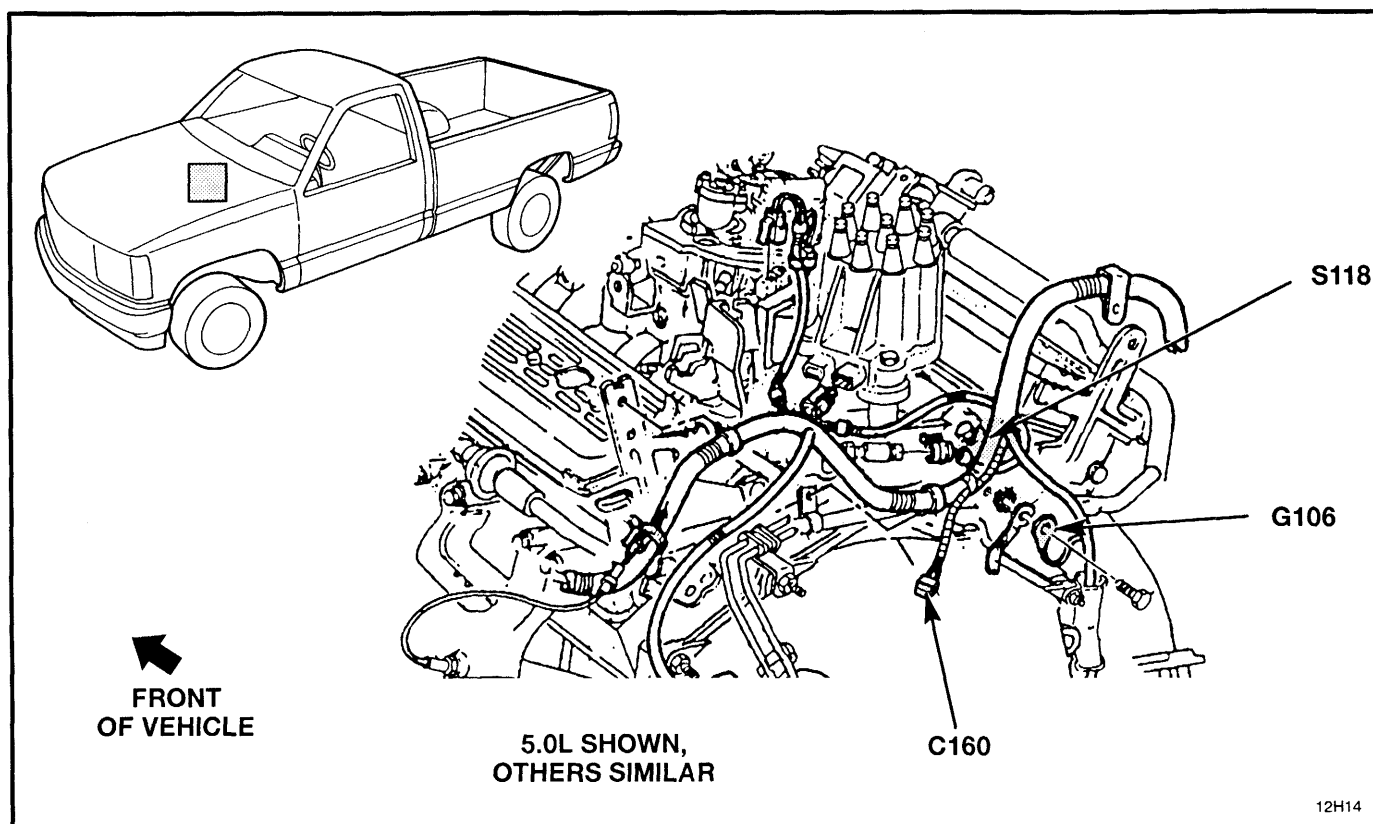


Figure 1 — LH Side of Engine, 5.0L (305 CID) 5.7L (350 CID) — Gasoline Engines

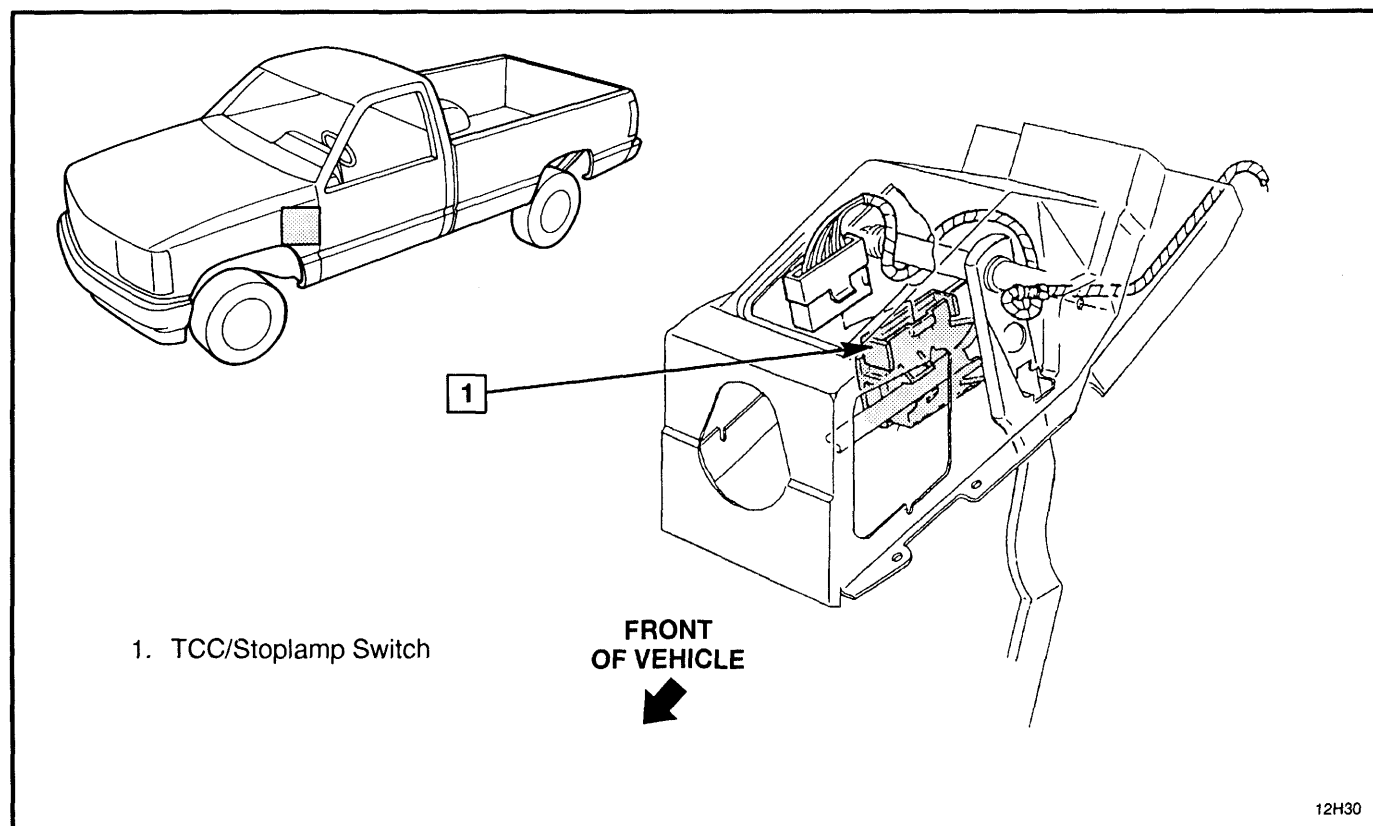


Figure 2 — TCC/Stoplamp Switch

## FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM 8A-44A-7

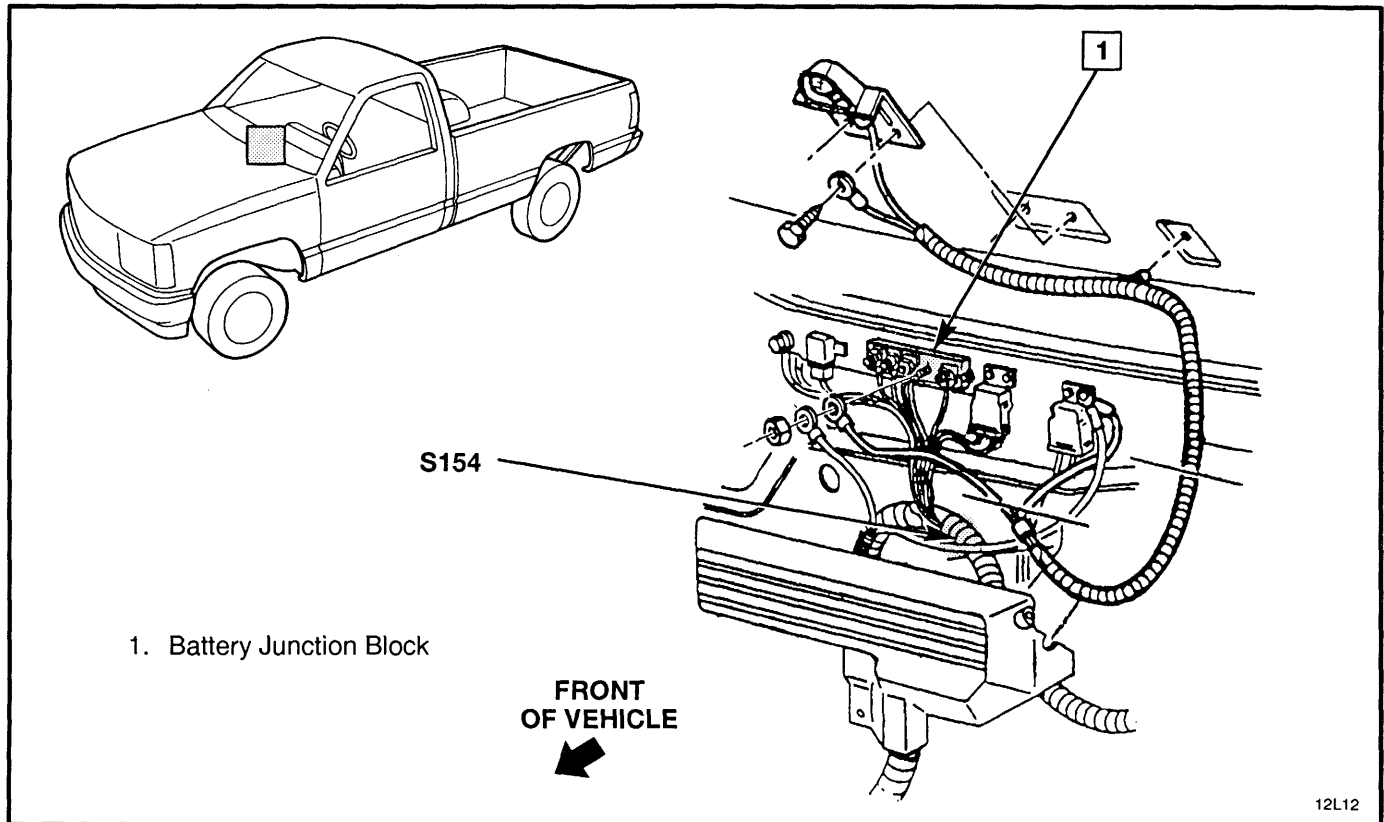


Figure 3 — Junction Block Wiring

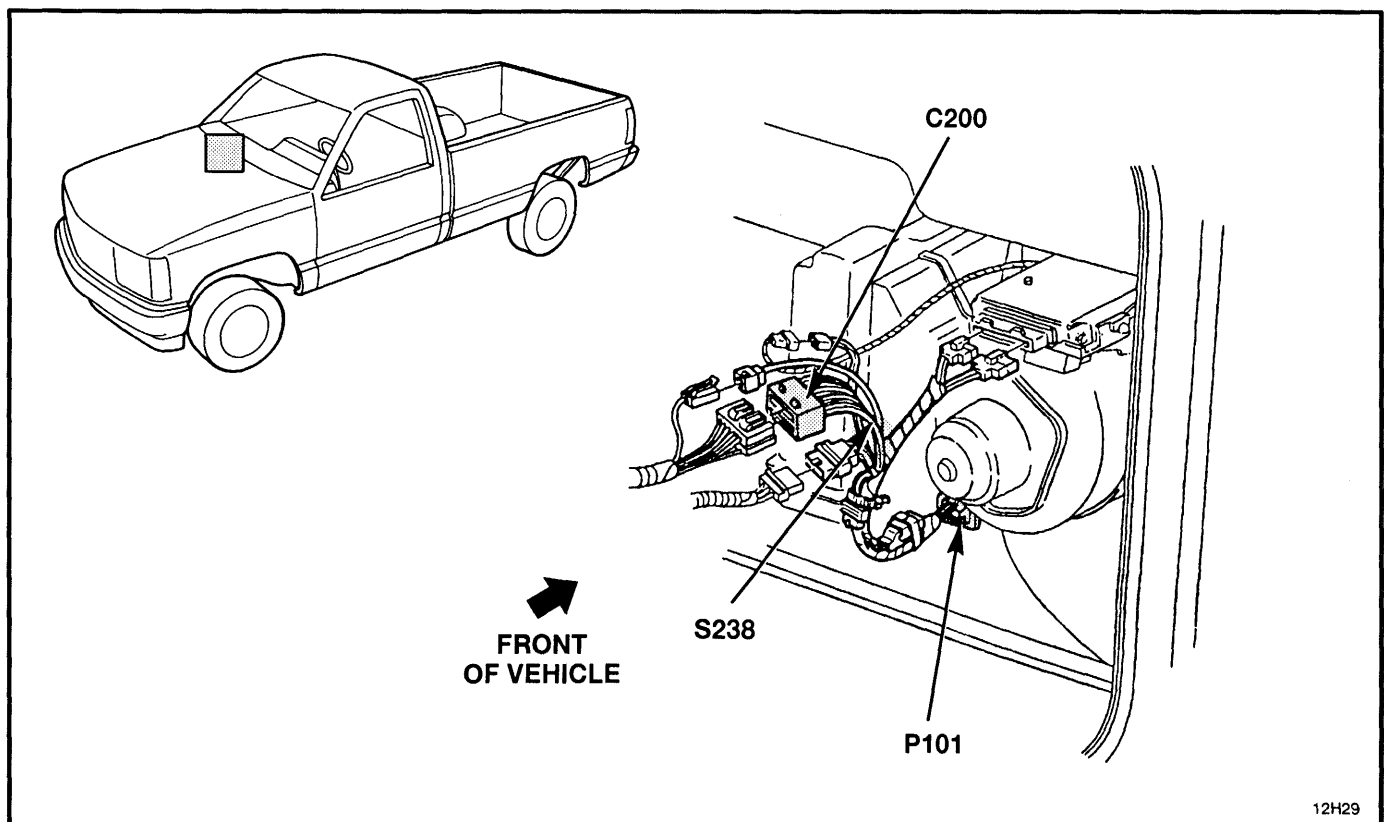


Figure 4 — Behind RH Side of I/P

## 8A-44A-8 FOUR-WHEEL ANTILOCK BRAKE WARNING SYSTEM

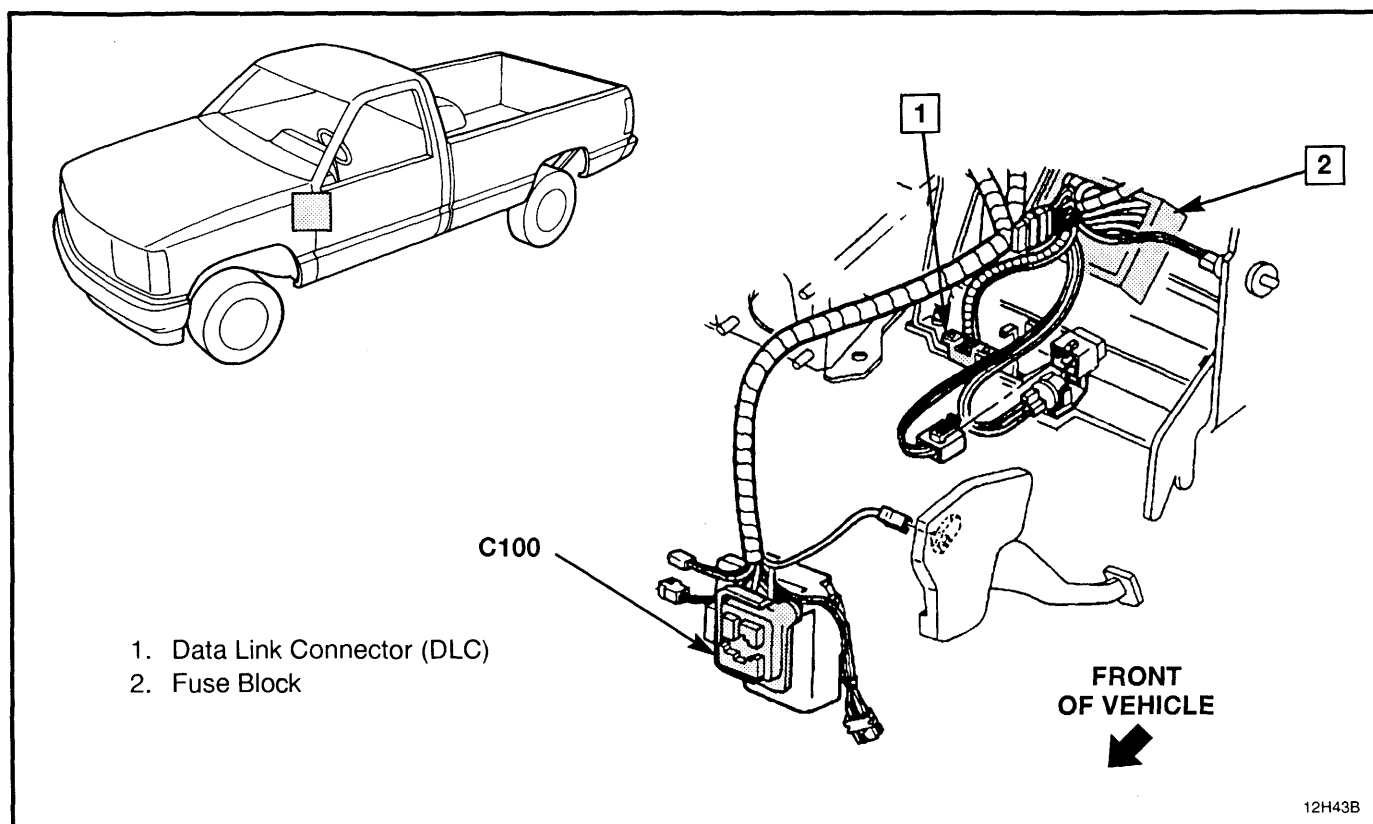


Figure 5 — LH Side of Instrument Panel

## CIRCUIT OPERATION

Battery voltage is supplied to the Brake Indicator when the Ignition Switch is in RUN or START. Three Switches are connected to the Brake Indicator. When any one of these Switches closes, ground is provided and the Indicator lights. The Brake Indicator is also connected to the Ignition Switch with Daytime Running Lamps.

The Park Brake Warning Switch provides a ground when the Park Brake is applied. The Park Brake Warning Indicator lights to alert the driver.

When the ignition switch is turned to the BULB TEST Position the Brake Warning Lamp lights (with Daytime Running Lamps only).

The Brake Pressure Warning Switch closes to light the Brake Warning Indicator when there is low brake fluid pressure in one of the two hydraulic brake systems. This could be caused by a leak in one of the brake lines. Refer to Section 5A in the 1994 C/K Service Manual for switch reset procedure. This can only be accomplished after the faulty system has been repaired.

The Electronic Rear-Wheel Brake Control Module grounds the Brake Indicator when the Module senses a fault in the Antilock Brake System. For Rear-Wheel Antilock Brake Diagnosis refer to Section 5E3 in the 1994 C/K Service Manual.

## COMPONENT LOCATION

### Page — Figure

|                               |                                             |           |   |
|-------------------------------|---------------------------------------------|-----------|---|
| ABS Diode Module              | Under LH side of I/P                        | Not Shown |   |
| Brake Pressure Warning Switch | Below master cylinder, at combination valve | 44B-5     | 3 |
| Fuse Block                    | Under LH side of I/P                        | 44B-6     | 4 |
| Park Brake Warning Switch     | At park brake, under LH end of I/P          | 44B-6     | 4 |
| RWAL Module                   | LH rear engine compartment                  | 44B-5     | 3 |
| TCC/Stoplamp Switch           | Top of brake pedal                          | 44B-4     | 2 |

## CONNECTORS:

|      |                                         |       |   |
|------|-----------------------------------------|-------|---|
| C100 | At bulkhead connector                   | 44B-5 | 3 |
| C200 | Under RH side of I/P, near blower motor | 44B-7 | 5 |

## DIODES:

|      |                 |       |   |
|------|-----------------|-------|---|
| D200 | In diode module | 44B-6 | 4 |
| D201 | In diode module | 44B-6 | 4 |

## GROMMETS:

|      |               |       |   |
|------|---------------|-------|---|
| P101 | RH lower cowl | 44B-5 | 3 |
|------|---------------|-------|---|

## GROUND:

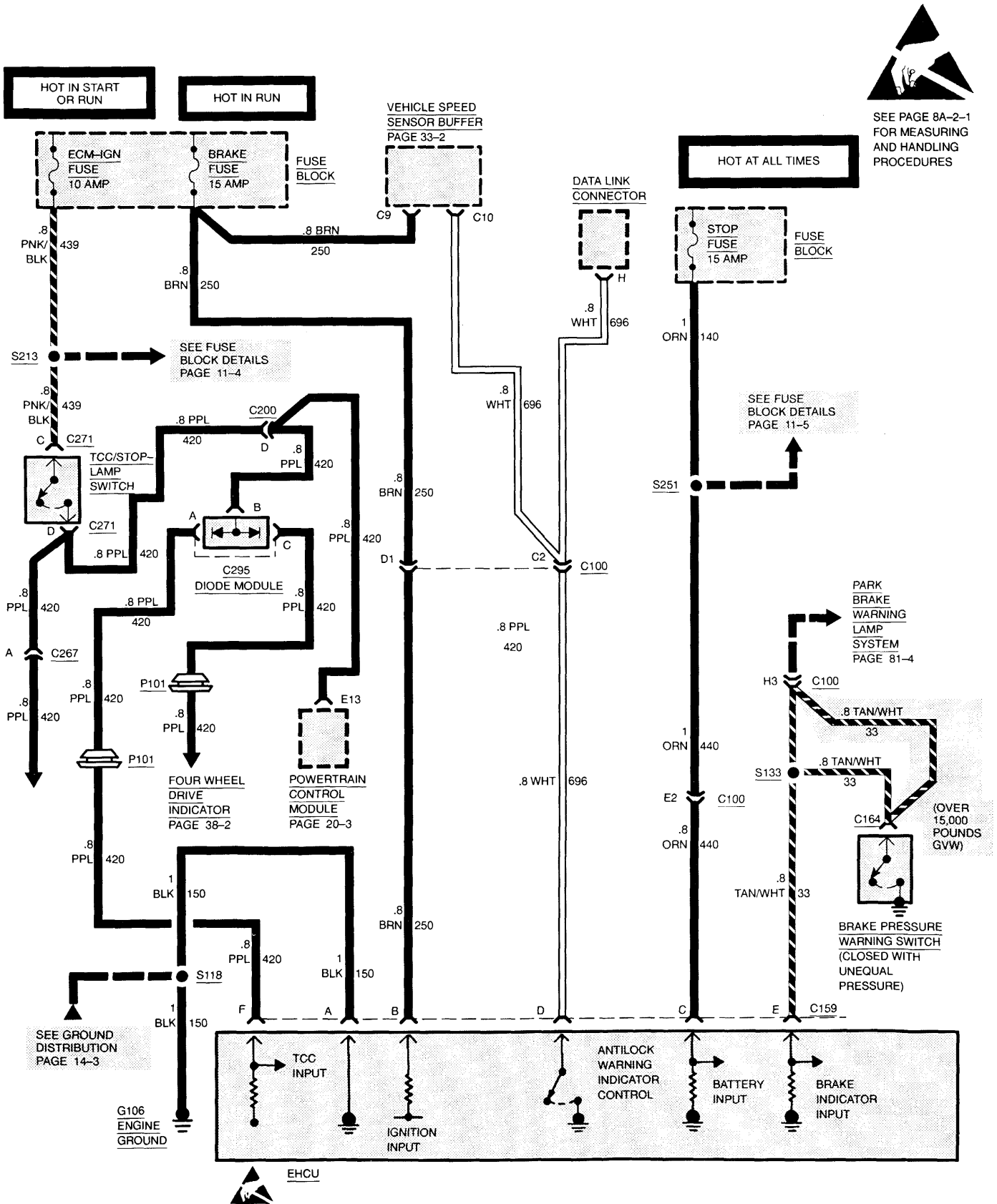
|      |                          |       |   |
|------|--------------------------|-------|---|
| G106 | Rear of RH cylinder head | 44B-4 | 1 |
|------|--------------------------|-------|---|

## SPLICES:

|      |                                                      |           |   |
|------|------------------------------------------------------|-----------|---|
| S118 | Engine harness, near cowl LH rear engine compartment | 44B-4     | 1 |
| S133 | LH rear engine compartment, near bulkhead connector  | Not Shown |   |
| S213 | Under LH side of I/P                                 | 44B-6     | 4 |
| S251 | Under LH side of I/P                                 | 44B-6     | 4 |

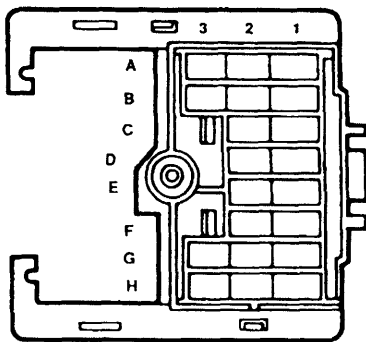


# 8A-44B-2 REAR-WHEEL ANTILOCK BRAKE WARNING SYSTEM



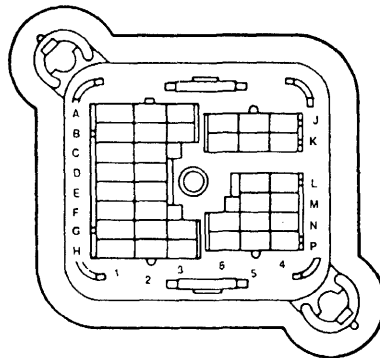
# REAR-WHEEL ANTILOCK BRAKE WARNING SYSTEM 8A-44B-3

12020183



**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



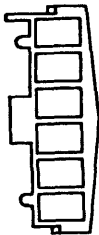
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12004635



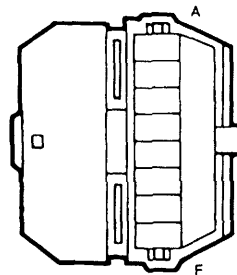
**CREAM**  
Molded on  
**C164**  
Brake Pressure Warning Switch

12040551



**BLACK**  
Metri-Pack 480  
**C271**  
TCC/Brake Switch

12040549



**GRAY**  
**C295**  
RWAL Diode Module

## 8A-44B-4 REAR-WHEEL ANTILOCK BRAKE WARNING SYSTEM

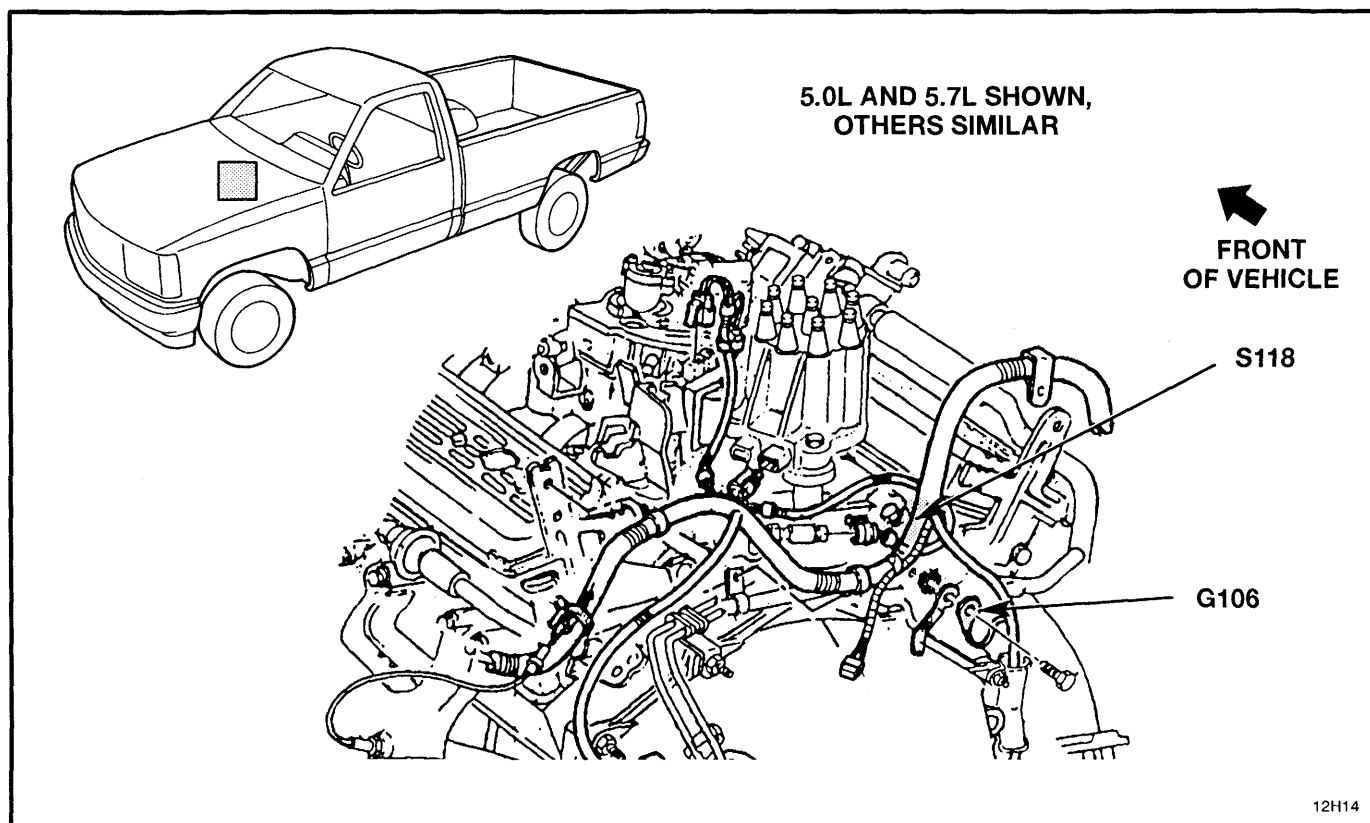


Figure 1 — LH Side of Engine, 5.0L and 5.7L — Gasoline

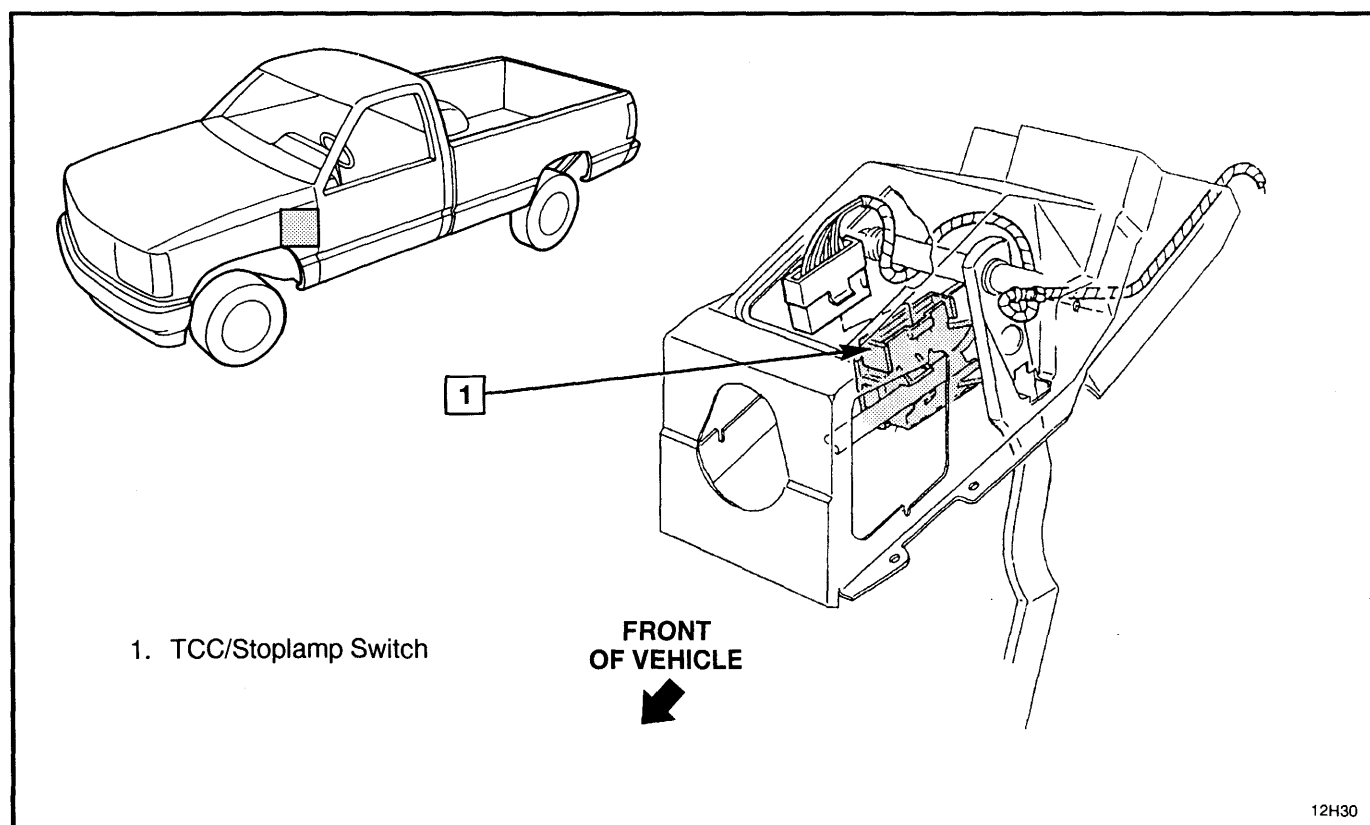
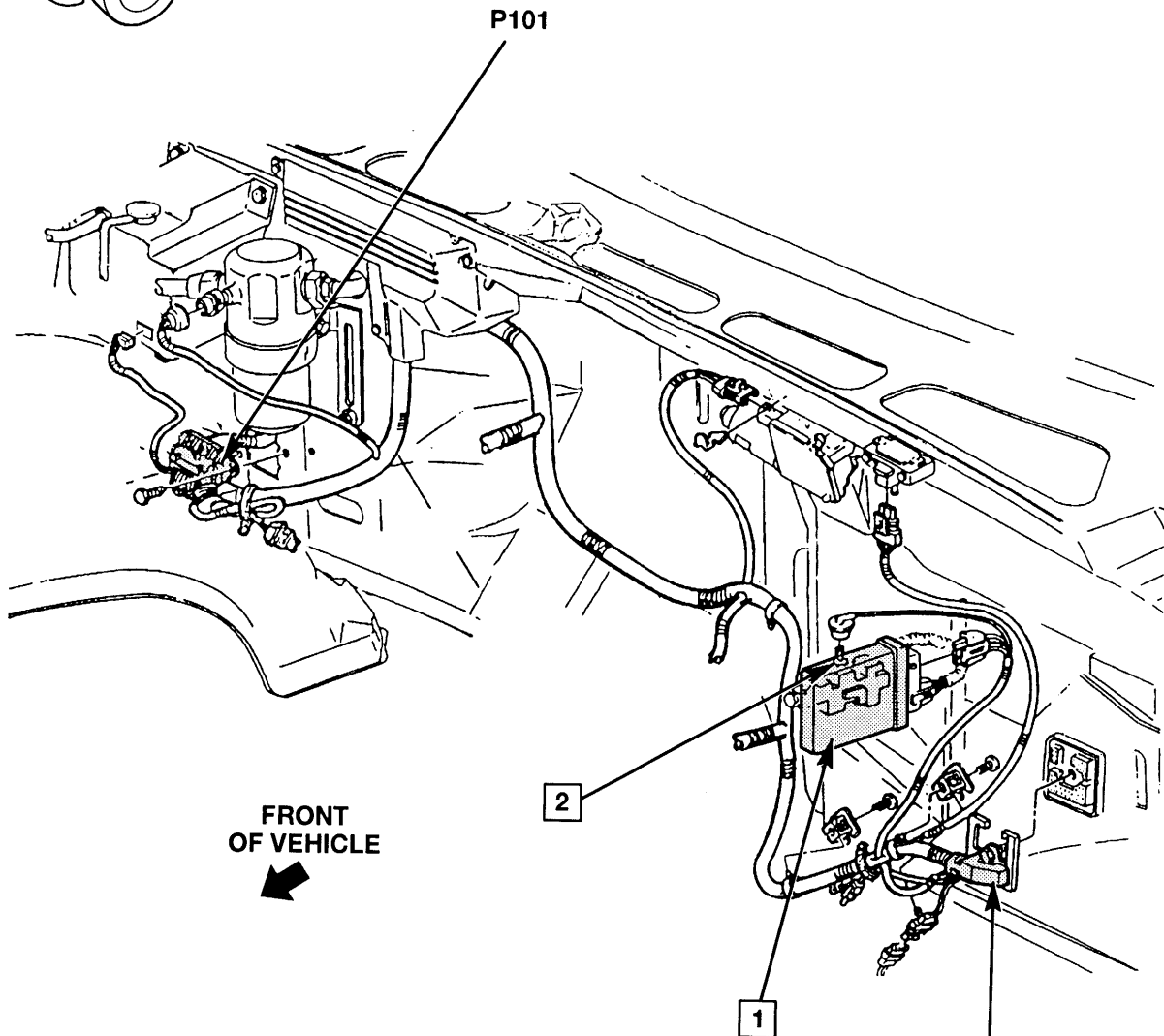
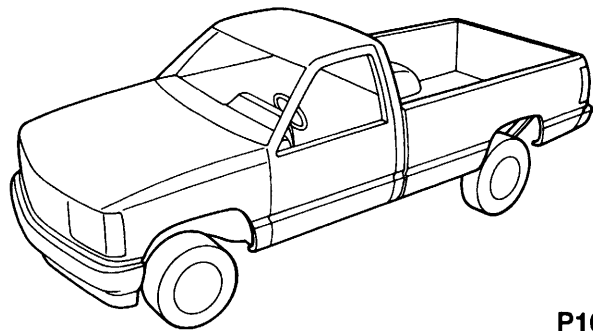


Figure 2 — TCC/Stoplamp Switch

# REAR-WHEEL ANTILOCK BRAKE WARNING SYSTEM 8A-44B-5



- 1. RWAL Module
- 2. Brake Pressure Warning Switch

Figure 3 — Cowl Wiring

## 8A-44B-6 REAR-WHEEL ANTILOCK BRAKE WARNING SYSTEM

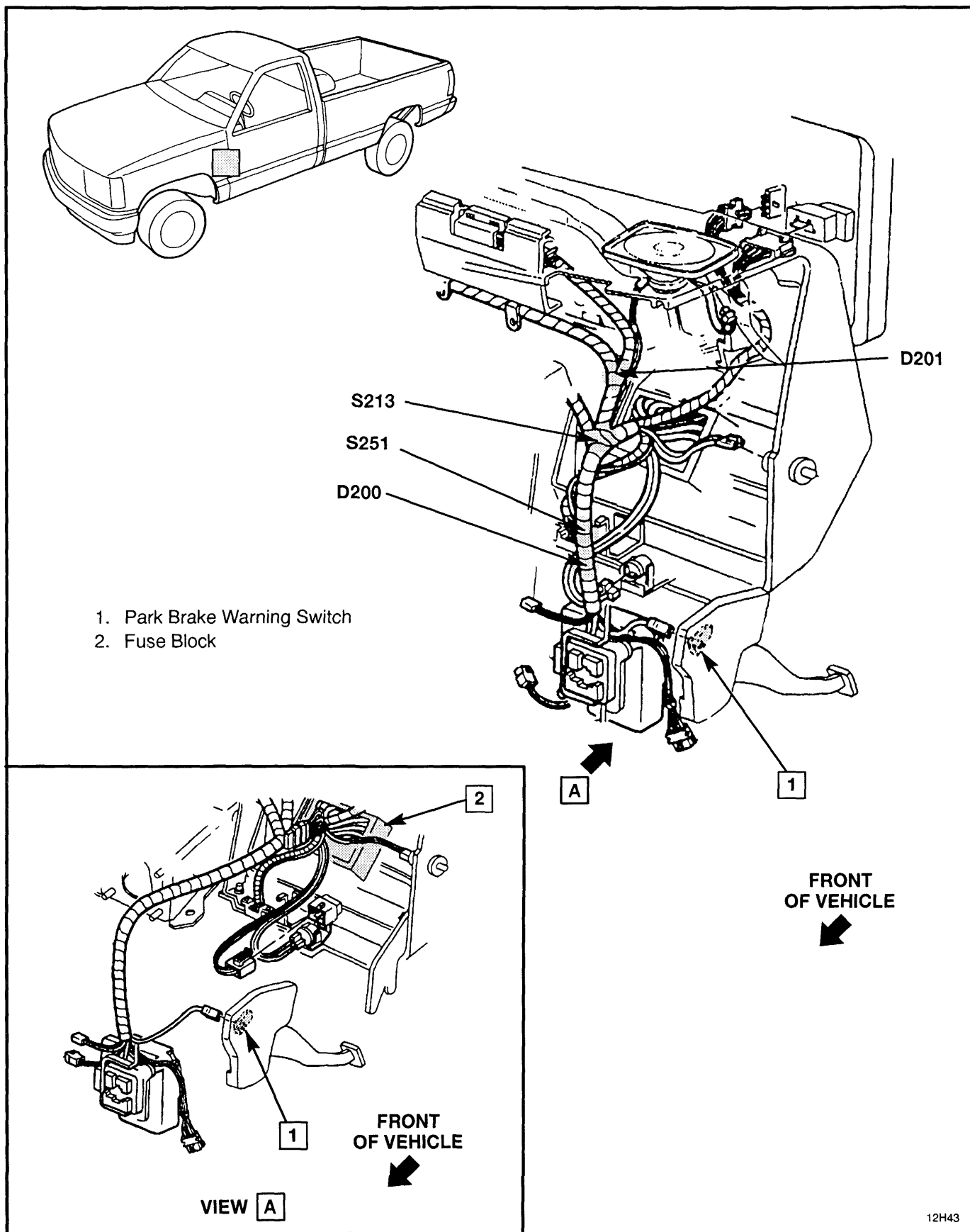


Figure 4 — LH Side of Instrument Panel

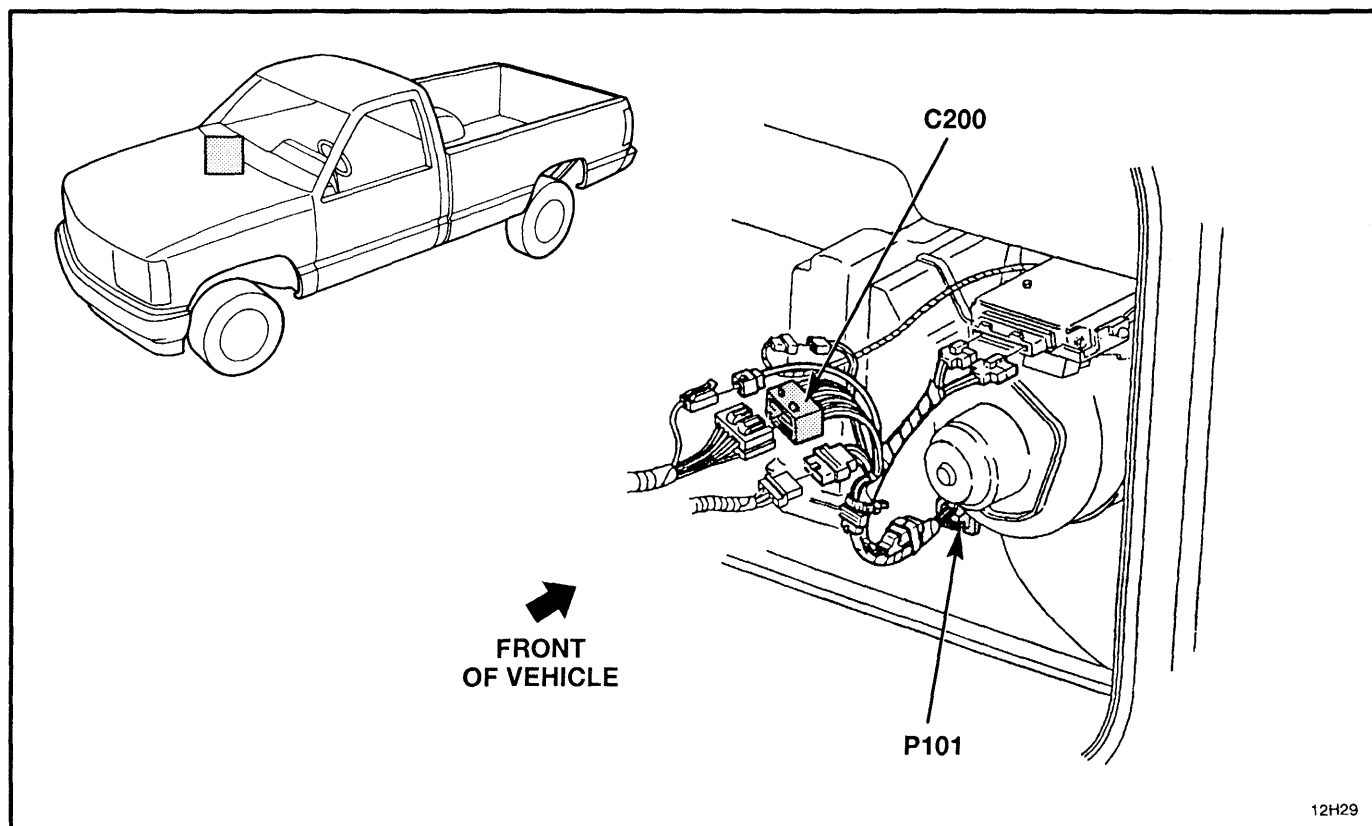


Figure 5 — Behind RH Side of I/P

**BLANK**

## CIRCUIT OPERATION

The Blower Motor delivers air to the interior of the vehicle. Its speed is controlled by the Blower Switch and the Blower Resistors. When the Ignition Switch is in RUN, battery voltage is supplied to the Blower Switch. With the Blower Switch in LO, voltage is supplied across both Blower Resistors and the Blower Motor. The Blower Motor

runs at its slowest speed. With the Blower Switch in MED, one of the Blower Resistors is bypassed and the Blower Motor runs faster. When the Blower Switch is set to HI, battery voltage is supplied directly to the Blower Motor and the Blower Motor runs at its fastest speed.

## COMPONENT LOCATION

### Page — Figure

|                       |                                    |       |   |
|-----------------------|------------------------------------|-------|---|
| Blower Motor .....    | Under RH side of I/P .....         | 60A-7 | 3 |
| Blower Resistor ..... | Under I/P, on heater housing ..... | 60A-7 | 3 |
| Blower Switch .....   | At heater control .....            | 60A-7 | 3 |

## CONNECTORS:

|            |                               |       |   |
|------------|-------------------------------|-------|---|
| C230 ..... | Near heater-A/C control ..... | 60A-8 | 4 |
|------------|-------------------------------|-------|---|

## GROUND:

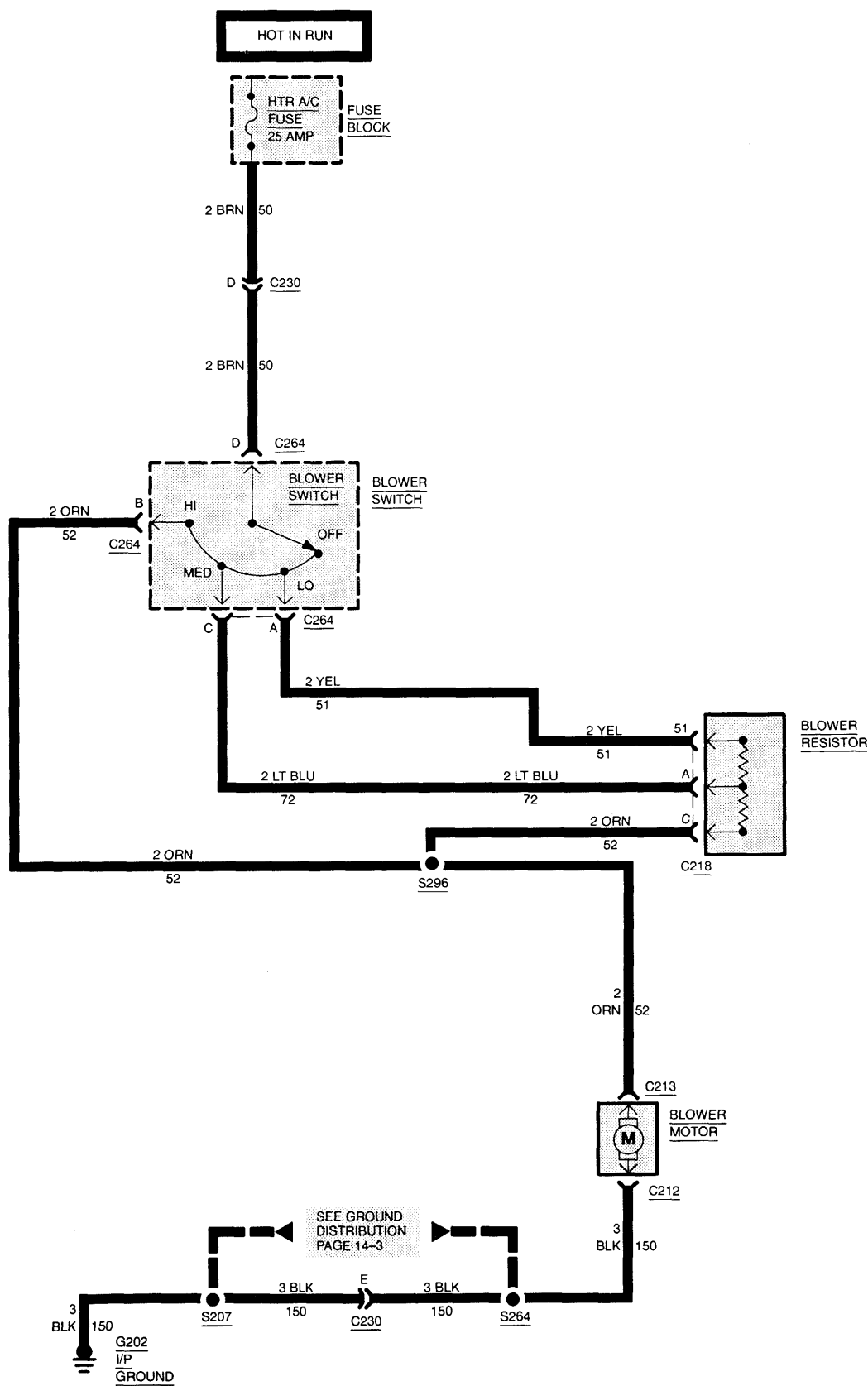
|            |                        |       |   |
|------------|------------------------|-------|---|
| G202 ..... | At DLC connector ..... | 60A-6 | 1 |
|------------|------------------------|-------|---|

## SPLICES:

|            |                                             |           |   |
|------------|---------------------------------------------|-----------|---|
| S264 ..... | Heater harness, near I/P harness lead ..... | Not Shown |   |
| S296 ..... | Heater harness, near resistor lead .....    | 60A-7     | 3 |
| S207 ..... | Under LH side of I/P .....                  | 60A-6     | 2 |



# 8A-60A-2 HEATER



## DIAGNOSIS — HEATER

### PRELIMINARY CHECKS:

1. Check condition of HTR A/C Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.
2. If fuse is not blown, proceed with the following diagnostic procedures.

#### BLOWER MOTOR DOES NOT OPERATE AT ALL

| TEST                                                                                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect blower motor connector C213. Connect test lamp from ORN (52) wire at blower motor connector C213 to ground.                                                                                                  | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in ORN (52) wire between blower motor connector C213 and splice S296 or from splice S296 to resistor connector C218 or from splice S213 to blower switch connector C264. If wire is good, GO to step 3. |
| 2. Connect test lamp from ORN (52) wire to BLK (150) wire at blower motor connectors C212 and C213.                                                                                                                        | Test lamp lights.         | REPLACE blower motor.                                                                                                                                                                                                          |
|                                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in ground BLK (150) wire between blower motor connector C212 and connector C230 or from C230 to I/P ground G202.                                                                                        |
| 3. Connect test lamp from BRN (50) wire at blower switch connector C264 to ground.                                                                                                                                         | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between blower switch connector C264 and connector C230 or from C230 to fuse block.                                                                                                    |
| 4. Place blower switch in LO, MED, or HI. Connect test lamp from blower switch connector C264 at wire that applies to position of switch to ground. LO is YEL (51) wire, MED is LT BLU (72) wire, and HI is ORN (52) wire. | Test lamp does not light. | REPLACE blower switch.                                                                                                                                                                                                         |
|                                                                                                                                                                                                                            | Test lamp lights.         | LOCATE and REPAIR open in wires between blower switch connector C264 and resistor connector C218.                                                                                                                              |

#### BLOWER MOTOR DOES NOT OPERATE IN HI, OPERATES ONLY IN LO AND/OR MED

| TEST                                                                                                             | RESULT                    | ACTION                                                                                        |
|------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------|
| 1. Place blower switch in HI and connect test lamp from ORN (52) wire at blower switch connector C264 to ground. | Test lamp lights.         | GO to step 2.                                                                                 |
|                                                                                                                  | Test lamp does not light. | REPLACE blower switch.                                                                        |
| 2. Connect test lamp from ORN (52) wire at resistor connector C218 to ground.                                    | Test lamp does not light. | LOCATE and REPAIR open in ORN (52) wire between splice S296 and blower switch connector C264. |

## 8A-60A-4 HEATER

### BLOWER MOTOR DOES NOT OPERATE IN LO AND/OR MED BUT ONLY IN HI

| TEST                                                                                                                                                                                                                        | RESULT                    | ACTION                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------|
| 1. Place blower switch in position where blower motor does not work. Connect test lamp from either YEL (51) LO wire or LT BLU (72) MED wire (depending on switch position) at blower motor switch connector C264 to ground. | Test lamp lights.         | GO to step 2.                                                                                              |
|                                                                                                                                                                                                                             | Test lamp does not light. | REPLACE blower switch.                                                                                     |
| 2. Connect test lamp from either YEL (51) LO wire or LT BLU (72) MED wire (depending on switch position) at resistor connector C218 to ground.                                                                              | Test lamp lights.         | GO to step 3.                                                                                              |
|                                                                                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in wire(s) (51 or 72) from resistor connector C218 to blower switch connector C264. |
| 3. Connect test lamp from ORN (52) wire at resistor connector C218 to ground.                                                                                                                                               | Test lamp does not light. | REPLACE resistor.                                                                                          |

**12004267**



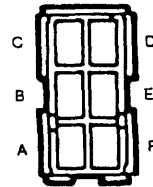
**BLACK**  
56 Series  
**C212**  
Blower Motor Ground

**02965104**



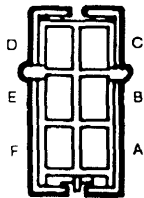
**NATURAL**  
56 Series  
**C218**  
Blower Resistor

**12034481**



**GRAY**  
Metri-Pack 280  
**C230**  
In-Line I/P to Heater Control

**12034482**



**GRAY**  
Metri-Pack 280  
**C230**  
In-Line Heater Control to I/P

## 8A-60A-6 HEATER

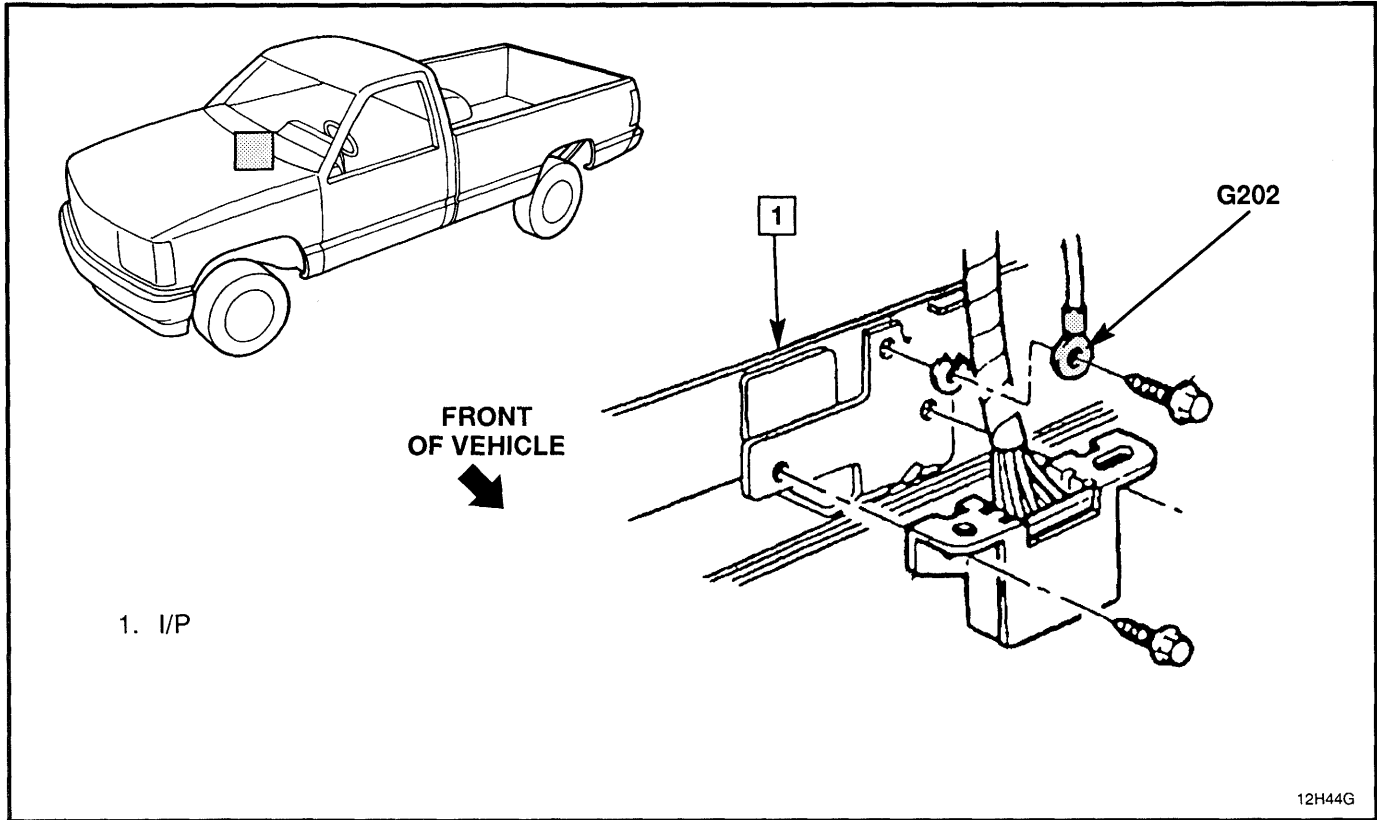


Figure 1 — I/P Ground

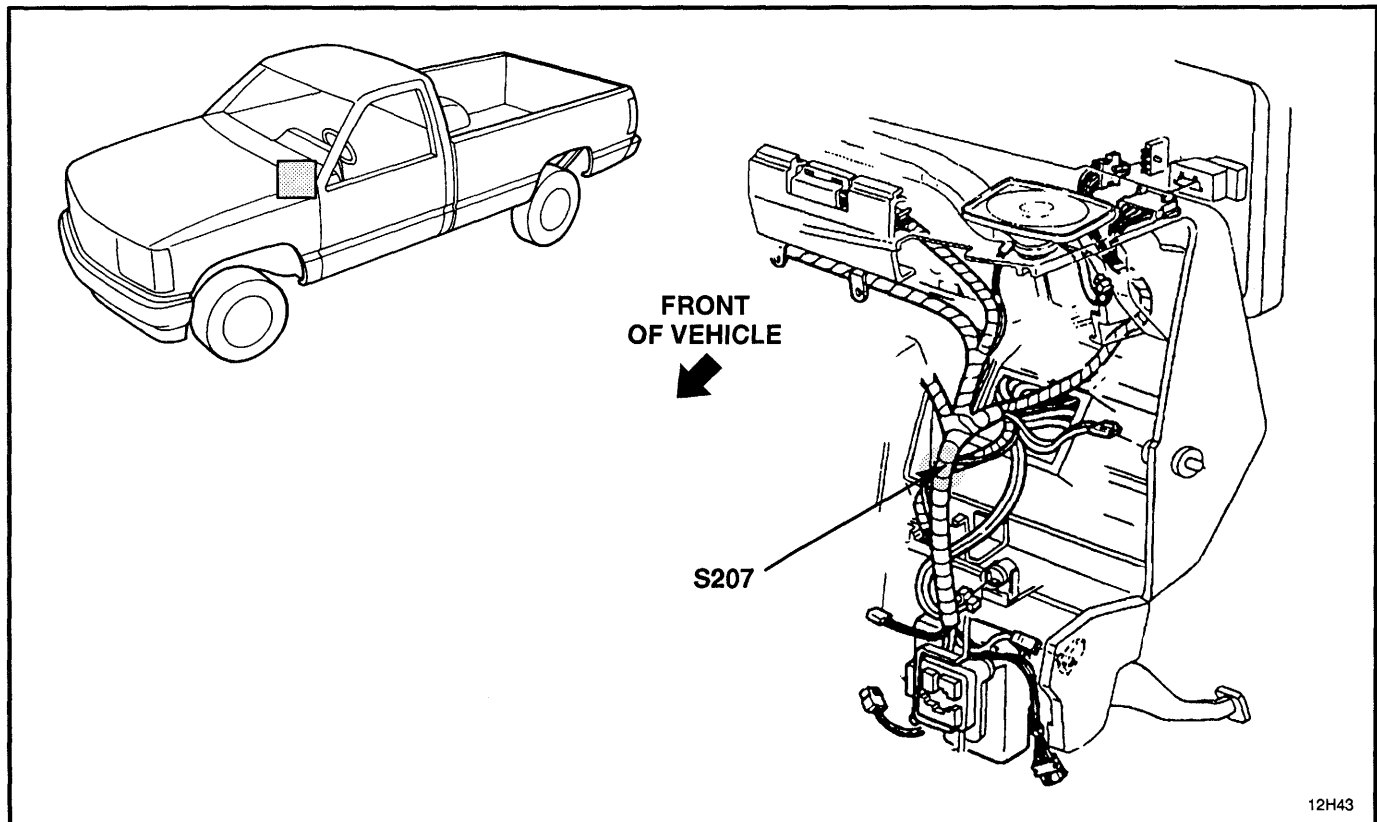


Figure 2 — LH Side of Instrument Panel

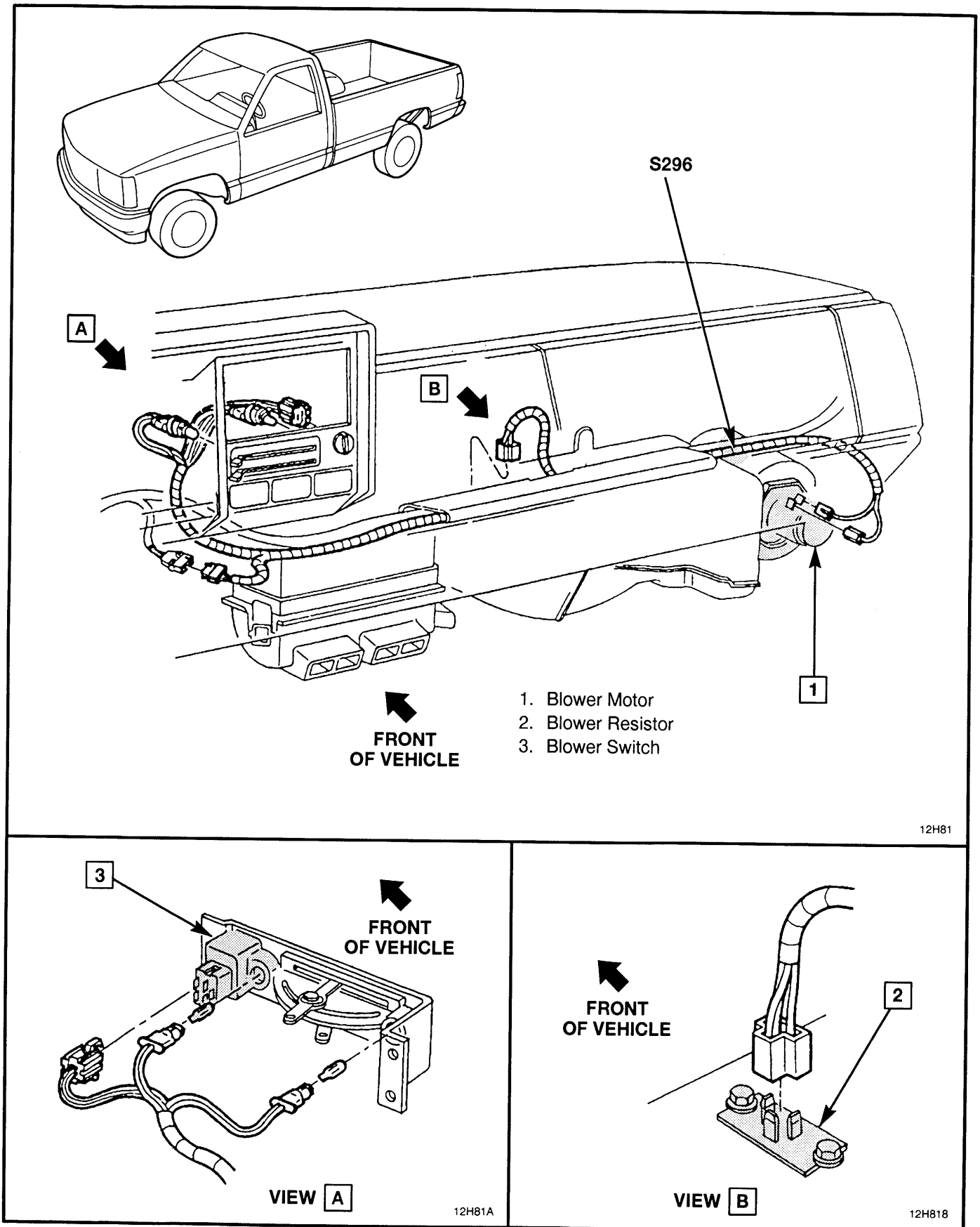
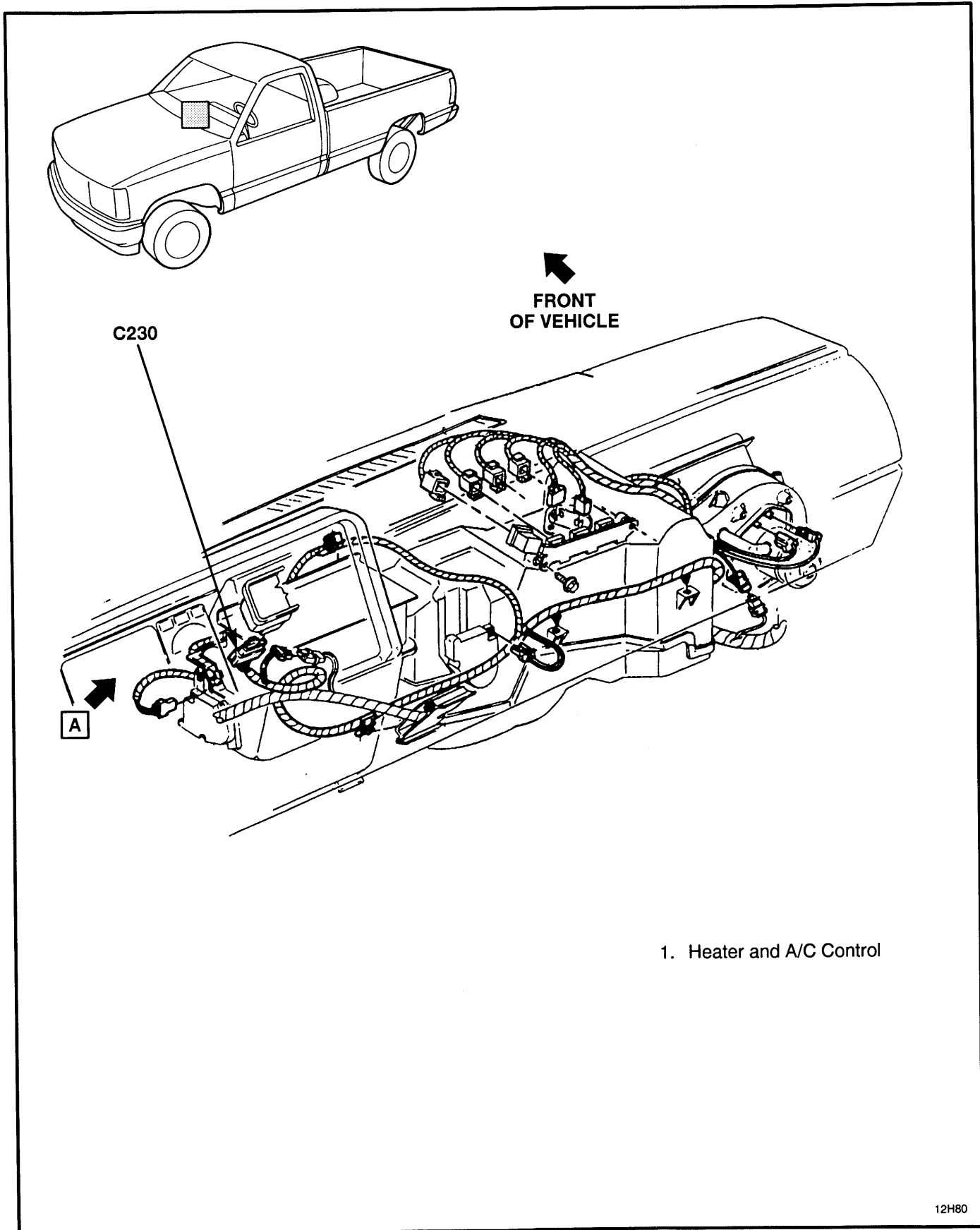


Figure 3 — Heater Wiring

## 8A-60A-8 HEATER



12H80

Figure 4 — Heater and A/C Harness Wiring

## CIRCUIT OPERATION

### REAR AUXILIARY HEATER

The Rear Auxiliary Heater Module operates independently from the vehicle front heater except that both systems receive their hot water supply from the engine cooling system.

Battery voltage for the rear heater module relays is supplied by the RED (2) and BRN (50) wires at the convenience center. The battery junction blower supplies battery voltage from the convenience center through the RED (2) wire. The RR HVAC Fuse supplies battery voltage to the convenience center through the BRN/WHT (650) wire.

A dash-mounted rear heater switch controls the temperature mode door relay through the DK GRN (949) wire. The temperature mode door relay operates the temperature mode door motor which regulates the air temperature. The dash switch also controls the three blower speeds.

Manually operated airflow direction vents are located at the air outlet openings.

### COMPONENT LOCATION

### Page — Figure

|                                   |                                     |           |   |
|-----------------------------------|-------------------------------------|-----------|---|
| Battery Junction Block            | RH rear engine compartment, at cowl | 60B-10    | 1 |
| Blower Motor, Rear                | Lower LH side of I/P                | 60B-14    | 8 |
| Blower Resistor                   | Under I/P, on heater housing        | 60B-13    | 6 |
| Convenience Center                | Under LH side of I/P                | 60B-11    | 3 |
| Fuse Block                        | Under LH side of I/P                | 60B-12    | 5 |
| Heater Control Switch, Rear       | On I/P, RH side of cluster          | Not Shown |   |
| HI Blower Relay, Rear             | On auxiliary heater and A/C module  | 60B-14    | 8 |
| Low Blower Relay                  | On auxiliary heater and A/C module  | 60B-14    | 8 |
| Medium Blower Relay               | On auxiliary heater and A/C module  | 60B-14    | 8 |
| Temperature Mode Door Motor, Rear | On rear heater housing              | 60B-14    | 8 |
| Temperature Mode Door Relay, Rear | On rear heater housing              | Not Shown |   |

### CONNECTORS:

|      |                                |        |   |
|------|--------------------------------|--------|---|
| C206 | At steering column, under cowl | 60B-14 | 7 |
| C228 | At convenience center          | 60B-11 | 3 |
| C231 | At convenience center          | 60B-11 | 3 |
| C263 | Under LH end of I/P            | 60B-11 | 3 |
| C264 | At heater switch               | 60B-11 | 4 |
| C475 | At RH D-pillar                 | 60B-14 | 8 |
| C476 | At RH D-pillar                 | 60B-14 | 8 |

### GROMMETS:

|      |                                    |           |
|------|------------------------------------|-----------|
| P101 | RH lower cowl (engine compartment) | Not Shown |
|------|------------------------------------|-----------|

### GROUND:

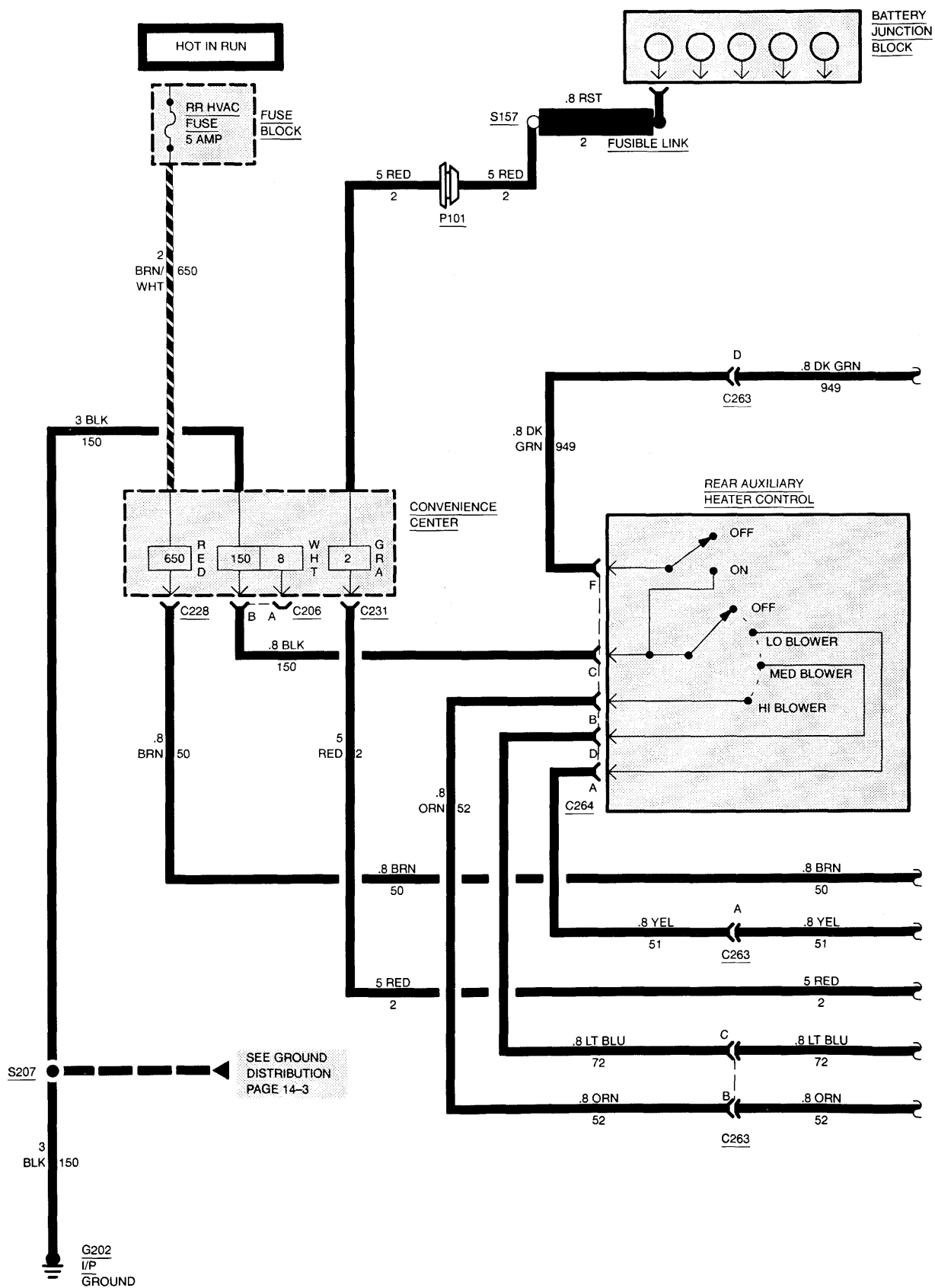
|      |                  |           |   |
|------|------------------|-----------|---|
| G202 | At DLC connector | 60B-10    | 2 |
| G400 | At RH D-pillar   | Not Shown |   |

### SPLICES:

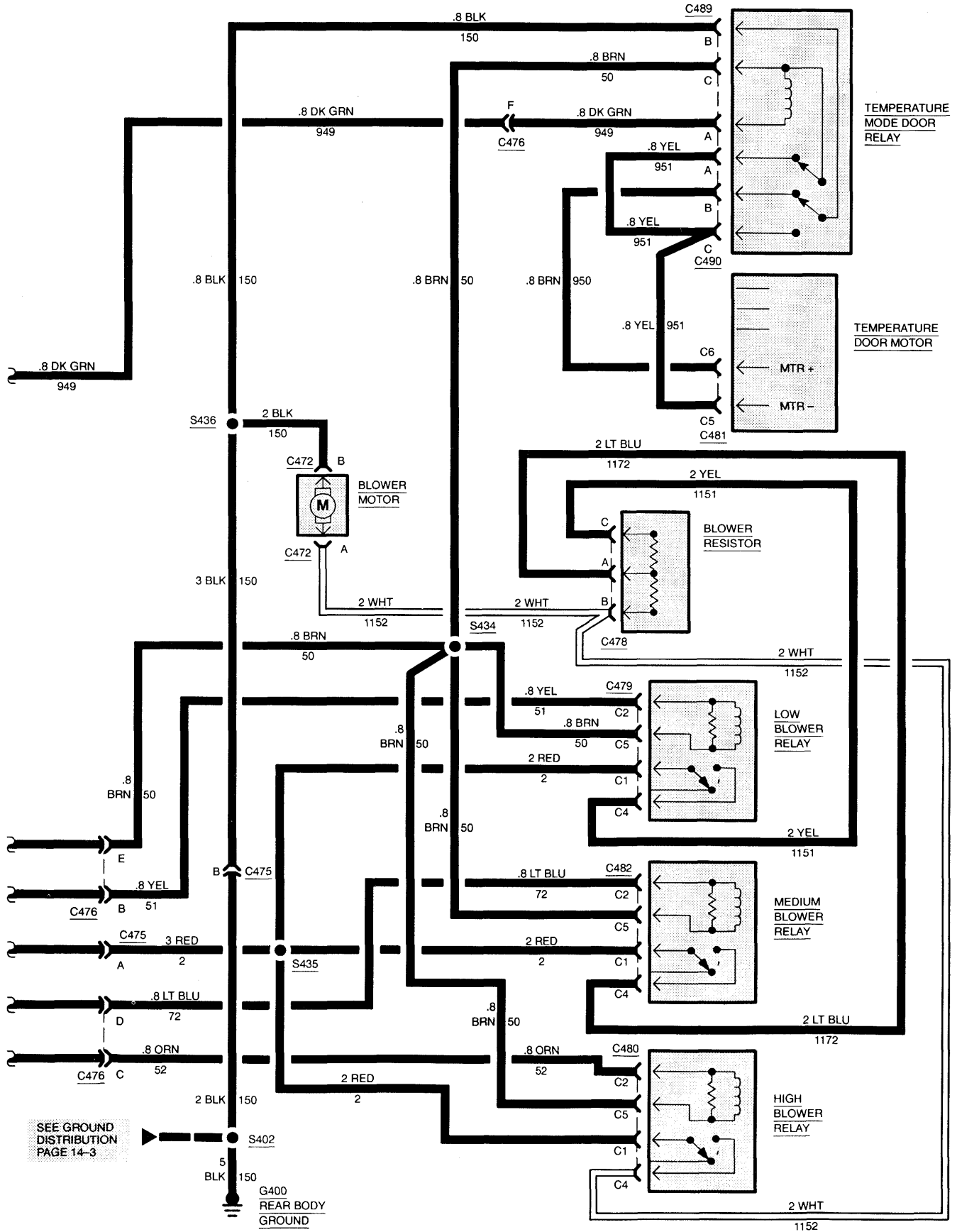
|      |                                                           |           |   |
|------|-----------------------------------------------------------|-----------|---|
| S157 | Center of cowl, below battery junction block              | 60B-10    | 1 |
| S207 | Under LH side of I/P                                      | 60B-12    | 5 |
| S402 | Above rear liftgate glass opening                         | 60B-15    | 9 |
| S434 | Auxiliary heater - A/C harness, near relay leads          | 60B-14    | 8 |
| S435 | Auxiliary heater - A/C harness, near relay leads          | 60B-14    | 8 |
| S436 | Auxiliary heater - A/C harness, near blower resistor lead | Not Shown |   |



# 8A-60B-2 REAR AUXILIARY HEATER



# REAR AUXILIARY HEATER 8A-60B-3



## 8A-60B-4 REAR AUXILIARY HEATER

### DIAGNOSIS — REAR AUXILIARY HEATER

#### PRELIMINARY CHECKS:

1. Check to see that RR HVAC Fuse is not blown. If fuse is blown locate and repair source of overload, replace fuse.
2. Check to see that RST (2) fuse wire is not melted, if melted located and repair source of overload, repair fuse wire.
3. If fuse is not blown or fuse wire is not melted, proceed with the following diagnostics.

#### REAR BLOWER MOTOR DOES NOT OPERATE IN HI BUT OPERATES IN LO OR MED

| TEST                                                                                                                                                   | RESULT                    | ACTION                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and rear heater blower switch to HI. Connect test lamp from BRN (50) wire at HI blower relay connector C480 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                         |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between HI blower relay connector C480 and splice S434.                                                                                                                       |
| 2. Connect test lamp from ORN (52) wire to BRN (50) wire at HI blower relay connector C480.                                                            | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                         |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in ORN (52) wire between HI blower relay connector C480 and connector C475, from C475 to connector C263 or from C263 to rear locator switch C264. If wire is good, REPLACE rear heater switch. |
| 3. Connect test lamp from RED (2) wire at HI blower relay connector C480 to ground.                                                                    | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                         |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between HI relay connector C480 and splice S435.                                                                                                                               |
| 4. Connect test lamp from WHT (1152) wire at HI blower relay connector C480 to ground.                                                                 | Test lamp lights.         | LOCATE and REPAIR open in WHT (1152) wire between HI blower relay connector C480 and blower resistor connector C478.                                                                                                  |
|                                                                                                                                                        | Test lamp does not light. | REPLACE HI blower relay.                                                                                                                                                                                              |

## REAR AUXILIARY HEATER 8A-60B-5

### REAR BLOWER DOES NOT OPERATE IN ANY SPEED

| TEST                                                                                                                                             | RESULT                    | ACTION                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and heater blower switch in HI. Connect test lamp from WHT (1152) wire at blower motor connector C477 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                           |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in WHT (1152) wire between blower motor connector C477 and resistor block connector C478 or from resistor block connector C478 to HI blower relay connector C480. If wire is good, GO to step 3. |
| 2. Connect test lamp from WHT (1152) wire to BLK (150) wire at blower motor connector C477.                                                      | Test lamp lights.         | REPLACE blower motor.                                                                                                                                                                                                   |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between blower motor connector C477 and splice S436 or from splice S436 to ground G400.                                                                                        |
| 3. Connect test lamp from BRN (50) wire at blower relay connector C480 to ground.                                                                | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                           |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between relay connector C480 and splice S434, from splice S434 to convenience center connector C228 or from convenience center to fuse block.                                   |
| 4. Connect test lamp from ORN (52) wire to BRN (50) wire at HI blower relay connector C480.                                                      | Test lamp lights.         | GO to step 6.                                                                                                                                                                                                           |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in ORN (52) wire between HI blower relay connector C480 and rear heater switch connector C264. If wire is good, GO to step 5.                                                                    |
| 5. Connect self-powered test lamp to BLK (150) wire from rear blower switch connector C264 to ground.                                            | Test lamp lights.         | REPLACE rear heater switch.                                                                                                                                                                                             |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear heater switch connector C264 to convenience center connector C206 or from convenience center to ground G202.                                                      |
| 6. Connect test lamp from RED (2) wire at blower relay connector C480 to ground.                                                                 | Test lamp lights.         | REPLACE blower relay.                                                                                                                                                                                                   |
|                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between relay connector C480 and splice S435 from splice S435 to convenience center connector C231 or from convenience center to battery junction block.                         |

## 8A-60B-6 REAR AUXILIARY HEATER

### REAR BLOWER OPERATES IN HI BUT DOES NOT OPERATE IN LOW OR MED

| TEST                                                                                                                                                                                                         | RESULT                    | ACTION                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and heater switch to LO or MED position. Connect self-powered test lamp from YEL (51) LO speed or LT BLU (72) MED speed wire at rear heater switch connector C264 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                               |
|                                                                                                                                                                                                              | Test lamp does not light. | REPLACE rear heater switch.                                                                                                                                                                                 |
| 2. Connect test lamp from BRN (50) wire at LO blower relay connector C479 or MEDIUM blower relay connector C482 to ground.                                                                                   | Test lamp lights.         | GO to step 3.                                                                                                                                                                                               |
|                                                                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between LO blower relay connector C479 or MED blower relay connector C482 and splice S434.                                                                          |
| 3. Connect test lamp from BRN (50) wire to YEL (51) LO blower or LT BLU (72) MED blower at blower relay connector(s) C479 or C482. Put blower switch in a position that blower will not operate.             | Test lamp lights.         | GO to step 4.                                                                                                                                                                                               |
|                                                                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in YEL (51) or LT BLU (72) wire(s) between blower relay connector(s) C479 or C482 and connector C475, from C475 to connector C263 or from C263 to rear heater switch connector C264. |
| 4. Connect test lamp from RED (2) wire at LO blower relay connector C479 or MEDIUM blower relay connector C482 to ground.                                                                                    | Test lamp lights.         | GO to step 5.                                                                                                                                                                                               |
|                                                                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire(s) between blower relay connectors C479 (LO) or C482 (MED) and splice S435.                                                                                          |
| 5. Place blower switch in a position that blower will not operate. Connect test lamp from YEL (151) LO or LT BLU (1172) (MED) wire(s) at blower relay connector C479 or C482 to ground.                      | Test lamp lights.         | GO to step 6.                                                                                                                                                                                               |
|                                                                                                                                                                                                              | Test lamp does not light. | REPLACE blower relay.                                                                                                                                                                                       |
| 6. Connect test lamp from YEL (1151) LO blower or LT BLU (1172) MED blower wire(s) at blower resistor connector C478 to ground.                                                                              | Test lamp lights.         | REPLACE blower resistor.                                                                                                                                                                                    |
|                                                                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in YEL (1151) LO blower or LT BLU (1172) MED blower wire(s) between resistor block connector C478 and blower relay connectors C479 LO or C482 MED.                                   |

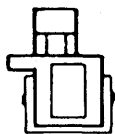
## REAR AUXILIARY HEATER 8A-60B-7

### REAR TEMPERATURE DOOR DOES NOT OPERATE

| TEST                                                                                                                                           | RESULT                    | ACTION                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN, heater switch to ON. Connect test lamp from BRN (50) wire at temperature door relay connector C489 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between temperature door relay connector C489 and splice S434, from splice S434 to convenience center connector C228 or from convenience center to fuse block.        |
| 2. Connect self-powered test lamp from BLK (150) wire at rear heater switch connector C264 to ground.                                          | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear locator switch connector C264 and convenience center connector C206, from convenience center to splice S207 or from splice S207 to ground G202.         |
| 3. Connect test lamp from BRN (50) wire to DK GRN (949) wire at temperature door relay connector C489.                                         | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in DK GRN (949) wire between temperature door relay connector C489 and rear heater switch connector C264. If wire is good, REPLACE rear heater control switch.                         |
| 4. Connect test lamp from BRN (50) wire to BLK (150) wire at temperature door relay connector C489.                                            | Test lamp lights.         | GO to step 5.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between temperature door relay connector C489 and splice S436 or from splice S436 to ground G400.                                                                    |
| 5. Connect test lamp from BRN (950) wire at temperature door relay connector C490 to ground.                                                   | Test lamp lights.         | GO to step 6.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | REPLACE relay.                                                                                                                                                                                                |
| 6. Connect test lamp from BRN (950) wire at temperature door motor connector C481 to ground.                                                   | Test lamp lights.         | GO to step 7.                                                                                                                                                                                                 |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BRN (950) wire between temperature door motor connector C481 and temperature door motor relay connector C480.                                                                       |
| 7. Connect test lamp from BRN (950) wire to YEL (951) wire at temperature door motor connector C418.                                           | Test lamp lights.         | REPLACE temperature door motor.                                                                                                                                                                               |
|                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in YEL (951) wire between temperature door motor connector C418 and temperature door relay connector C490 cavity C or from temperature door relay connector C490 cavity C to cavity A. |

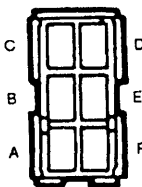
# 8A-60B-8 REAR AUXILIARY HEATER

12089856



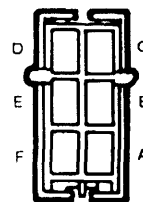
**C231**  
Rear Auxiliary Heater Battery Tap  
at Convenience Center

12015345



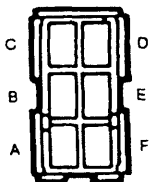
**BLACK**  
Metri-Pack 280  
**C264**  
Rear Auxiliary Heater Control

12015344



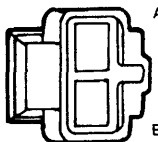
**BLACK**  
Metri-Pack 280  
**C263**  
In-Line Rear Auxiliary Heater  
Control to Extension Harness

12015345



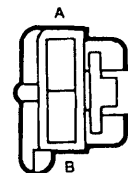
**BLACK**  
Metri-Pack 280  
**C263**  
In-Line Extension Harness to  
Rear Auxiliary Heater Control

12064750



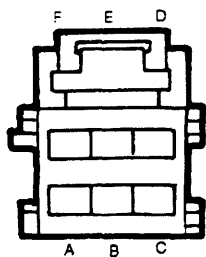
**BLACK**  
Mteri-Pack 480  
**C475**  
In-Line Rear A/C Heater Control  
Extension Harness to Rear  
Module

12064749



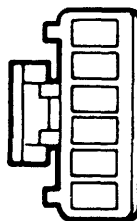
**BLACK**  
Metri-Pack 480  
**C475**  
In-Line Rear Module to Rear A/C  
Heater Control Extension  
Harness

12064762



**GRAY**  
Metri-Pack 150  
**C476**  
In-Line Rear Module to Rear A/C  
Heater Control Extension  
Harness

12040953



**BLACK**  
Micro-Pack  
**C481**  
Temp Door Motor

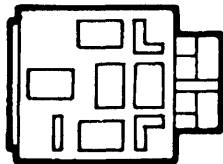
02965104



**NATURAL**  
56 Series  
**C478**  
Blower Resistor

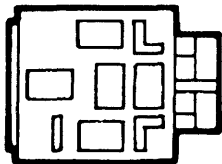
**REAR AUXILIARY HEATER 8A-60B-9**

12034003



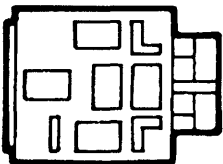
**BLACK**  
Metri-Pack 630  
**C479**  
Blower Relay

12034003



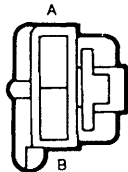
**BLACK**  
Metri-Pack 630  
**C480**  
Blower Relay

12034003



**BLACK**  
Metri-Pack 630  
**C482**  
Blower Relay

12064749



**BLACK**  
Metri-Pack 480  
**C472**  
Blower Motor



## 8A-60B-10 REAR AUXILIARY HEATER

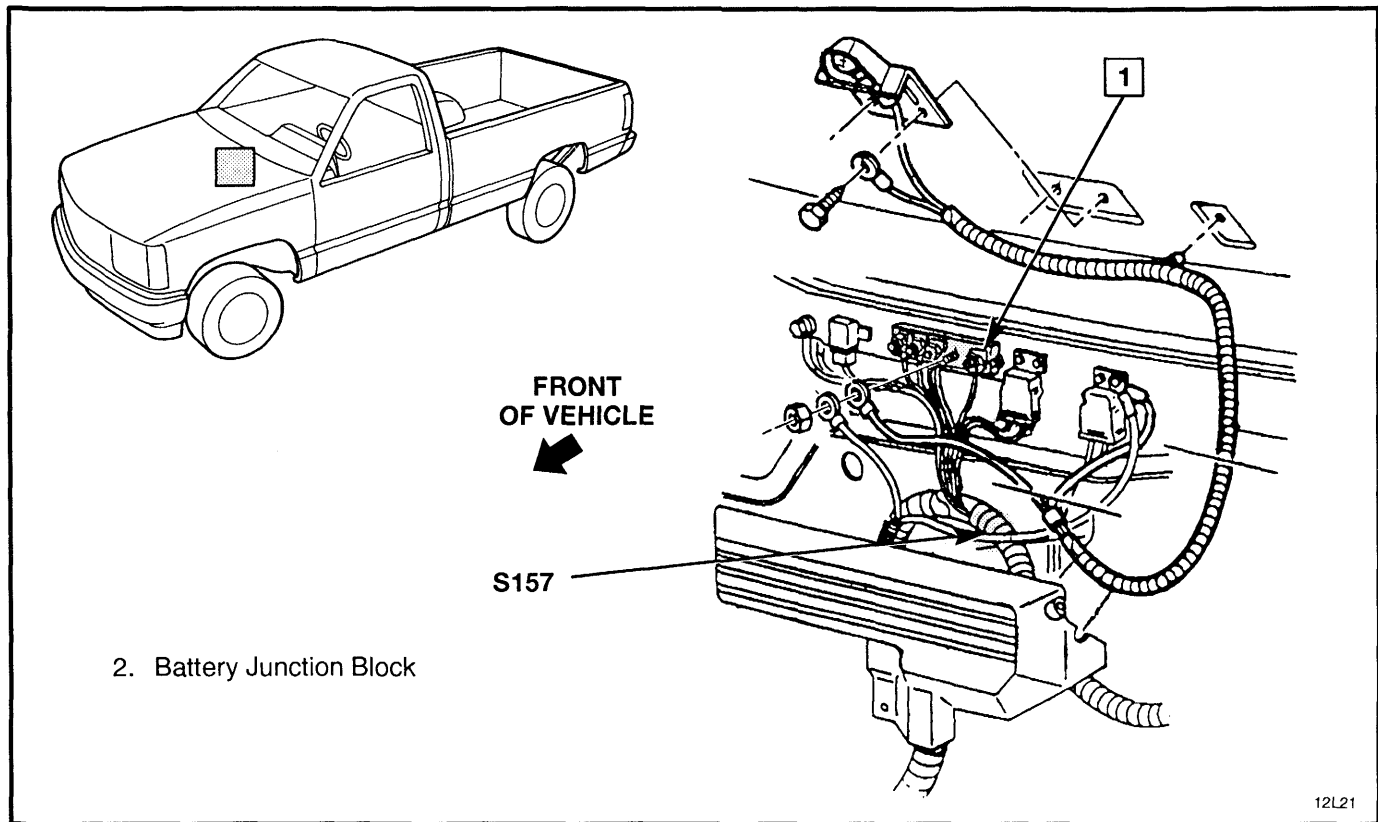


Figure 1 — Battery Junction Block

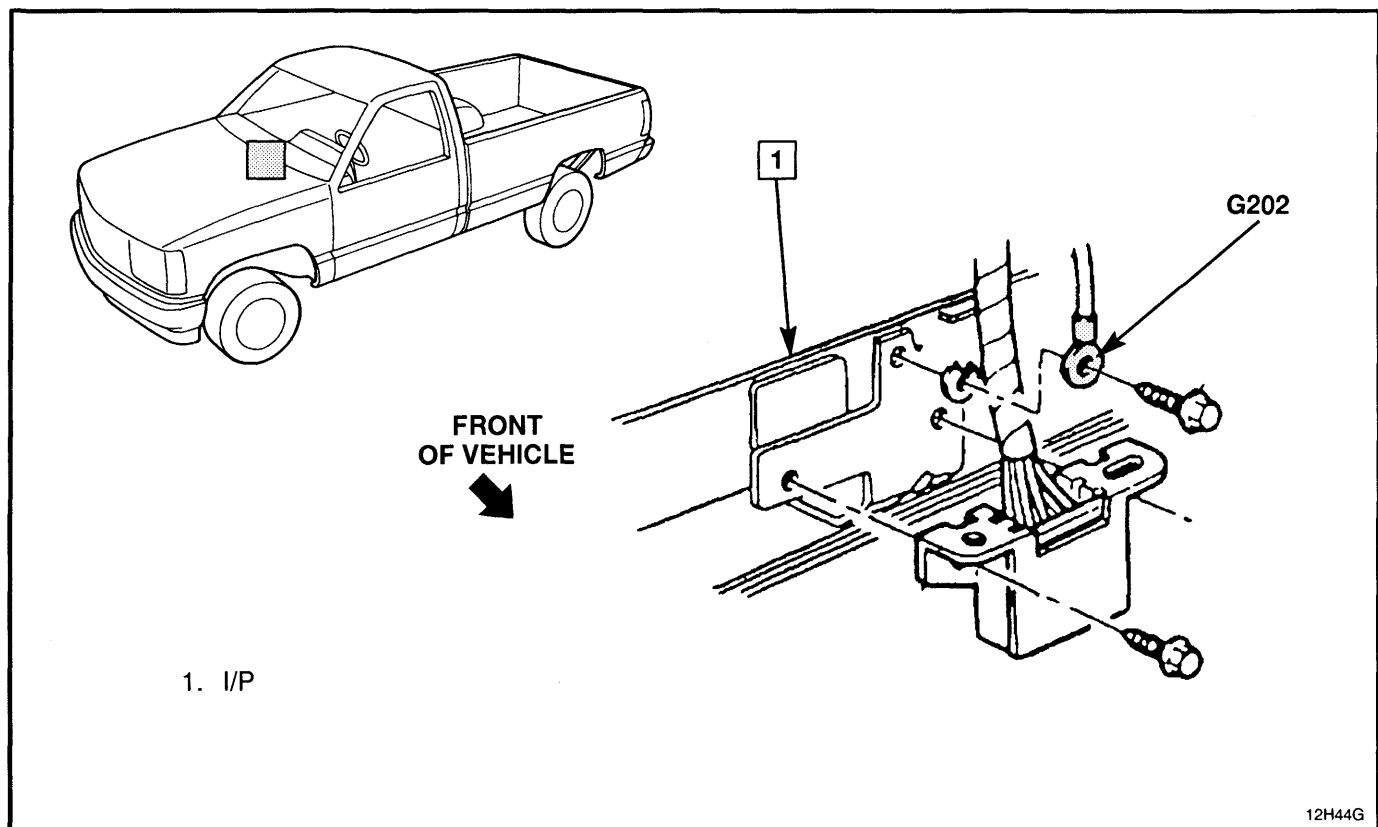


Figure 2 — I/P Ground Wiring

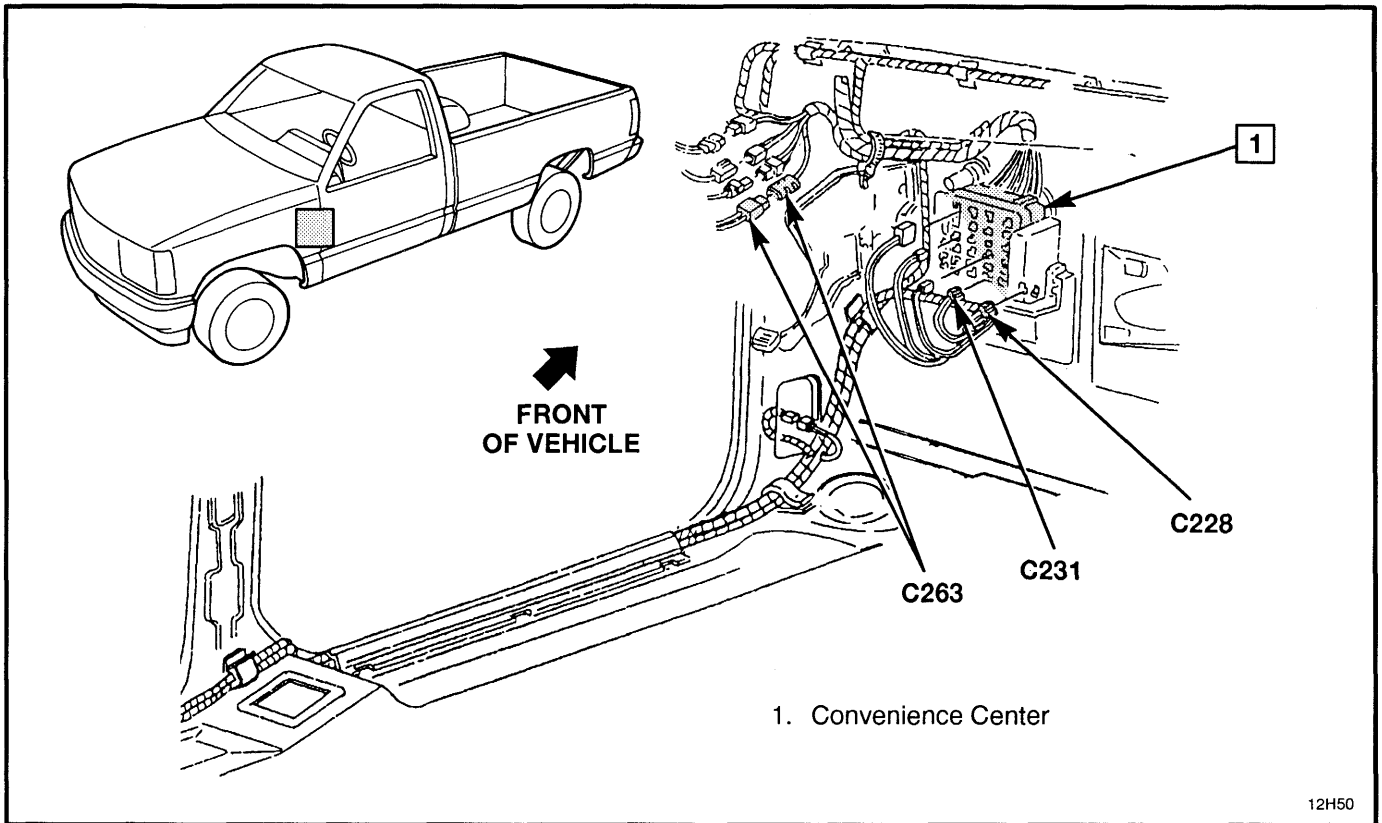


Figure 3 — Body Wiring Harness, Front

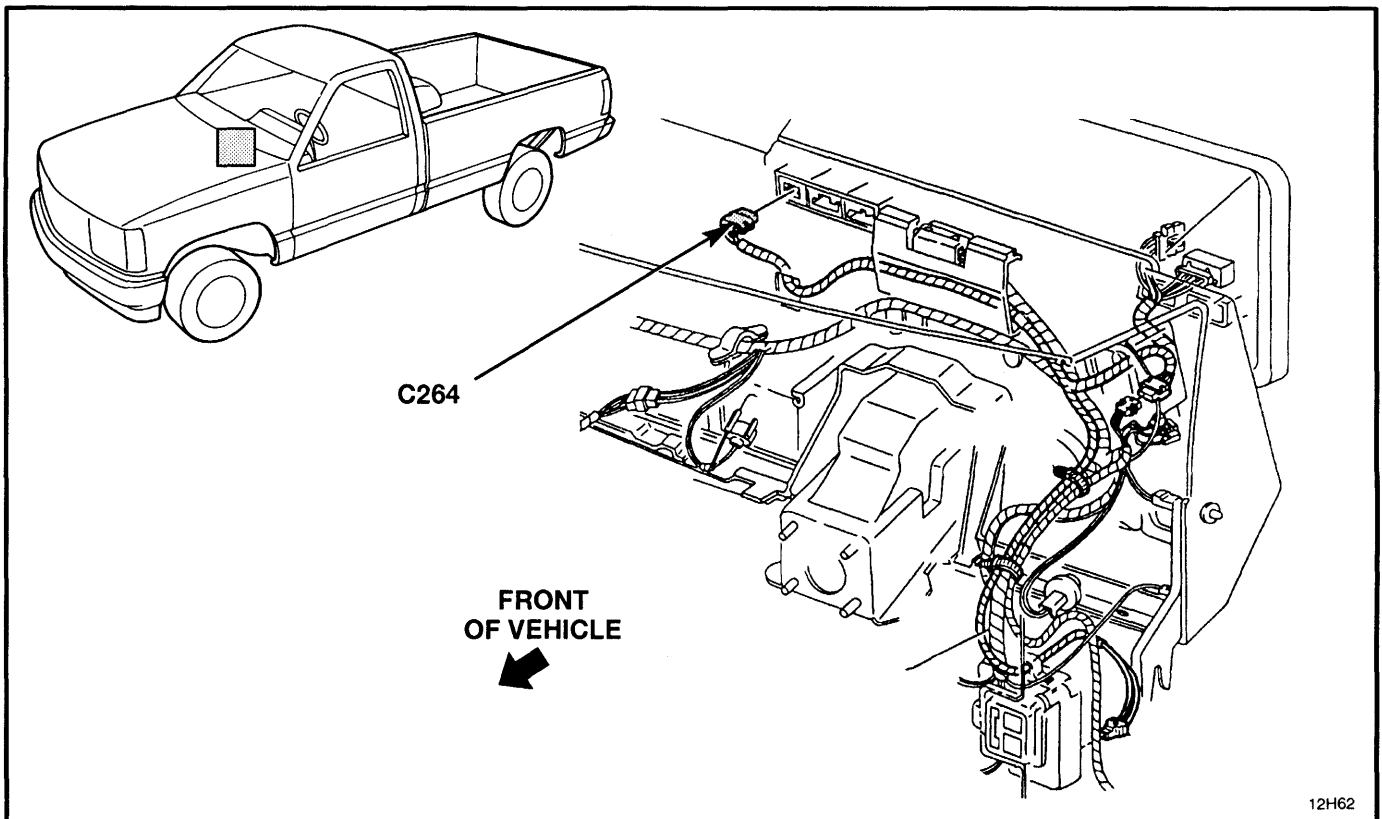


Figure 4 — Auxiliary Heater Front Wiring

## 8A-60B-12 REAR AUXILIARY HEATER

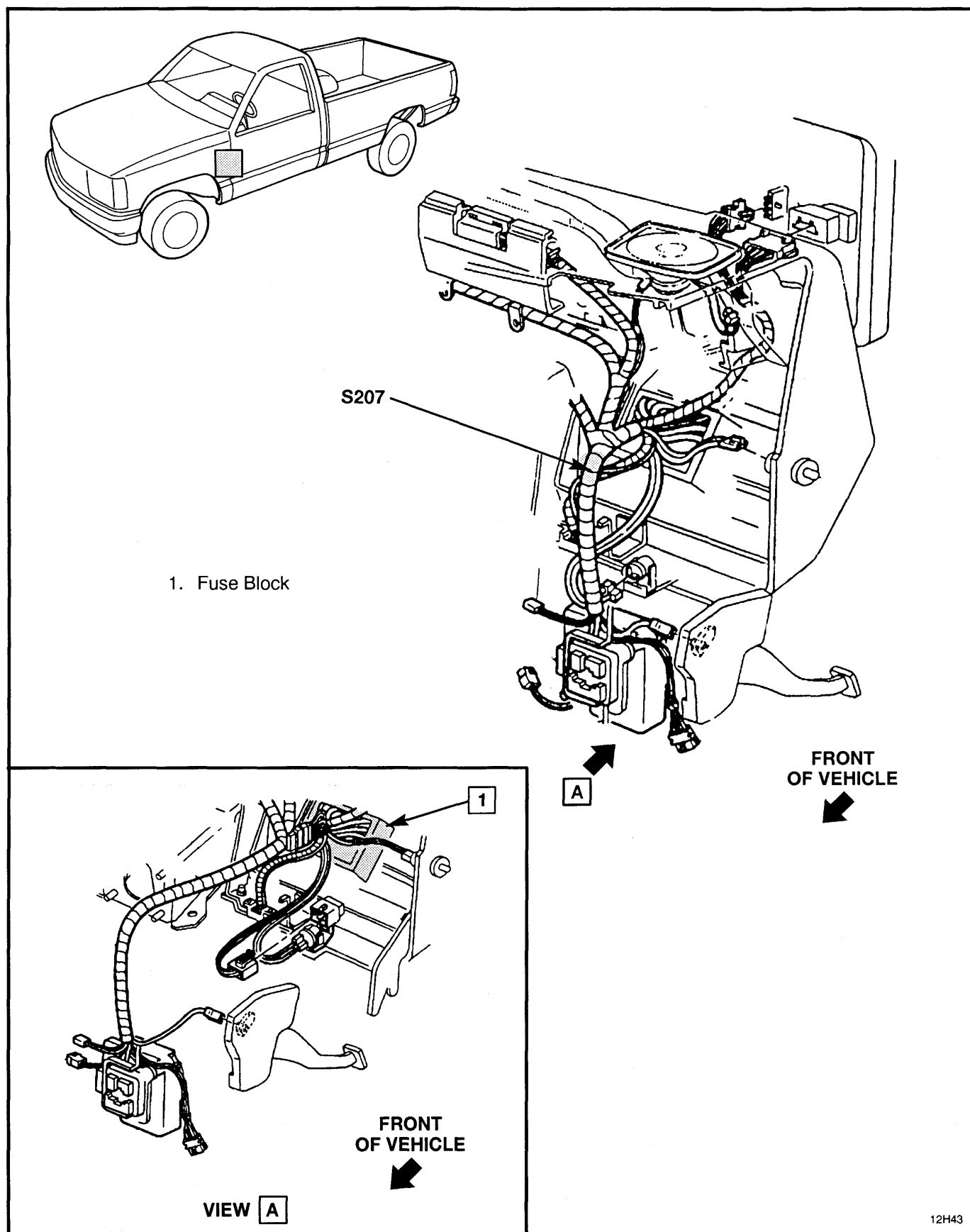


Figure 5 — LH Side of Instrument Panel

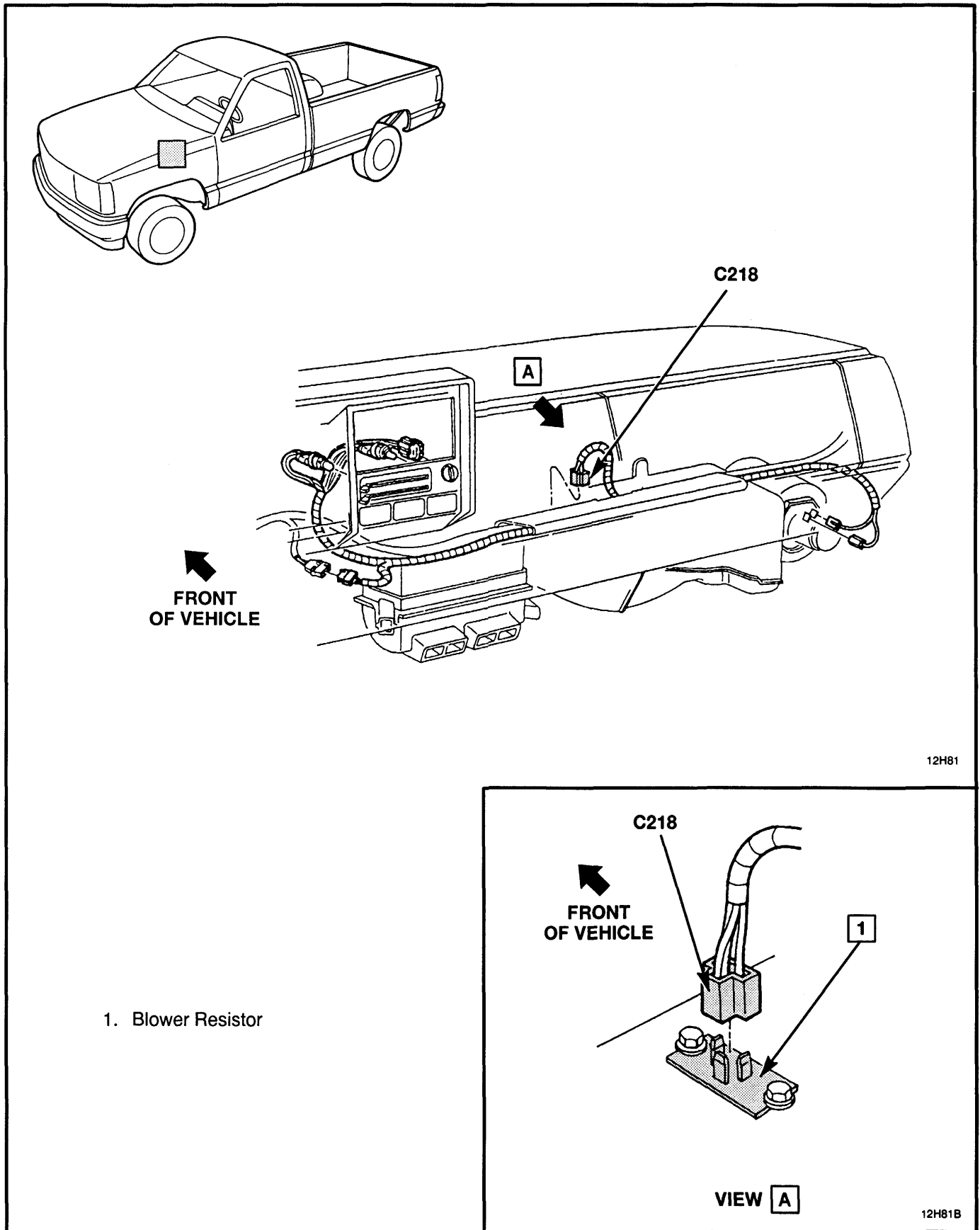


Figure 6 — Heater A/C Wiring

## 8A-60B-14 REAR AUXILIARY HEATER

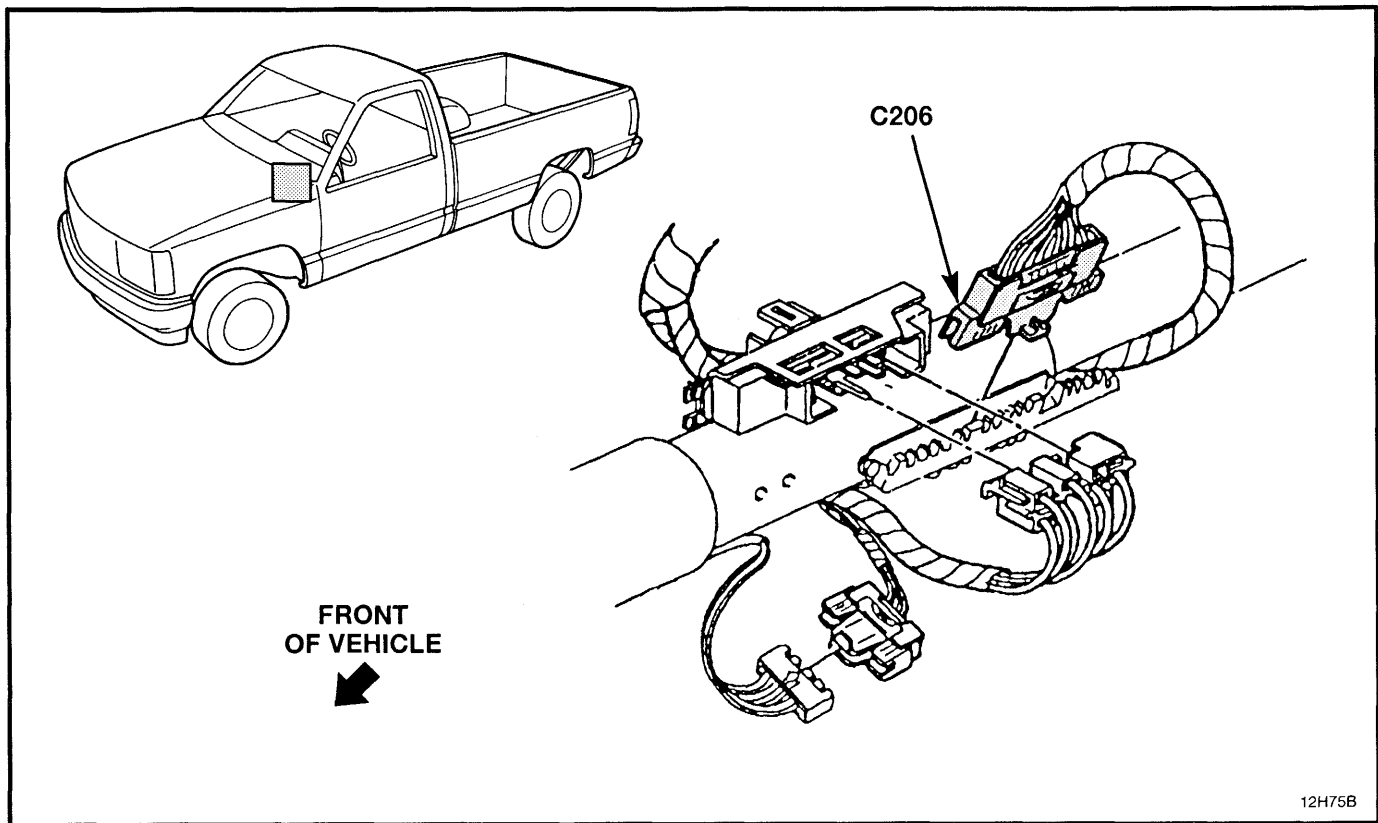


Figure 7 — Ignition Switch Wiring

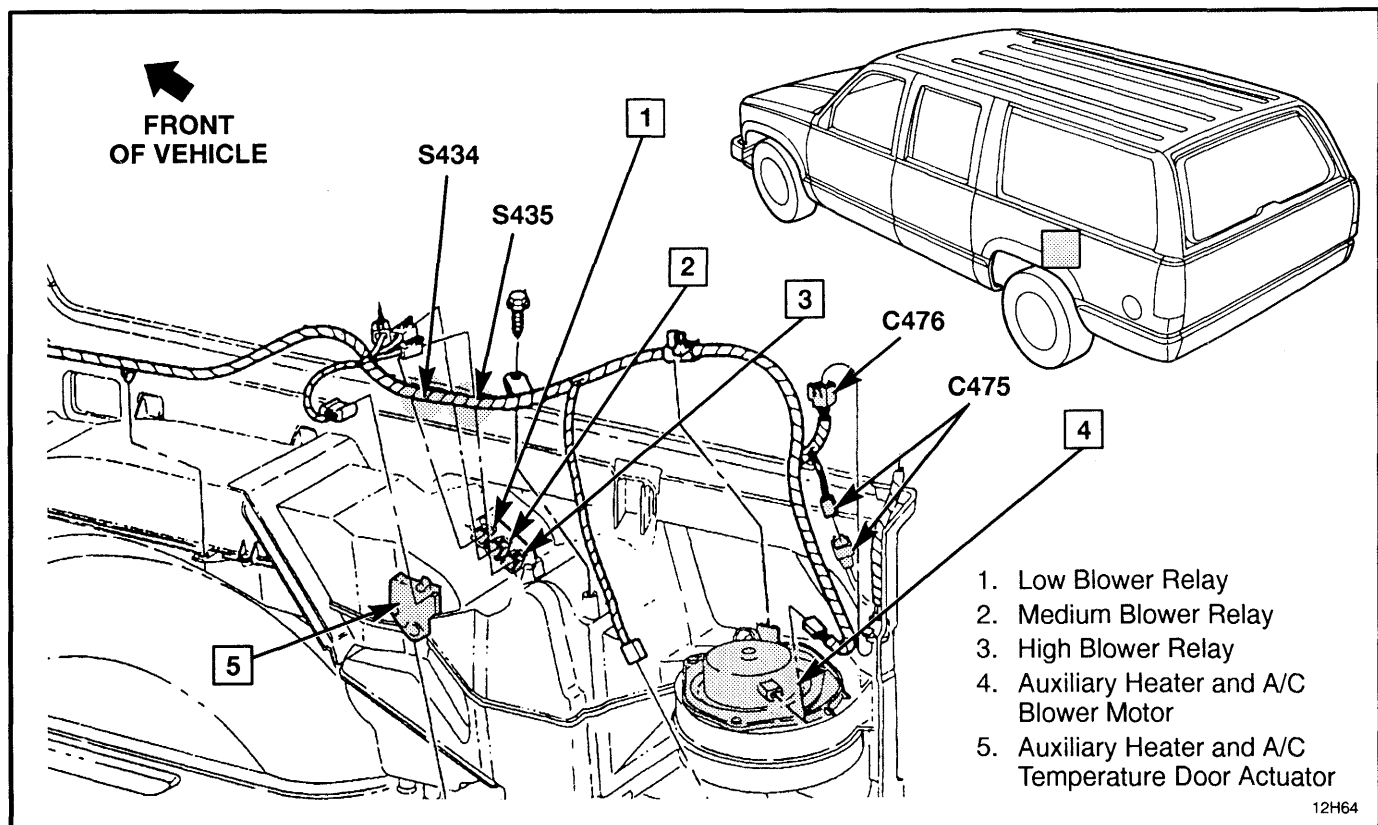


Figure 8 — Auxiliary Heater and A/C Wiring

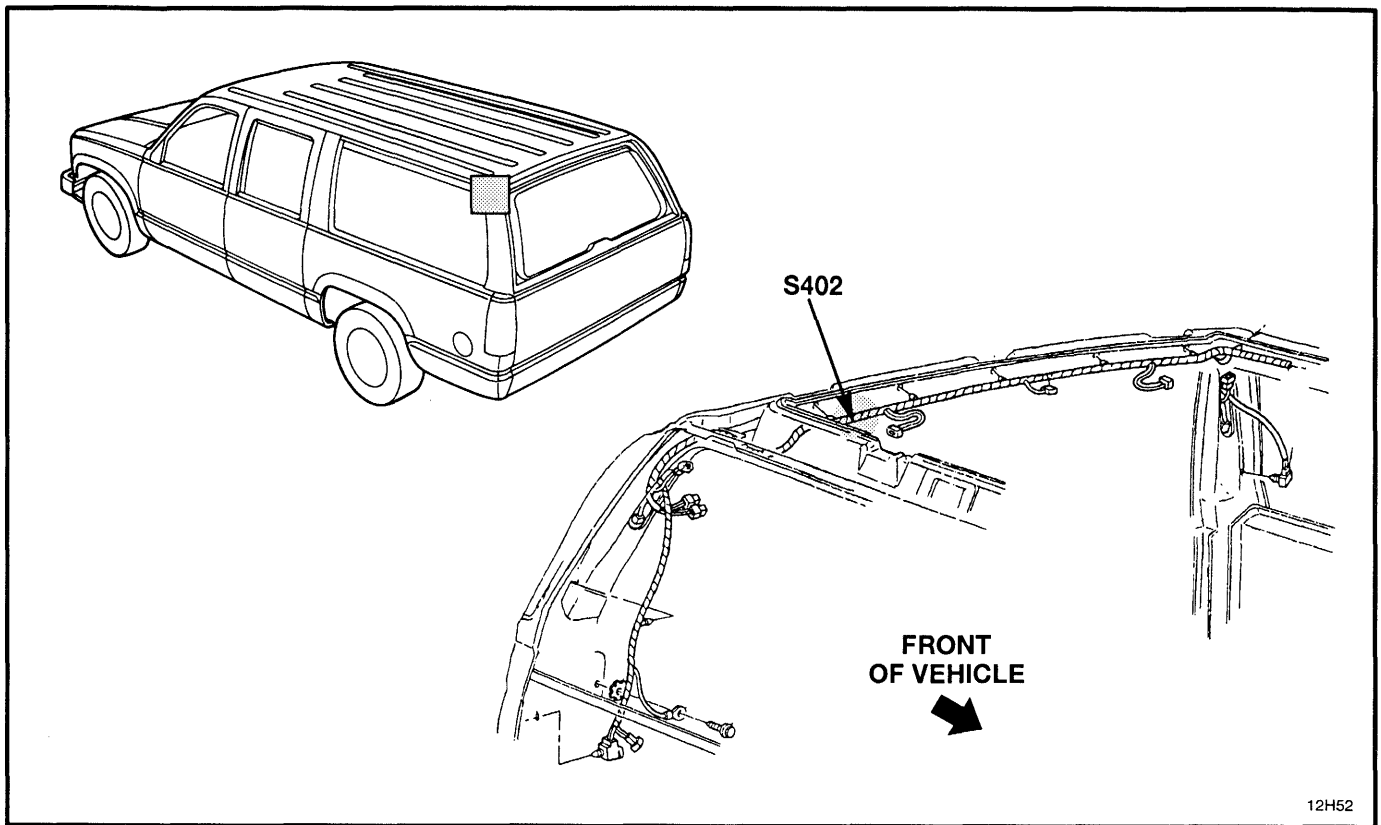


Figure 9 — Body Wiring, Rear — Suburban

12H52

**BLANK**

## CIRCUIT OPERATION

With the Ignition Switch in RUN, voltage is supplied to the Rear Defogger Control. When the Rear Defogger Control Switch is moved to the ON position, the contact closes, which provides voltage to the ON Indicator and the Rear Defogger. The rear window will become warm to remove fog from the surface of the window.

The contact in the Rear Defogger Control will stay closed until the Rear Defogger Control Switch is turned off or the timer cycle is complete.

The Timer also shuts off anytime the Rear Defogger Control ON-OFF Switch is depressed to OFF.

## COMPONENT LOCATION

### Page — Figure

|                                   |                                           |           |   |
|-----------------------------------|-------------------------------------------|-----------|---|
| Contactor, LH Cargo Door .....    | Upper LH rear body opening and door ..... | 61-14     | 4 |
| Cargo Door Defogger Grid, LH Rear | On LH rear cargo door glass .....         | Not Shown |   |
| Cargo Door Defogger Grid, RH Rear | On RH rear cargo door glass .....         | Not Shown |   |
| Contactor, RH Cargo Door .....    | Upper RH rear body opening and door ..... | 61-15     | 5 |
| Convenience Center .....          | Under LH side of I/P .....                | 61-13     | 3 |
| Fuse Block .....                  | Under LH side of I/P .....                | 61-12     | 1 |
| Rear Liftgate Defogger Grid ..... | On rear liftgate glass .....              | Not Shown |   |
| Rear Window Defogger Switch ..... | Center of I/P .....                       | 61-13     | 3 |

## CONNECTORS:

|            |                           |           |   |
|------------|---------------------------|-----------|---|
| C261 ..... | Under LH end of I/P ..... | 61-13     | 3 |
| C492 ..... | At LH D-pillar .....      | 61-15     | 5 |
| C493 ..... | At LH D-pillar .....      | 61-15     | 5 |
| C494 ..... | At RH D-pillar .....      | 61-14     | 4 |
| C495 ..... | At RH D-pillar .....      | 61-14     | 4 |
| C496 ..... | At LH D-pillar .....      | Not Shown |   |
| C497 ..... | At RH D-pillar .....      | Not Shown |   |
| C920 ..... | Inside LH rear door ..... | 61-14     | 4 |
| C921 ..... | Inside RH rear door ..... | 61-15     | 5 |
| C922 ..... | Inside LH rear door ..... | 61-14     | 4 |
| C923 ..... | Inside RH rear door ..... | 61-15     | 5 |

## GROMMETS:

|            |                                        |       |   |
|------------|----------------------------------------|-------|---|
| P415 ..... | At LH upper side of body opening ..... | 61-17 | 8 |
| P416 ..... | At RH upper side of body opening ..... | 61-17 | 8 |
| P910 ..... | Inside LH cargo door below glass ..... | 61-14 | 4 |
| P911 ..... | Inside RH cargo door below glass ..... | 61-14 | 4 |
| P912 ..... | Inside LH cargo door below glass ..... | 61-15 | 5 |
| P913 ..... | Inside RH cargo door below glass ..... | 61-15 | 5 |
| P914 ..... | At liftgate strut .....                | 61-17 | 8 |
| P915 ..... | At liftgate strut .....                | 61-17 | 8 |
| P916 ..... | At liftgate strut .....                | 61-17 | 8 |
| P917 ..... | At liftgate strut .....                | 61-17 | 8 |



## 8A-61-2 REAR WINDOW DEFOGGER

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### COMPONENT LOCATION

Page — Figure

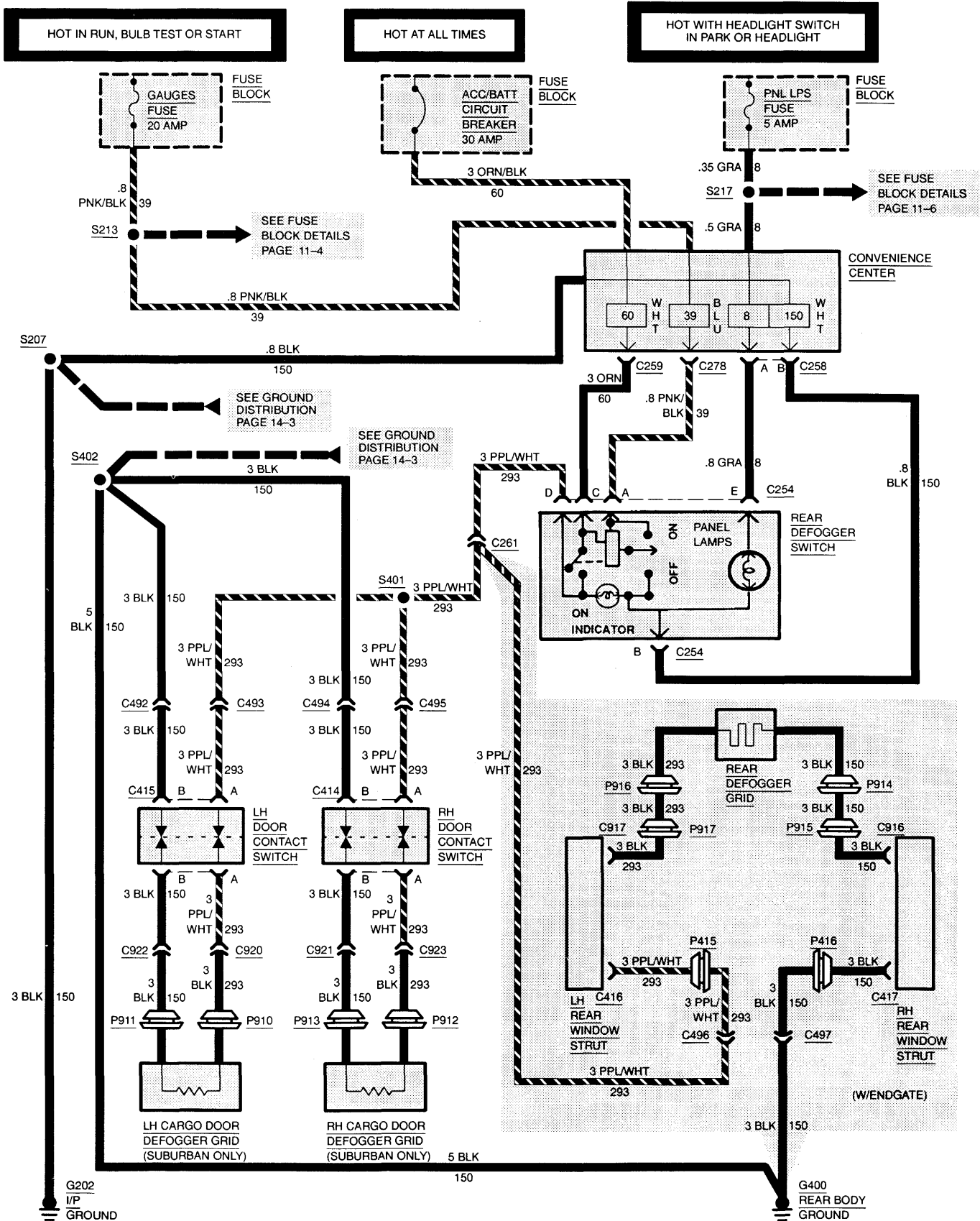
#### GROUNDING:

|      |                              |           |   |
|------|------------------------------|-----------|---|
| G202 | ..... At DLC connector ..... | 61-13     | 2 |
| G307 | ..... At RH B-Pillar .....   | 61-16     | 6 |
| G400 | ..... At RH D-pillar .....   | Not Shown |   |
| G415 | ..... At RH C-pillar .....   | Not Shown |   |

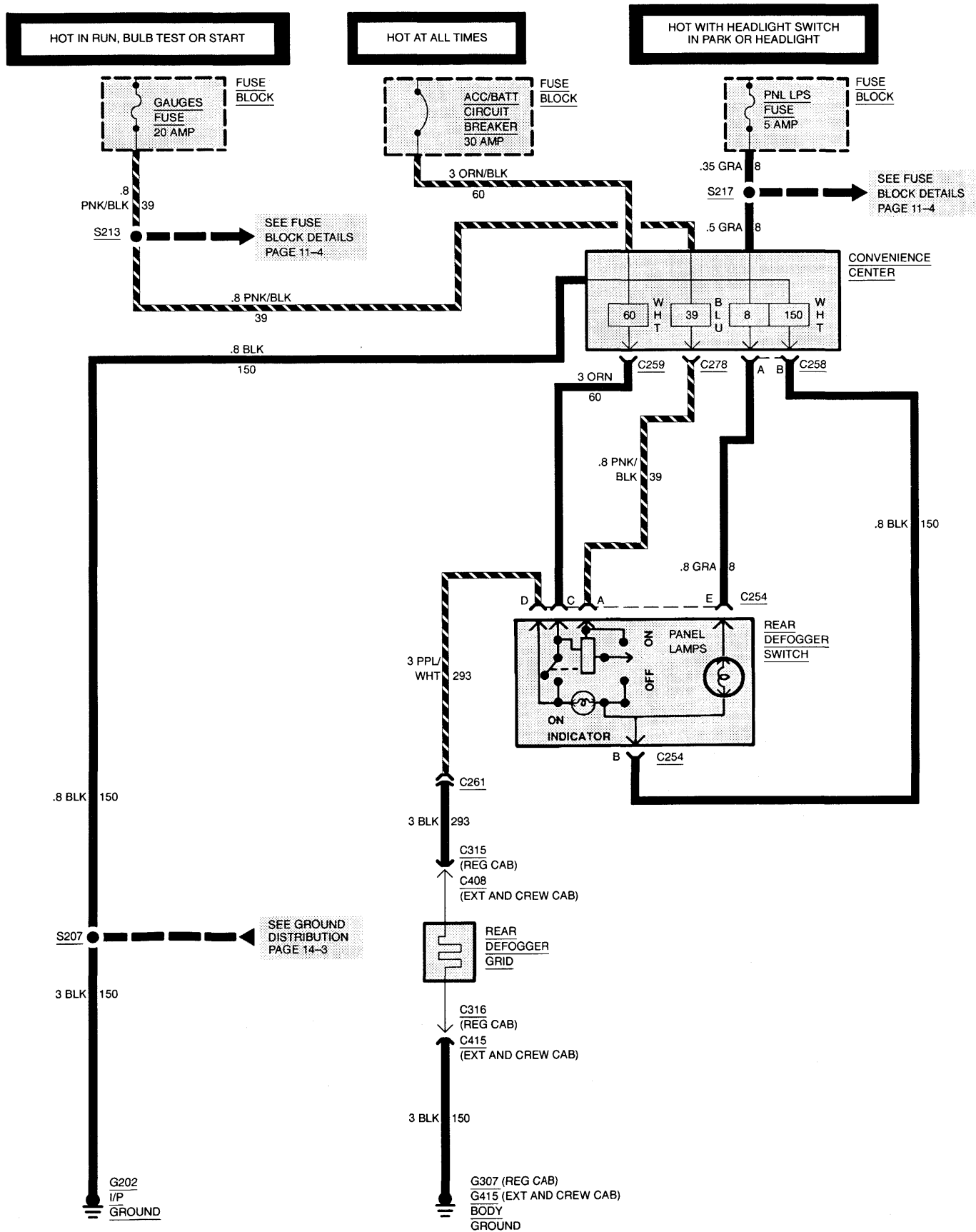
#### SPLICES:

|      |                                               |       |   |
|------|-----------------------------------------------|-------|---|
| S207 | ..... Under LH side of I/P .....              | 61-12 | 1 |
| S213 | ..... Under LH side of I/P .....              | 61-12 | 1 |
| S217 | ..... Under LH side of I/P .....              | 61-12 | 1 |
| S401 | ..... Above rear liftgate glass .....         | 61-16 | 7 |
| S402 | ..... Above rear liftgate glass opening ..... | 61-18 | 9 |

# REAR WINDOW DEFOGGER 8A-61-3 SUBURBAN AND UTILITY



# 8A-61-4 REAR WINDOW DEFOGGER PICKUP



## DIAGNOSIS — REAR WINDOW DEFOGGER

### PRELIMINARY CHECKS:

1. Check to see that GAUGES and PNL LPS Fuses and also ACC-BATT circuit breaker are not blown. If blown, locate and repair source of overload, then replace fuse or breaker.
2. If fuses are not blown, proceed with the following diagnostic charts.

### ON INDICATOR WORKS BUT REAR WINDOW DEFOGGER DOES NOT DEFROST— REGULAR, EXTENDED AND CREW CAB

| TEST                                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and turn rear defogger switch ON. Connect test lamp from PPL/WHT (293) wire at rear window grid connector C315 or C408 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                   |
|                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in PPL/WHT (293) wire between rear window grid connector C315 or C408 and body connector C261 or PPL/WHT (293) wire between body connector C261 and rear defogger switch connector C254. |
| 2. Connect test lamp from PPL (293) wire at rear window grid LH connector C315 or C408 to BLK (150) wire at rear window grid RH connector C316 or C415.                    | Test lamp lights.         | REPAIR rear window defogger grid as required.                                                                                                                                                                   |
|                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear window grid RH connector C316 and ground terminal G307 or G415.                                                                                           |

### ON INDICATOR WORKS BUT REAR WINDOW DEFOGGER DOES NOT DEFROST — UTILITY AND SUBURBAN WITH LIFTGATE

| TEST                                                                                                                                                                                | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position and turn rear defogger switch ON. Connect test lamp from BLK (293) wire at LH side of rear window where wire attaches from grid to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (293) wire between rear window grid wire attaching point and liftgate strut rod connector C917, or PPL/WHT (293) wire from liftgate strut rod body side connector C416 to body connector C412, from body connector C412 to body connector C261 or from body connector C261 to rear defogger switch connector C254. |
| 2. Connect test lamp from BLK (293) wire at rear window grid LH wire attaching point to BLK (150) wire at rear window grid RH attaching point.                                      | Test lamp lights.         | REPAIR rear window defogger grid as required.                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear window grid RH attaching point and RH liftgate strut rod connector C916, from RH strut rod connector C417 and body connector C413 or from body connector C413 to ground G400.                                                                                                              |

## 8A-61-6 REAR WINDOW DEFOGGER

### REAR WINDOW DEFOGGER DOES NOT WORK AND ON INDICATOR DOES NOT LIGHT

| TEST                                                                                                                                                                                | RESULT                    | ACTION                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect rear defogger switch connector C254 and place ignition switch in RUN position. Connect test lamp from ORN (40) wire at rear defogger switch connector C254 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                    |
|                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in ORN (60) wire between rear defogger switch connector C254 and convenience center connector C259 or from convenience center to fuse block.                                              |
| 2. Connect test lamp from PNK/BLK (39) wire at defogger switch connector C254 and ground.                                                                                           | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                    |
|                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire between rear window defogger switch connector C254 and convenience center connector C255, from convenience center to splice S213, or from splice S213 to fuse block. |
| 3. Connect test lamp from PNK/BLK (39) wire to BLK (150) wire at rear defogger switch connector C254.                                                                               | Test lamp lights.         | REPLACE rear defogger switch.                                                                                                                                                                                    |
|                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear defogger switch connector C254 and convenience center connector C258, from convenience center to splice S207, or from splice S207 to ground G202.          |

### ON INDICATOR WORKS BUT LH OR RH CARGO DOOR WINDOW(S) DO NOT DEFROST — SUBURBAN W/CARGO DOORS

| TEST                                                                                                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Close both rear cargo doors, place ignition switch in RUN position and turn rear defogger switch ON. Connect test lamp from BLK (293) wire at LH side of rear window in LH or RH cargo door from where wire attaches at grid to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (293) wire between rear window grid wire attaching point and connector C920 in LH cargo door or connector C923 in RH cargo door, from connector C920 or C923 to LH contact connector C918 or RH contact connector C919, from LH contact connector C414 or RH contact connector C415 to LH body connector C412 or RH body connector C413, from LH body connector C412 or RH body connector C413 to splice S410, from splice S401 to connector C261, or from connector C261 to rear defogger switch connector C254. |

**ON INDICATOR WORKS BUT LH OR RH CARGO DOOR WINDOW(S)  
DO NOT DEFROST — SUBURBAN W/CARGO DOORS (CONTINUED)**

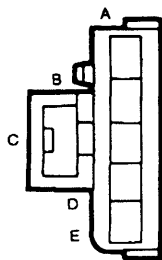
| TEST                                                                                                                                                                                                                                                                        | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. Close both rear cargo doors, place ignition switch in RUN position and turn rear defogger switch ON. Connect test lamp from BLK (293) wire at LH side of rear window to BLK (150) wire at RH side of rear window in LH or RH cargo door from where wires attach to grid. | Test lamp lights.         | REPAIR rear window grid.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear window grid wire attaching point and connector C922 in LH cargo door or connector C921 in RH cargo door, from connector C922 or C921 to LH contact connector C918 or RH contact connector C919, from LH contact connector C414 or RH contact connector C415 to LH body connector C412 or RH body connector C413, from LH body connector C412 or RH body connector C413 to splice S402, from splice S402 to ground G400. |

**REAR DEFOGGER PANEL LAMP DOES NOT WORK**

| TEST                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Turn headlamps ON and position dimmer control to BRIGHT. Connect test lamp from GRA (8) wire at rear defogger switch connector C254 to ground. | Test lamp lights.         | REPLACE panel lamp.                                                                                                                                                                                 |
|                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in GRA (8) wire between rear defogger switch connector C254 and convenience center connector C258, from convenience center to splice S217 or from splice S217 to fuse block. |

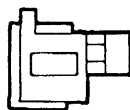
# 8A-61-8 REAR WINDOW DEFOGGER

12059296



**C254**  
Rear Defogger Switch

12059233



**C259**  
Defogger Switch to Convenience Center

12015952



**MED. GRAY**  
Metri-Pack 480  
**C261**  
Defogger Switch to Grid Extension

12015987



**MED. GRAY**  
Metri-Pack 480  
**C261**  
Grid Extension to Defogger Switch

02977253



**BLACK**  
56 Series  
**C315**  
Grid to Extension Power (Regular Cab)

02977253



**BLACK**  
56 Series  
**C315**  
Grid to Ground (Regular Cab)

02977253



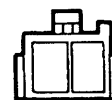
**BLACK**  
56 Series  
**C408**  
Grid to Extension Power (Extended Cab)

02977253



**BLACK**  
56 Series  
**C408**  
Grid to Ground (Extended Cab)

12015197



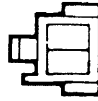
**BLACK**  
Weather Pack  
**C918**  
LH Door Contactor to Grid Extension

12015197



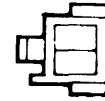
**BLACK**  
Weather Pack  
**C919**  
RH Door Contactor to Grid  
Extension

12033709



**BLACK**  
Metri-Pack 280  
**C414**  
Switch Extension to LH Door  
Contactor

12033709



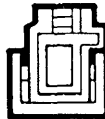
**BLACK**  
Metri-Pack 280  
**C415**  
Switch Extension to RH Door  
Contactor

12015952



**MED. GRAY**  
Metri-Pack 480  
**C492**  
Switch Extension to RH  
Contactors

12015987



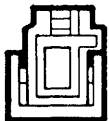
**MED. GRAY**  
Metri-Pack 480  
**C492**  
Switch Extension to RH  
Contactors

12015952



**MED. GRAY**  
Metri-Pack 480  
**C493**  
Switch Extension to RH  
Contactors

12015987



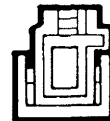
**MED. GRAY**  
Metri-Pack 480  
**C493**  
Switch Extension to RH  
Contactors

12015952



**MED. GRAY**  
Metri-Pack 480  
**C494**  
Switch Extension to LH  
Contactors

12015987



**MED. GRAY**  
Metri-Pack 480  
**C494**  
Switch Extension to LH  
Contactors



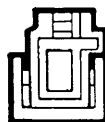
## 8A-61-10 REAR WINDOW DEFOGGER

12015952



**MED. GRAY**  
Metri-Pack 480  
**C495**  
Switch Extension to LH  
Contactors

12015987



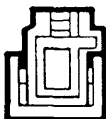
**MED. GRAY**  
Metri-Pack 480  
**C495**  
Switch Extension to LH  
Contactors

12015952



**MED. GRAY**  
Metri-Pack 480  
**C496**  
Switch Extension to LH  
Contactors

12015987



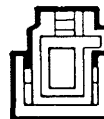
**MED. GRAY**  
Metri-Pack 480  
**C496**  
Switch Extension to LH  
Contactors

12015952



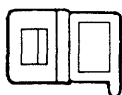
**MED. GRAY**  
Metri-Pack 480  
**C497**  
Switch Extension to RH  
Contactors

12015987



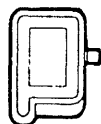
**MED. GRAY**  
Metri-Pack 480  
**C497**  
Switch Extension to RH  
Contactors

12059884



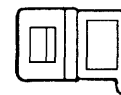
**C920**  
LH Contactors to Grid

12059885



**C920**  
Grid to LH Contactors Extension

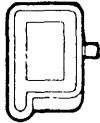
12059884



**C921**  
RH Contactors to Grid

# REAR WINDOW DEFOGGER 8A-61-11

12059885



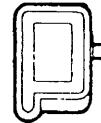
**C921**  
Grid to RH Contactors Extension

12059884



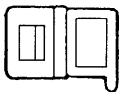
**C922**  
LH Contactors to Grid

12059885



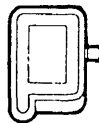
**C922**  
Grid to LH Contactors Extension

12059884



**C9233**  
RH Contactors to Grid

12059885



**C923**  
Grid to RH Contactors Extension

02962793



**BLACK**  
56 Series  
**C416**  
Grid Extension to LH Gas  
Cylinder

02962793



**BLACK**  
56 Series  
**C417**  
Grid Extension to RH Gas  
Cylinder

# 8A-61-12 REAR WINDOW DEFOGGER

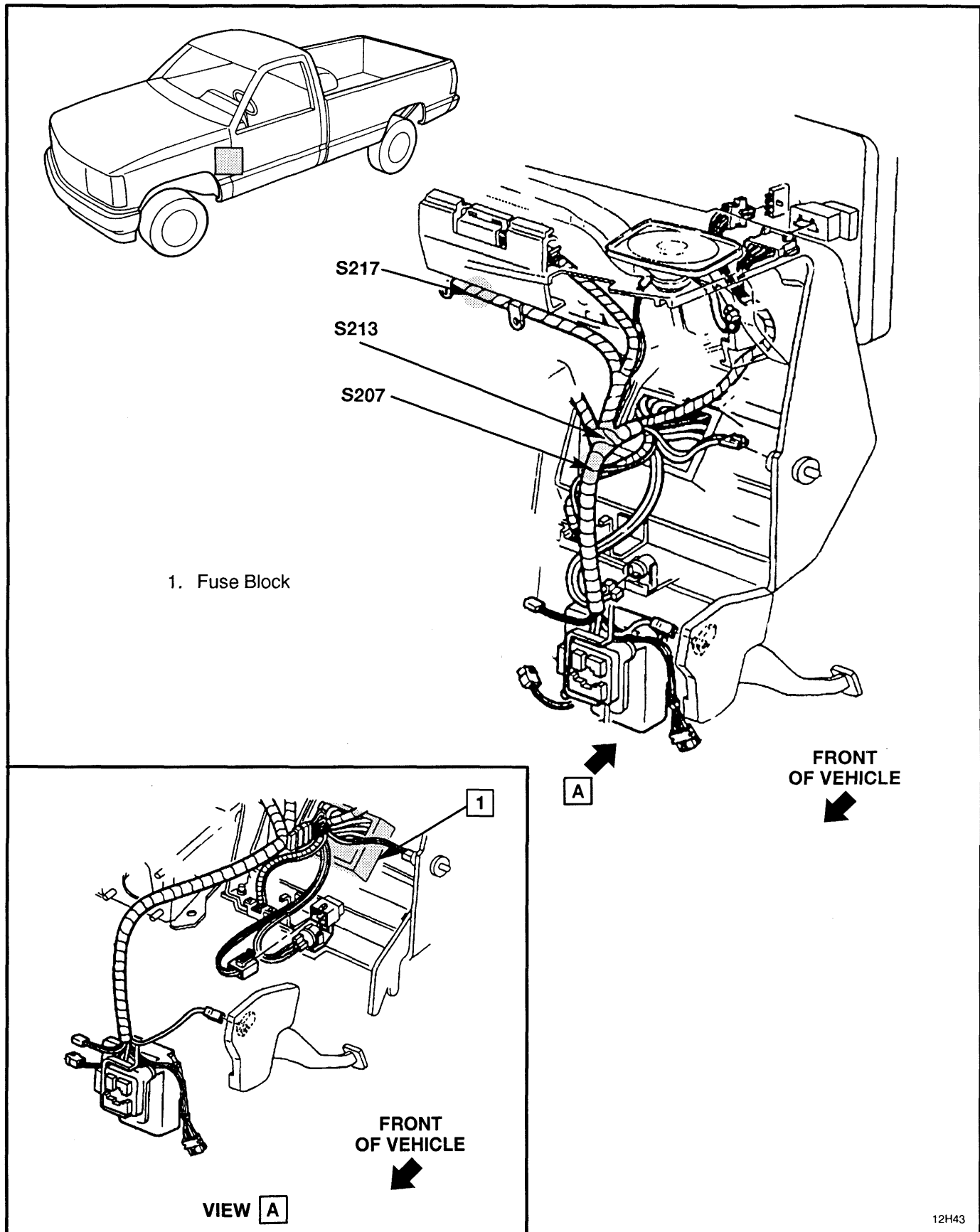
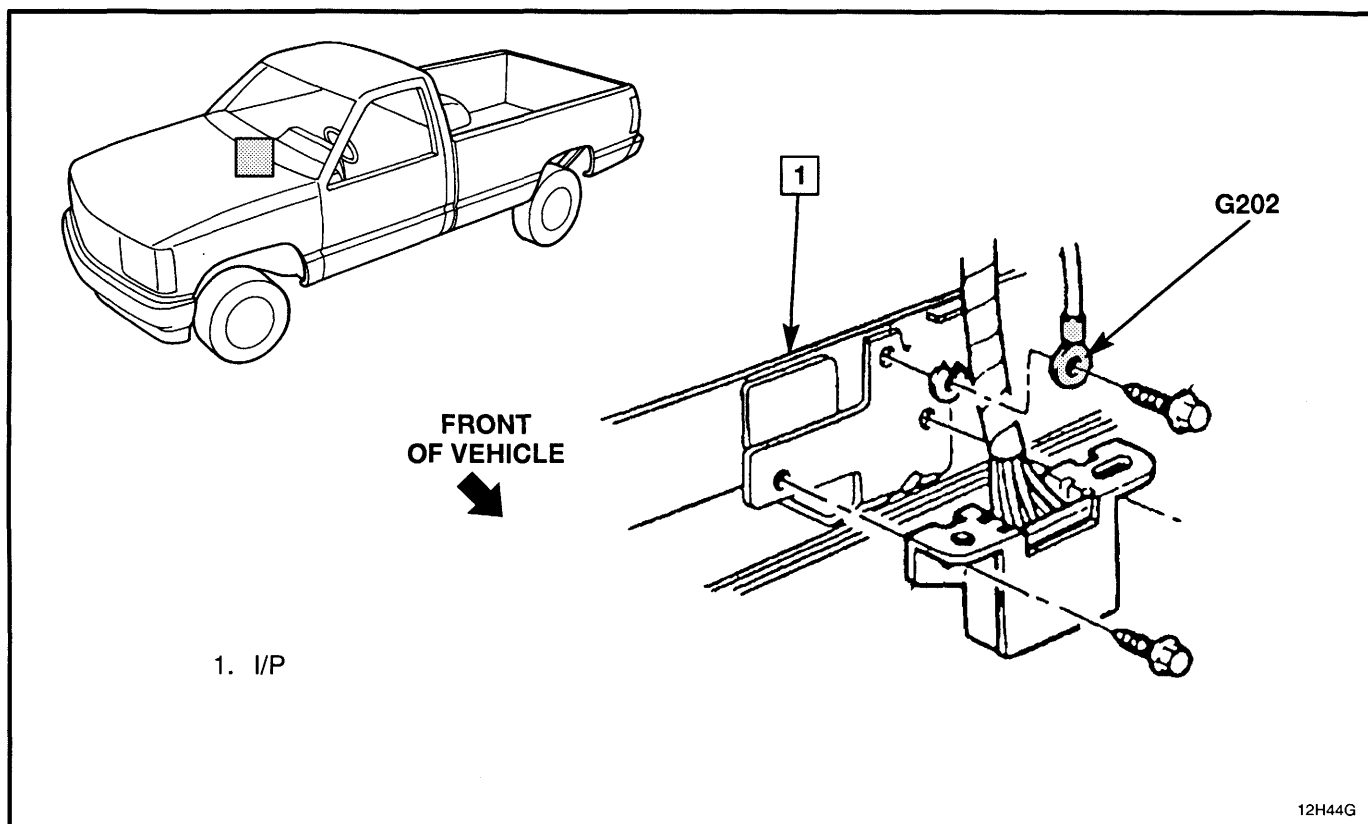
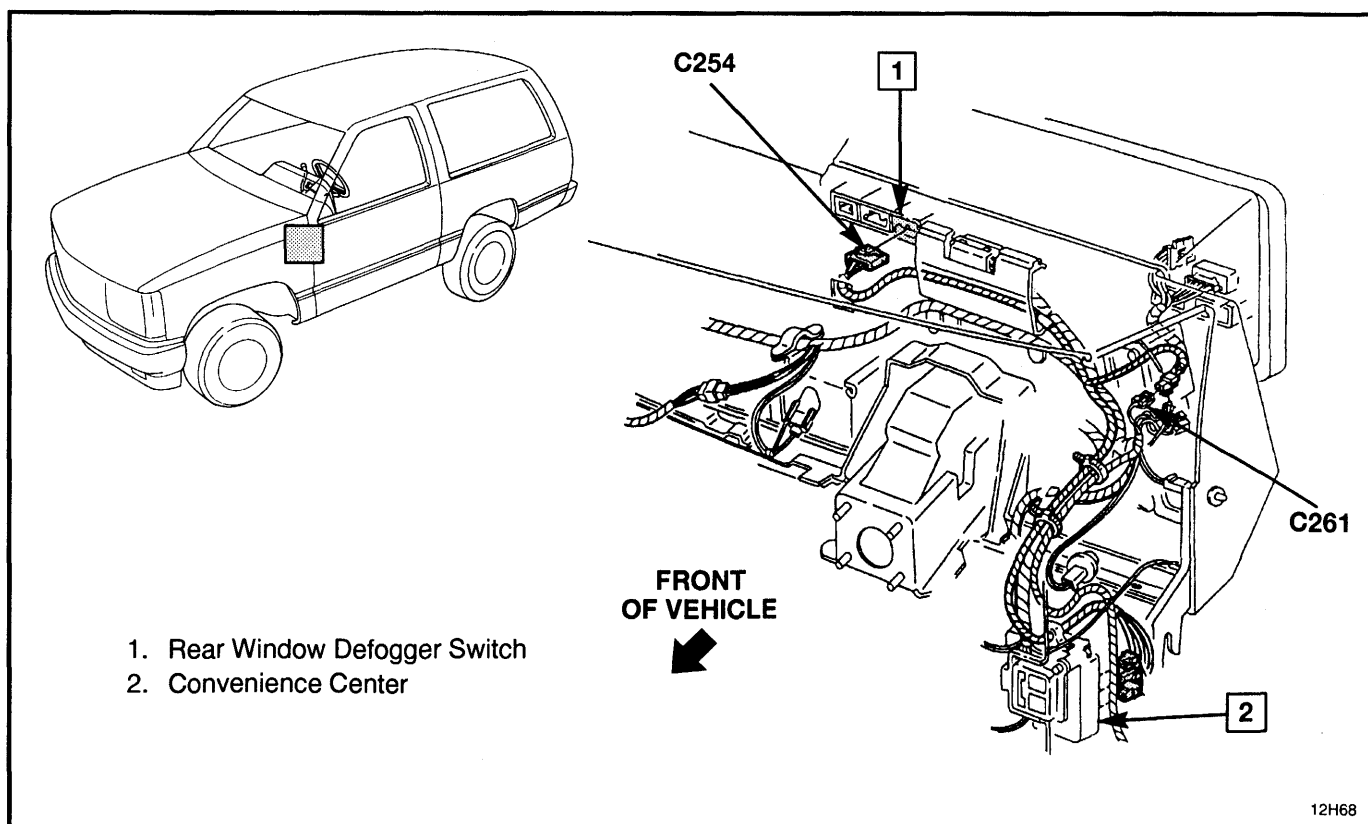


Figure 1 — LH Side of Instrument Panel



### Figure 2 — I/P Ground



**Figure 3 — Rear Window Defogger Front Wiring, Utility and Suburban Shown — Extended and 4-Door Cabs Similar**

## 8A-61-14 REAR WINDOW DEFOGGER

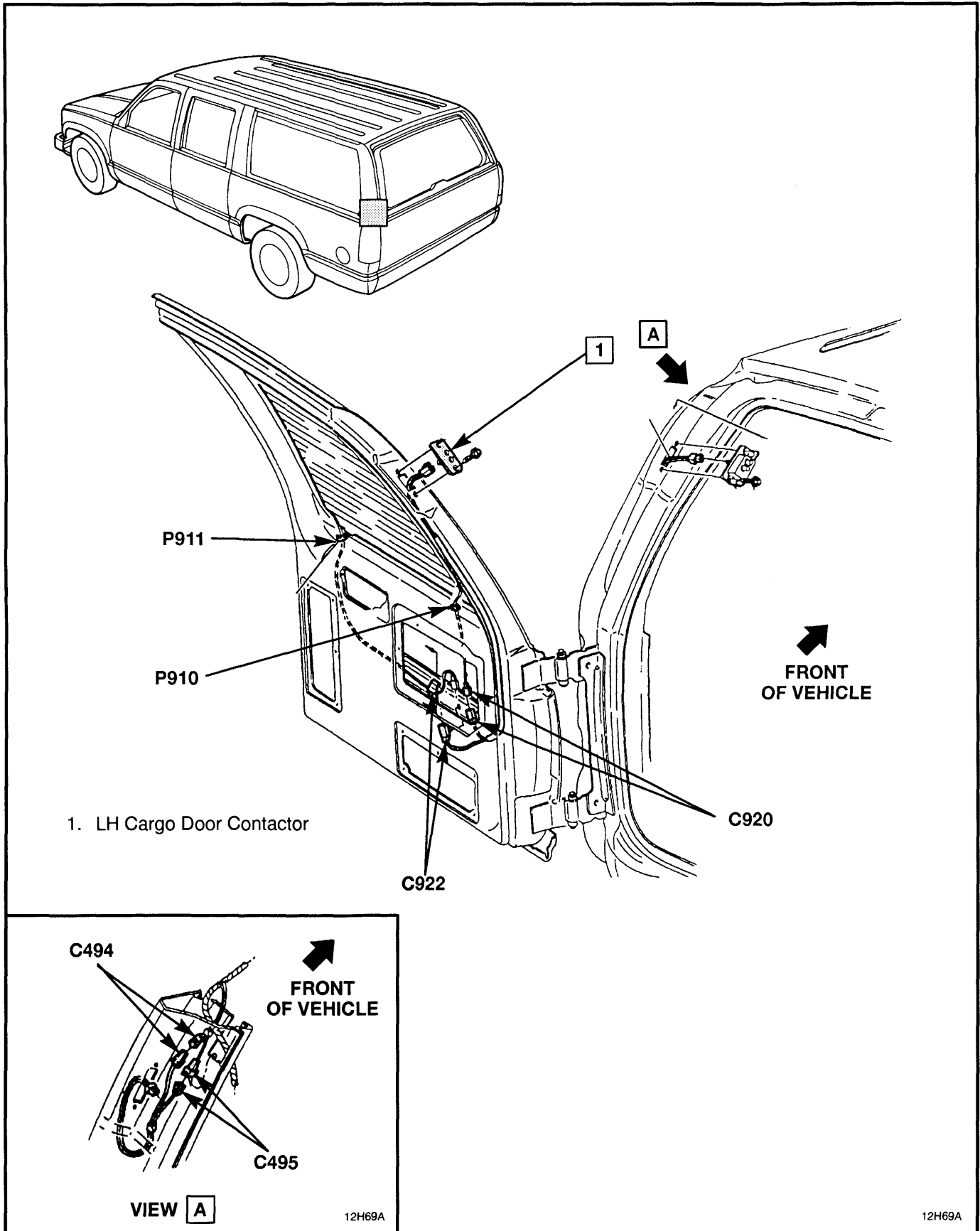
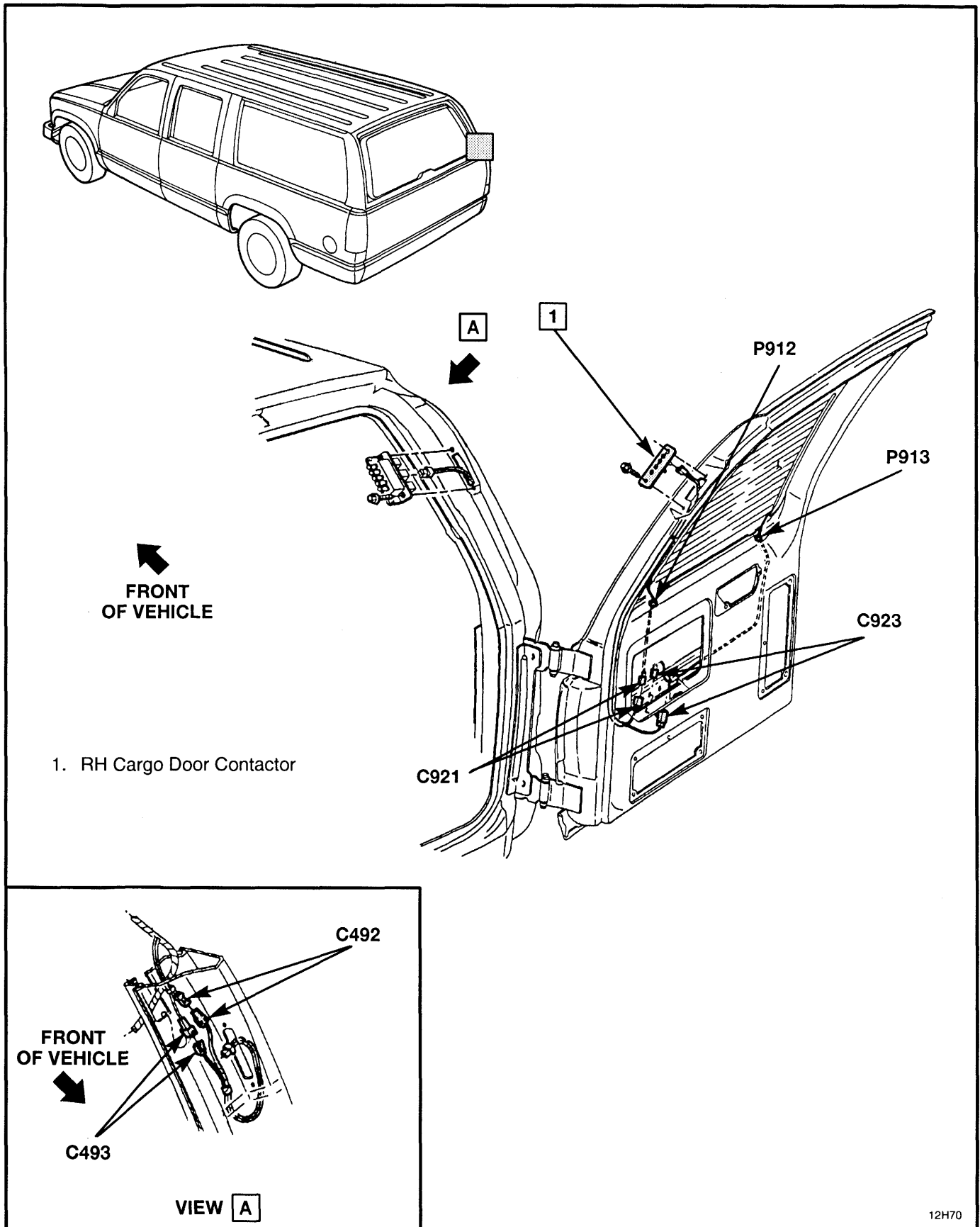


Figure 4 — Rear Door Contact Assembly



12H70

Figure 5 — Rear Door Contact Assembly

## 8A-61-16 REAR WINDOW DEFOGGER

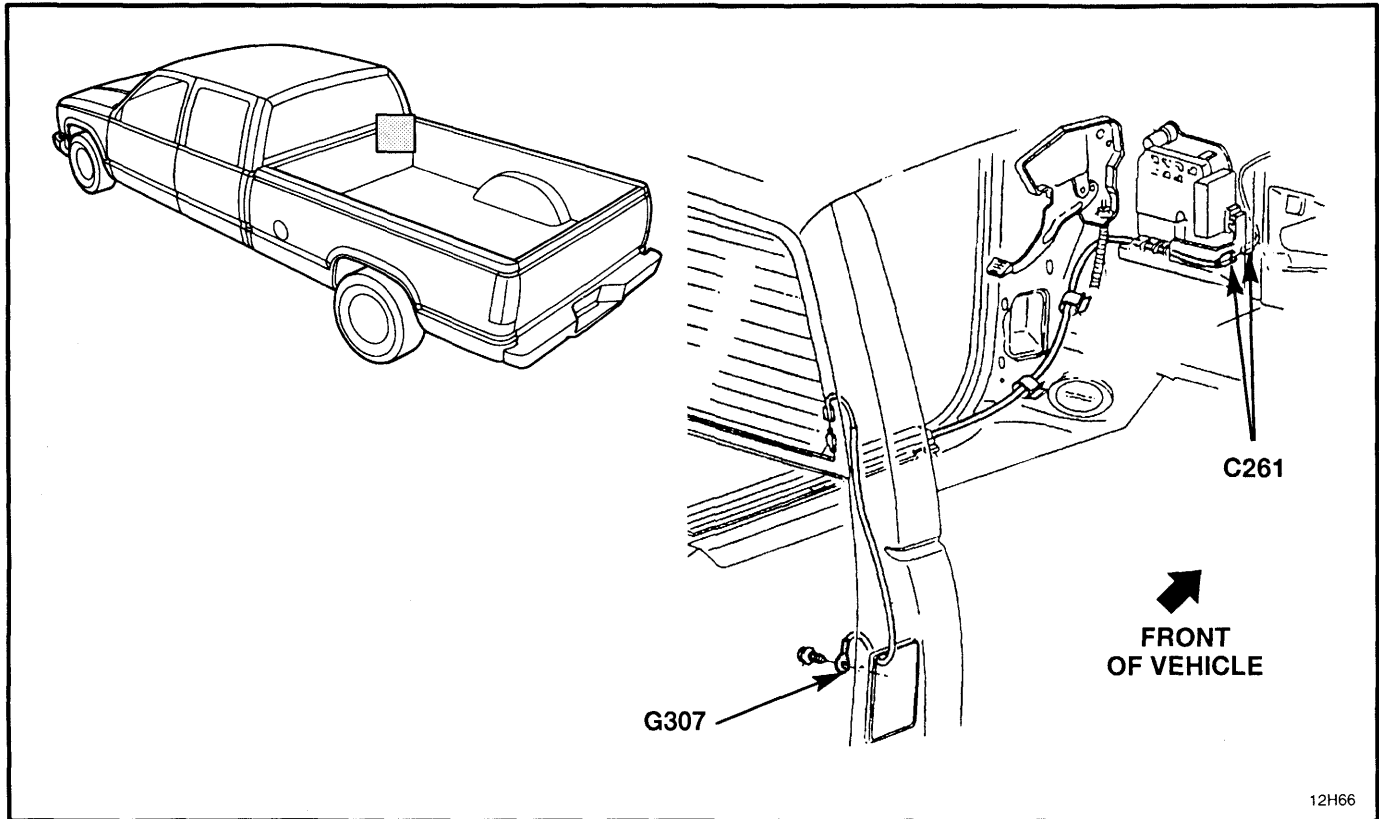


Figure 6 — Rear Window Defogger Wiring, 4-Door Cab Shown — Pickup and Extended Cabs Similar

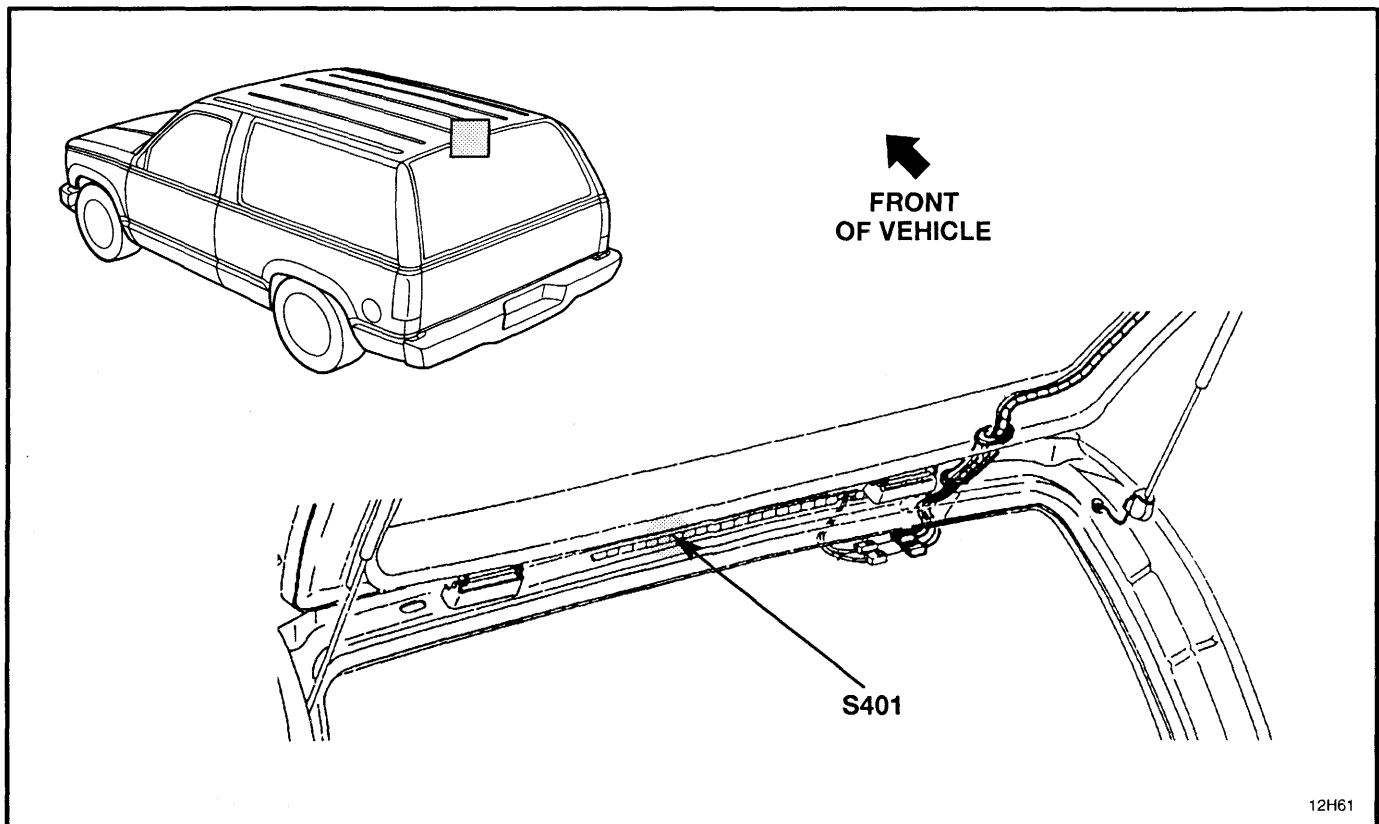


Figure 7 — Rear Window Wiper and Washer Rear Wiring, Utility and Suburban

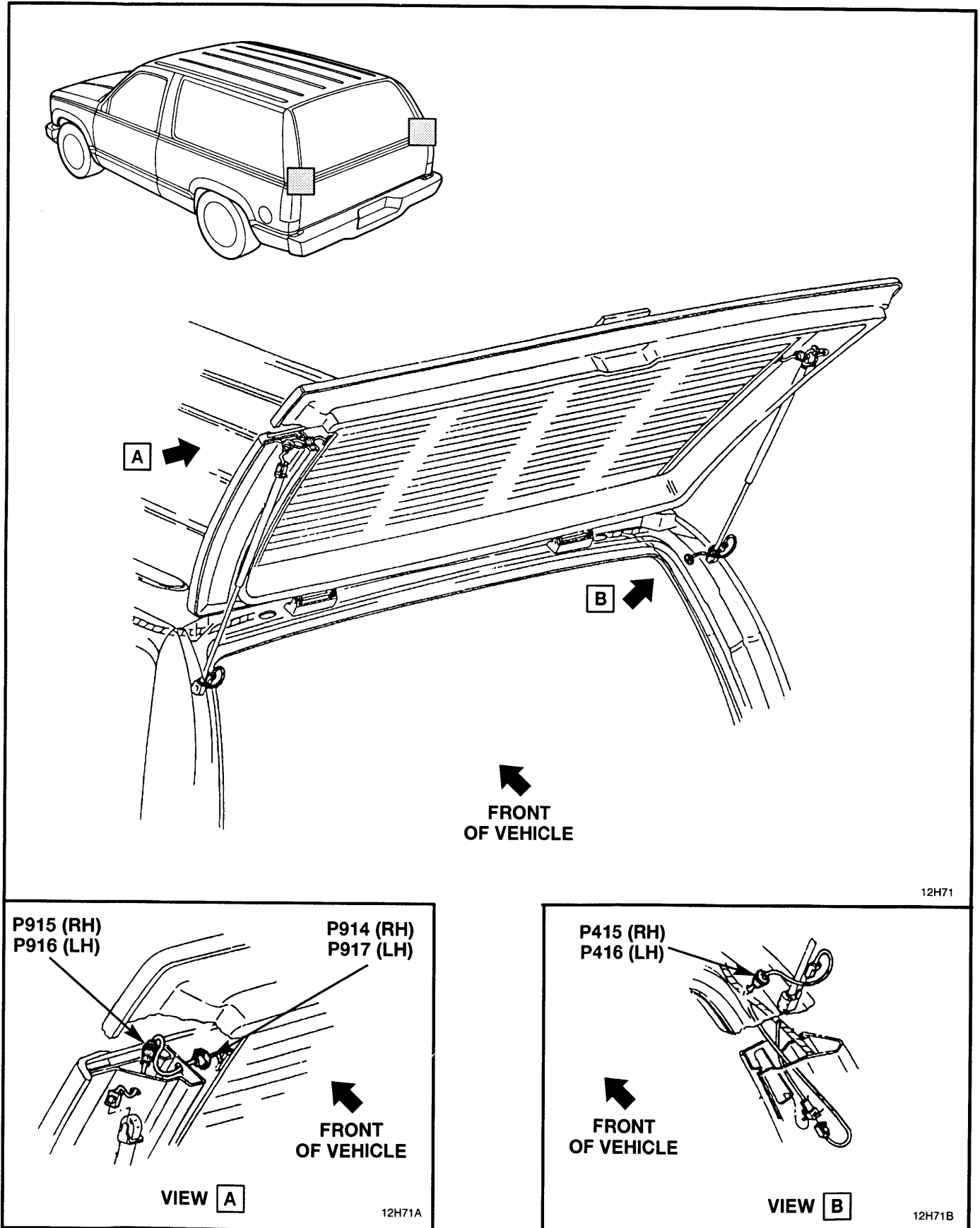


Figure 8 — Rear Window Defogger Rear Wiring, Utility and Suburban W/Endgate



## 8A-61-18 REAR WINDOW DEFOGGER

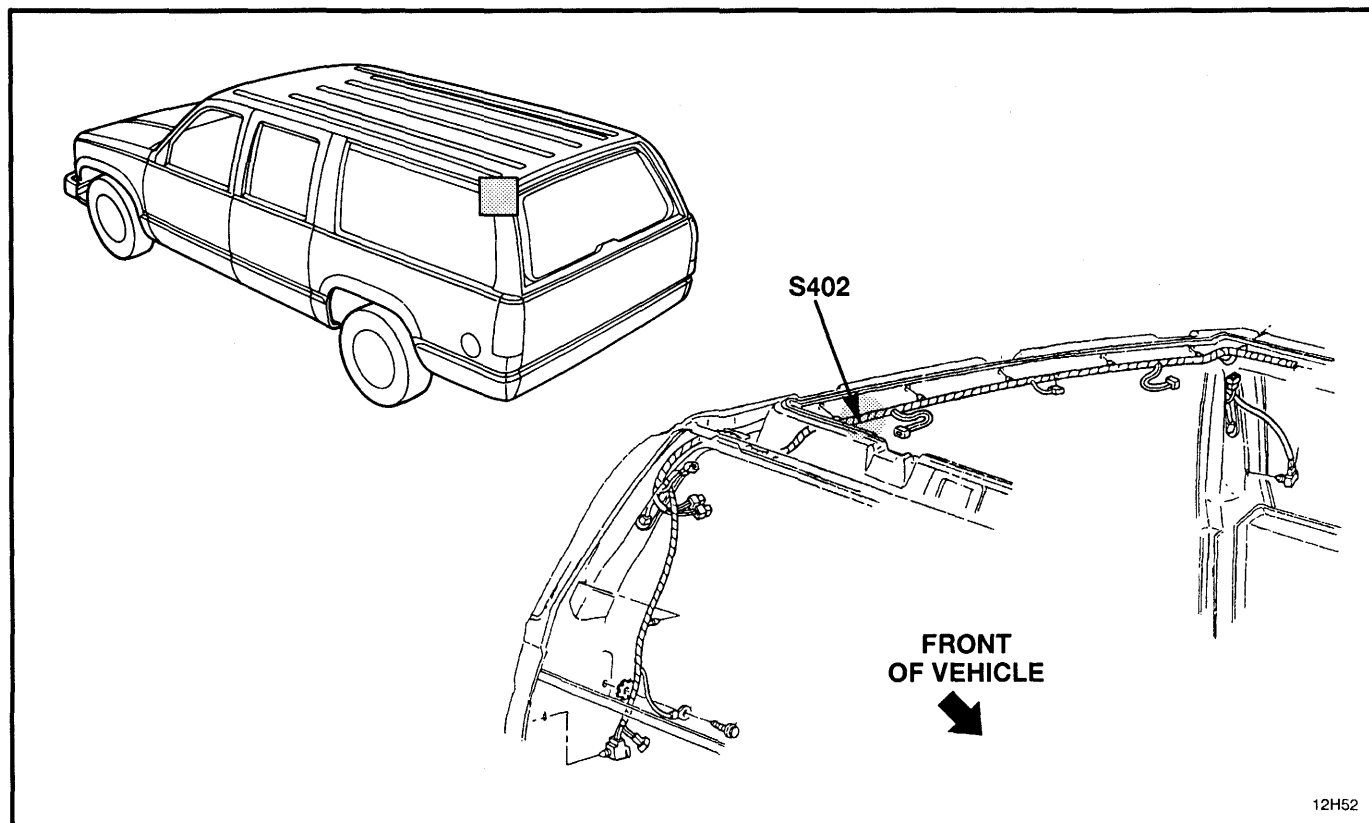


Figure 9 — Body Wiring, Rear — Suburban

## CIRCUIT OPERATION

### BLOWER CONTROLS

Battery voltage is supplied at all times to Terminal 1 of the Low Blower Relay through RED (2) wire. When the Heater and A/C Controller is OFF, the Low, Medium, and High Blower Relays are de-energized. In this state there is no voltage path through the relay contacts to the Blower Motor so the Blower Motor does not run.

With the Blower Mode in Low, Terminals 1649 and 1650 of the Heater and A/C Controller are grounded, energizing the Low Blower and High Blower Relay. Voltage is supplied through the closed contacts of the Low Blower Relay, the YEL (51) wire and the two Blower Resistors to the Blower Motor. The Blower Motor is a variable speed motor which runs at a speed proportional to the voltage supplied to the Motor. With both Blower Resistors in the circuit, the supplied voltage is low and the Blower runs slowly.

In either of the Medium blower speed positions, Terminal 1650 of the Heater and A/C Controller is not grounded which de-energizes the High Blower Relay. In the de-energized state, the contacts of the Relay shunt one of the Blower Resistors allowing the Blower Motor to operate at increased speed.

With the Blower Mode in High, the Low Blower Relay is de-energized and the High Blower Relay is energized. The voltage path is then through the normally closed contacts of the Low Blower Relay, the DK GRN (249) wire and the closed contacts of the High Blower Relay to the Blower Motor. With battery voltage supplied directly to the Motor, it runs at maximum speed.

|     | LO Blower<br>Relay | HI Blower<br>Relay |
|-----|--------------------|--------------------|
| LO  | ON                 | ON                 |
| MED | ON                 | OFF                |
| HI  | OFF                | ON                 |

### AIR DELIVERY

The Valves which control the flow of air through the Heater and A/C Module are positioned by electric Motors. There is one Motor and one Position Potentiometer for each Valve except the Recirculation Valve which does not contain a potentiometer. The Position Potentiometer indicates the position of the Valve at any time to the Heater and A/C Controller by means of a voltage level.

There are two drive circuits for each Motor in the Controller which can operate the Motors in either direction. When any Motor is to operate one of the drivers supplies approximately 7.5 volts to one side of the Motor depending on the direction it is to run.

The Recirculation Valve is normally in the position that allows outside air to enter the system. When RECIRC is selected, the Motor changes to the Recirc Air position. If RECIRC is selected again or defrost is selected, the Controller will provide voltage to position the Motor back to the outside air position. Since there is no potentiometer on the Recirculation Valve, the Controller drives the motor for 22 seconds to ensure the proper position is attained.

The Temperature Valve Motor positions the Temperature Valve according to the Temperature setting of the Heater and A/C Controller. For the full Cold temperature setting, the Valve is in the cold position and the Temperature Valve Potentiometer returns about 4.0 volts to the Heater and A/C Controller. As the temperature setting is changed to full HOT, the Temperature Valve is moved to the warm positions and the potentiometer output rises to about 0.5 volts. For a temperature setting in the mid range, the Temperature Valve is positioned to a point where the potentiometer output is the same as the preprogrammed value for the selected setting.

The Mode Valve Motor operates in a manner similar to that for the Temperature Valve and is positioned according to the Mode selected. For full A/C, the potentiometer output is about 0.2 volts and for full DEFROST, the output is about 4.8 volts. In the Heat Mode, the potentiometer output is about 2.5 volts.

Should any of the Motors stall when changing a Valve location, voltage is removed by the Heater and A/C Controller after 45 seconds to protect the Motor. This sequence will be repeated each time there is a change in the Mode setting.

### SYSTEM DIAGNOSTICS

The microprocessor monitors the actuators position and flashes an indicator should a malfunction occur.

Should a malfunction occur, the respective indicator will flash for a period of two minutes at every ignition ON cycle and everytime a control head key-press command selects the malfunctioning actuator, until the malfunction is repaired.

## 8A-63-2 HEATER AND A/C CONTROLS

The first time an actuator malfunction is diagnosed the corresponding flashing indicators will begin after a five second delay.

The assignments of the flashing indicators to the malfunctioning actuators are listed in the following table:

| Actuator    | Flashing Indicator                          |
|-------------|---------------------------------------------|
| Mode        | The active mode indicator, and mode cursors |
| Temperature | All the temperature scale cursors           |

T2561

### COMPONENT LOCATION

### Page — Figure

|                             |                                                  |           |   |
|-----------------------------|--------------------------------------------------|-----------|---|
| A/C Controller              | Center of I/P                                    | 63-17     | 5 |
| Battery Junction Block      | RH rear engine compartment, at cowl              | 63-15     | 1 |
| Blower Motor                | Under RH side of I/P                             | 63-17     | 5 |
| Blower Resistor A           | Under I/P, on heater housing                     | 63-17     | 5 |
| Blower Resistor B           | Under RH side of I/P                             | 63-17     | 5 |
| HI Blower Relay             | Under I/P, on top heater – A/C case              | 63-17     | 5 |
| Low Blower Relay            | Under center of I/P, on top of heater – A/C case | 63-17     | 5 |
| Medium Blower Relay         | Under RH side of I/P                             | 63-17     | 5 |
| Mode Door Motor             | Under I/P, on heater – A/C case                  | 63-17     | 5 |
| Recirc Door Motor           | Under I/P, on heater – A/C case                  | Not Shown |   |
| Temperature Mode Door Motor | Under I/P, on heater – A/C case                  | 63-17     | 5 |

### CONNECTORS:

|      |                                         |       |   |
|------|-----------------------------------------|-------|---|
| C230 | Below center of I/P, near heater outlet | 63-17 | 5 |
| C260 | Under LH side of I/P                    | 63-16 | 4 |

### GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 63-18 | 6 |
|------|------------------------------------|-------|---|

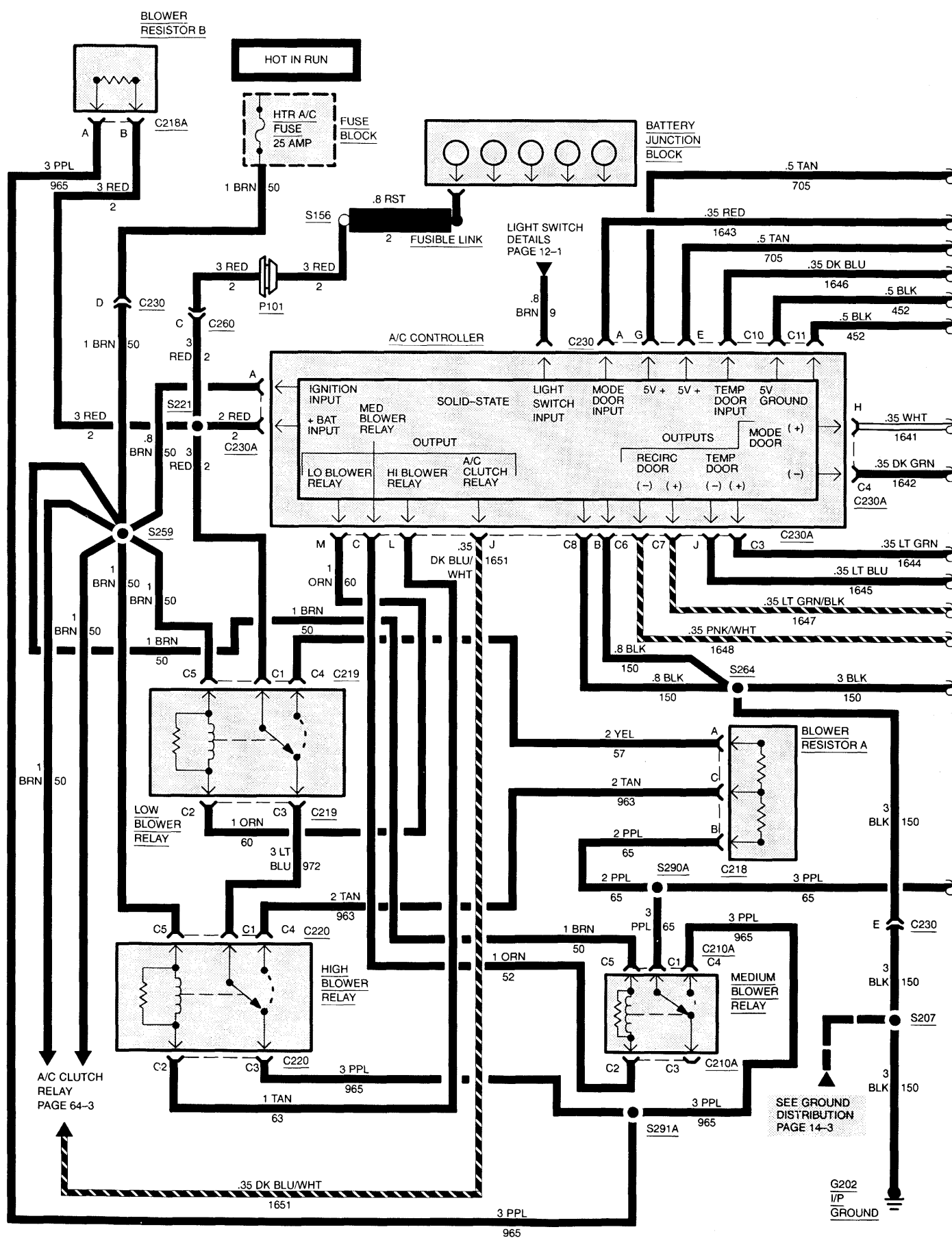
### GROUND:

|      |                  |       |   |
|------|------------------|-------|---|
| G202 | At DLC connector | 63-16 | 3 |
|------|------------------|-------|---|

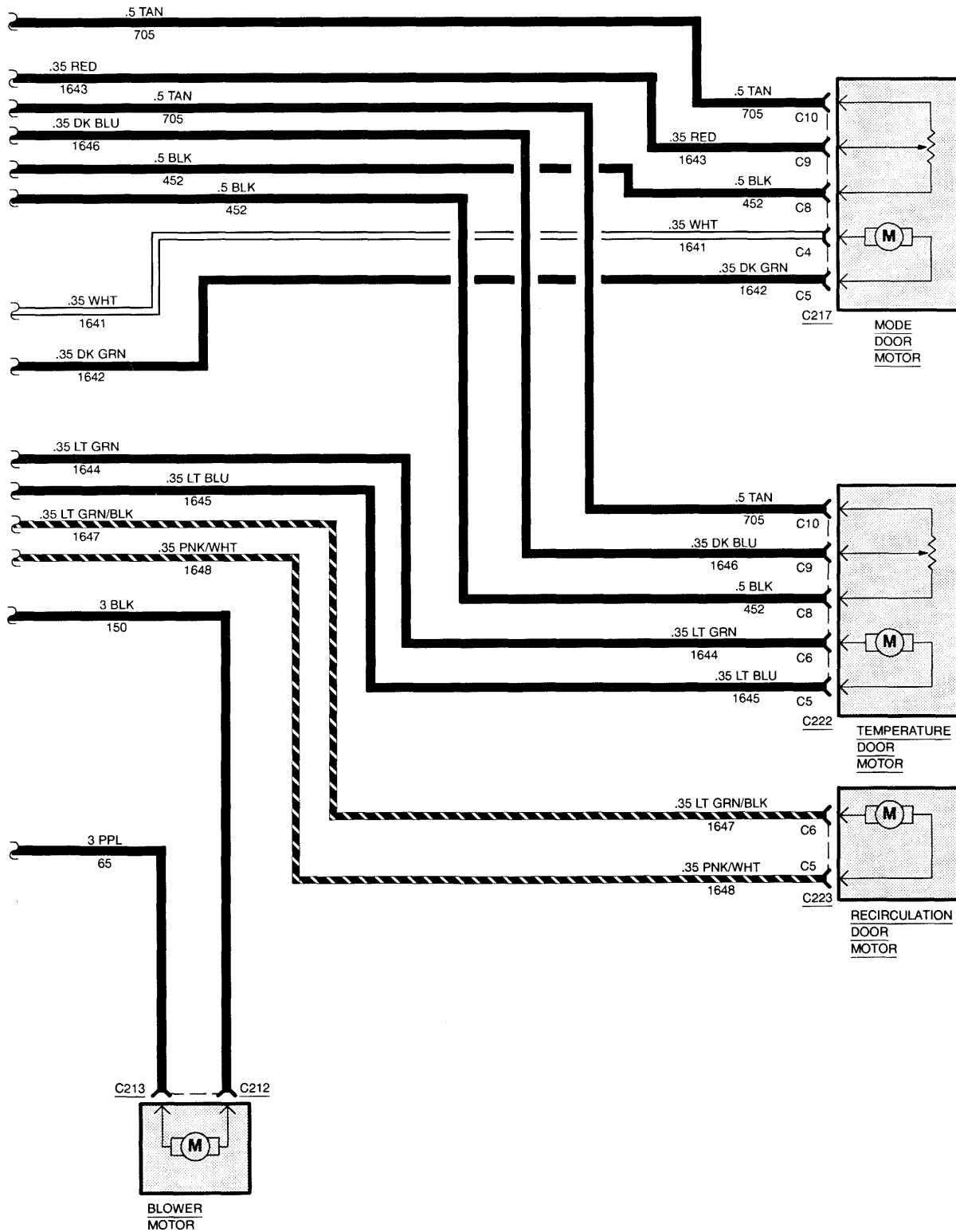
### SPLICES:

|       |                                              |           |   |
|-------|----------------------------------------------|-----------|---|
| S156  | Center of cowl, below battery junction block | 63-15     | 1 |
| S207  | Under LH side of I/P                         | 63-15     | 2 |
| S221  | Engine harness, near PCM                     | 63-18     | 6 |
| S259  | RH upper side of engine                      | Not Shown |   |
| S264  | A/C wiring harness, near I/P connector lead  | Not Shown |   |
| S290A | A/C wiring harness, near blower motor        | 63-18     | 6 |
| S291A | A/C wiring harness, near blower motor        | 63-18     | 6 |

## HEATER AND A/C BLOWER CONTROLS 8A-63-3



## 8A-63-4 HEATER AND A/C BLOWER CONTROLS



## DIAGNOSIS — HEATER AND A/C CONTROLS

### PRELIMINARY CHECKS:

1. Complete operational check to identify all display, air deliver, blower and refrigeration (A.C clutch) operating symptoms.
2. If refrigeration performance is symptom, refer to 1B of the 1994 C/K Service Manual.  
(All other symptoms, refer to SYMPTOM TABLE.)

### SYMPTOM TABLE

| SYMPTOM                                                                 | TEST                                        |
|-------------------------------------------------------------------------|---------------------------------------------|
| A/C clutch does not engage                                              | REFER to Section 64 A/C Compressor Controls |
| A/C indicator flashing                                                  | Test B                                      |
| Control head display blank or none of the door motors operate           | Test C                                      |
| Display does not dim properly                                           | Test D                                      |
| Recirculation valve does not operate                                    | Test E                                      |
| Incorrect air delivery or mode indicators flashing                      | Test F                                      |
| Temperature door motor does not operate or temperature cursors flashing | Test G                                      |
| Water valve does not operate (Suburban)                                 | Test H                                      |
| Blower Motor does not operate in any mode or speed                      | Test I                                      |
| Blower Motor does not operate in low speed only                         | Test J                                      |
| Blower Motor does not operate in medium speed                           | Test K                                      |
| Blower Motor does not operate in high speed                             | Test L                                      |

### TEST I

#### BLOWER MOTOR DOES NOT OPERATE IN ANY MODE

| TEST                                                                                                                                                                                                                            | RESULT                | ACTION                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------|
| 1. Disconnect blower motor connectors C213 and C212. Place ignition switch in RUN position, A/C controller in VENT-UPPER and blower speed in HI. Connect voltmeter from PPL (65) wire at blower motor connector C213 to ground. | Battery voltage.      | GO to step 2.                                                                                 |
|                                                                                                                                                                                                                                 | No voltage.           | GO to step 6.                                                                                 |
| 2. Connect voltmeter from PPL (65) wire to BLK (150) wire at blower motor connectors C213 and C212.                                                                                                                             | Battery voltage.      | REPLACE blower motor.                                                                         |
|                                                                                                                                                                                                                                 | No voltage.           | GO to step 3.                                                                                 |
| 3. Place light switch in HEAD position. Vary intensity of panel lamps. Observe HEATER-A/C illumination lamps.                                                                                                                   | Lamps vary intensity. | LOCATE and REPAIR open in BLK (150) wire between blower motor connector C212 and splice S218. |
|                                                                                                                                                                                                                                 | Lamps do not operate. | GO to step 4.                                                                                 |

## 8A-63-6 HEATER AND A/C CONTROLS

### TEST I BLOWER MOTOR DOES NOT OPERATE IN ANY MODE (CONTINUED)

| TEST                                                                                                                                                           | RESULT                                                 | ACTION                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|
| 4. Connect voltmeter from BLK (150) wire at connector C209 to ground.                                                                                          | Battery voltage.                                       | GO to step 5.                                                                     |
|                                                                                                                                                                | No voltage.                                            | LOCATE and REPAIR open in BLK (150) wire between connector C209 and splice S218.  |
| 5. Does I/P cluster and cigarette lighter operate properly?                                                                                                    | Yes.                                                   | LOCATE and REPAIR open in BLK (150) wire between splice S207 and connector C209.  |
|                                                                                                                                                                | No.                                                    | LOCATE and REPAIR open in BLK (150) wire between splice S207 and I/P ground G202. |
| 6. Ignition ON, blower speed low, connect test lamp to Low blower relay connector C219 terminal 1 RED (2) wire and ground.                                     | Test lamp lights.                                      | GO to step 7.                                                                     |
|                                                                                                                                                                | Test lamp does not light.                              | LOCATE and REPAIR open in RED (2) wire between C219 and junction block.           |
| 7. Connect test lamp to terminal 4 YEL (51) wire and ground.                                                                                                   | Test lamp does not light.                              | GO to step 8.                                                                     |
|                                                                                                                                                                | Test lamp lights.                                      | GO to step 11.                                                                    |
| 8. Disconnect low blower relay and connect a test lamp across C219 terminals 2 LT BLU/BLK (1649) and 5 BRN (50) wires.                                         | Test lamp lights.                                      | REPLACE relay.                                                                    |
|                                                                                                                                                                | Test lamp does not light.                              | GO to step 9.                                                                     |
| 9. Connect test lamp to terminal 5 BRN (50) wire of C219 and ground.                                                                                           | Test lamp lights.                                      | GO to step 10.                                                                    |
|                                                                                                                                                                | Test lamp does not light.                              | LOCATE and REPAIR open in circuit BRN (50) wire.                                  |
| 10. Ignition off, disconnect control head. Install ohmmeter across terminal 2 LT BLU/BLK (1649) wire of C219 and terminal M LT BLU/BLK (1649) wire of C230.    | Continuity of circuit #1649.                           | REPLACE control head.                                                             |
|                                                                                                                                                                | Greater than 30 ohms resistance.                       | LOCATE and REPAIR open in LT BLU/BLK (1649) wire                                  |
| 11. Ignition ON, blower speed low, connect test lamp from terminal C YEL (51) wire of C218 blower resistor connector (low blower relay installed), and ground. | Test lamp lights.                                      | GO to step 12.                                                                    |
|                                                                                                                                                                | Test lamp does not light.                              | LOCATE and REPAIR open in YEL (51) wire between C219 and C218.                    |
| 12. Connect test lamp to terminal B PPL (65) wire of C218 and ground.                                                                                          | Test lamp lights (slightly dimmer than previous test). | LOCATE and REPLACE open in (65) wire between C218 and C213.                       |
|                                                                                                                                                                | Test lamp does not light.                              | REPLACE blower resistor.                                                          |

**TEST C  
CONTROL HEAD DISPLAY BLANK OR NONE OF THE DOOR MOTORS OPERATE**

| TEST                                                                                                       | RESULT                    | ACTION                                                                                        |
|------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------|
| 1. Ignition ON, A/C switch ON, blower speed LO, does blower, A/C and air delivery mode operate correctly?  | Yes.                      | REPLACE control head.                                                                         |
|                                                                                                            | No.                       | GO to step 2.                                                                                 |
| 2. Check A/C HTR 25 amp fuse with test lamp.                                                               | OK.                       | GO to step 3.                                                                                 |
|                                                                                                            | Blown fuse.               | Use ohmmeter to ground on BRN (50) wire to locate short to ground at faulty component.        |
| 3. Check battery junction block for battery feed with test lamp to ground and visually check fusible link. | OK.                       | GO to step 4.                                                                                 |
|                                                                                                            | Blown fusible link.       | Use ohmmeter to ground on circuit RED (2) wire to locate short to ground or faulty component. |
| 4. Remove control head, connect a test lamp to C230 terminal A BRN (50) wire to ground (ignition on).      | Test lamp lights.         | GO to step 5.                                                                                 |
|                                                                                                            | Test lamp does not light. | REPAIR open in BRN (50) wire.                                                                 |
| 5. Connect a test lamp to C230 terminal 12 RED (2) wire to ground.                                         | Test lamp lights.         | GO to step 6.                                                                                 |
|                                                                                                            | Test lamp does not light. | REPAIR open in RED (2) wire.                                                                  |
| 6. Connect a test lamp to C230 across terminals A BRN (50) wire and 8 BLK (150) wire.                      | Test lamp lights.         | REPLACE control head.                                                                         |
|                                                                                                            | Test lamp does not light. | GO to step 7.                                                                                 |
| 7. Does I/P cluster and cigarette lighter operate?                                                         | Yes.                      | REPAIR open in BLK (150) wire from S207 to C230.                                              |
|                                                                                                            | No.                       | REPAIR open at G202 or BLK (150) wire to S207.                                                |

**TEST D  
DISPLAY DOES NOT DIM PROPERLY**

| TEST                                                                                                                                                                                                 | RESULT                                   | ACTION                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN, A/C controller in OFF, light switch in PARK and dimming control to full brightness. Connect voltmeter from BRN (9) wire at A/C controller connector C230 to ground. | Battery voltage.                         | GO to step 2.                                                                                                 |
|                                                                                                                                                                                                      | No voltage.                              | LOCATE and REPAIR open in BRN (9) wire between A/C controller connector C230 and light switch connector C204. |
| 2. Connect voltmeter from GRA (8) wire at A/C controller connector C230 to ground.                                                                                                                   | Battery voltage.                         | GO to step 3.                                                                                                 |
|                                                                                                                                                                                                      | No voltage.                              | GO to step 4.                                                                                                 |
| 3. Observe radio display while adjusting panel and interior lamps control switch.                                                                                                                    | Radio display changes intensity.         | LOCATE and REPAIR open in GRA (8) wire between A/C controller connector and splice S217.                      |
|                                                                                                                                                                                                      | Radio display does not change intensity. | LOCATE and REPAIR open in GRA (8) wire between splice S217 and fuse block.                                    |



## 8A-63-8 HEATER AND A/C CONTROLS

### TEST D DISPLAY DOES NOT DIM PROPERLY (CONTINUED)

| TEST                                                                                                                           | RESULT                    | ACTION                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------|
| 4. Place dimming control to full brightness. Connect test lamp from BLK (150) wire at A/C controller connector C230 to ground. | Test lamp lights.         | GO to step 5.                                                                                   |
|                                                                                                                                | Test lamp does not light. | REPLACE A/C controller.                                                                         |
| 5. Place A/C controller in ON and blower speed in LOW.                                                                         | Blower operates.          | LOCATE and REPAIR open in BLK (150) wire between A/C controller connector C230 and splice S264. |
|                                                                                                                                | Blower does not operate.  | GO to step 6.                                                                                   |
| 6. Connect test lamp from BLK (150) wire at connector C209 to ground.                                                          | Test lamp lights.         | LOCATE and REPAIR open in BLK (150) wire between splice S264 and connector C209.                |
|                                                                                                                                | Test lamp does not light. | GO to step 7.                                                                                   |
| 7. Open drivers door. Observe dome lamp.                                                                                       | Lamp operates.            | LOCATE and REPAIR open in BLK (150) wire between connector C209 and splice S207.                |
|                                                                                                                                | Lamp does not operate.    | LOCATE and REPAIR open in BLK (150) wire between splice S207 and ground G202.                   |

### TEST E RECIRCULATION VALVE DOES NOT OPERATE

| TEST                                                                                                                                                                                                 | RESULT                                                           | ACTION                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN, blower in MED, A/C controller in RECIRC. Disconnect recirculation valve motor connector C223. Connect voltmeter from PNK/WHT (1648) wire to LT GRN/BLK (1647) wire. | A reading of $\pm 6$ to 7.5 volts, for approximately 22 seconds. | CHECK for stuck door, if ok REPLACE recirculation door motor.                                                                                                                                                     |
|                                                                                                                                                                                                      | A reading of less than $\pm 6$ volts.                            | LOCATE and REPAIR open in PNK/WHT (1648) wire or LT GRN/BLK (1647) wire between recirculation door motor connector C223 and A/C controller connector C230. If wires are good, REPLACE A/C controller.             |
|                                                                                                                                                                                                      | A reading of greater than $\pm 7.5$ volts.                       | LOCATE and REPAIR short to voltage in PNK/WHT (1648) wire or LT GRN/BLK (1647) wire between recirculation door motor connector C223 and A/C controller connector C230. If wires are good, REPLACE A/C controller. |

**TEST F  
INCORRECT AIR DELIVERY OR MODE INDICATORS FLASHING**

| TEST                                                                                                                                                                                                                                                                        | RESULT                                                 | ACTION                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Ignition ON, A/C switch on, select defrost, floor and then upper vent modes. Are mode indicators flashing?                                                                                                                                                               | No.                                                    | GO to step 2.                                                                                                                                      |
|                                                                                                                                                                                                                                                                             | Yes.                                                   | GO to step 3.                                                                                                                                      |
| 2. Ignition ON, A/C switch ON, blower MED speed. Change mode to floor selection, followed by defrost, followed by upper vent, while visually checking for mode door and linkage movement. Does the linkage move from one extreme position to the other?                     | Yes.                                                   | CHECK for internal valve problem or air box restriction.                                                                                           |
|                                                                                                                                                                                                                                                                             | No.                                                    | GO to step 3.                                                                                                                                      |
| 3. Disconnect connector C217 and install A/C Diagnostic Tester to C217, - harness side only. Install voltmeter across terminals 5 DK GRN (1642) and 6 WHT (1641) wires and change mode setting from floor to defrost. (Take reading within 20 seconds of making selection.) | A reading of positive or negative 6 to 7.5 volts.      | GO to step 4.                                                                                                                                      |
|                                                                                                                                                                                                                                                                             | A reading of less than positive or negative 6 volts.   | LOCATE and REPAIR open in DK GRN (1642) or WHT (1641) wires between C217 and controller connector C230, if wires are good, REPLACE A/C controller. |
|                                                                                                                                                                                                                                                                             | A reading of more than positive or negative 7.5 volts. | LOCATE and REPAIR short to voltage in DK GRN (1642) or WHT (1641) wires between C217 and C230. If wires are good, REPLACE A/C controller.          |
| 4. Connect A/C Diagnostic Tester to mode door motor and select defrost then upper vent mode. Does motor and linkage move?                                                                                                                                                   | Yes.                                                   | GO to step 5.                                                                                                                                      |
|                                                                                                                                                                                                                                                                             | No.                                                    | REPLACE motor assembly.                                                                                                                            |
| 5. Install voltmeter across terminals 10 TAN (705) and 8 BLK (452) wires at C217. Install A/C Diagnostic Tester.                                                                                                                                                            | A reading of 5 volts $\pm$ .3.                         | GO to step 6.                                                                                                                                      |
|                                                                                                                                                                                                                                                                             | A reading of less than 4.7 volts.                      | LOCATE and REPAIR open in TAN (705) and BLK (452) wires between C217 and C230. If good CHECK connections at C230 and if ok REPLACE A/C controller. |
|                                                                                                                                                                                                                                                                             | A reading of greater than 5.3 volts.                   | LOCATE and REPAIR short in TAN (705) and BLK (452) wires between C217 and C230. If good REPLACE A/C controller.                                    |
| 6. Ignition OFF. Disconnect A/C Diagnostic Tester from motor and connect ohmmeter from terminal 9 RED (1643) wire of C217 and ground, (set meter to 400 Ohm scale or lower).                                                                                                | Continuity reading.                                    | LOCATE and REPAIR short to ground in RED (1643) wire.                                                                                              |
|                                                                                                                                                                                                                                                                             | Out of limits reading.                                 | GO to step 7.                                                                                                                                      |
| 7. Connect ohmmeter across terminal 9 RED (1643) wire of C217 and terminal D RED (1643) wire of C230 control head connector.                                                                                                                                                | Less than 10 ohms.                                     | REPLACE motor assembly.                                                                                                                            |
|                                                                                                                                                                                                                                                                             | Greater than 10 ohms.                                  | LOCATE and REPAIR open in RED (1643) wire.                                                                                                         |

## 8A-63-10 HEATER AND A/C CONTROLS

### TEST G

#### TEMPERATURE DOOR MOTOR DOES NOT OPERATE OR TEMP CURSORS FLASH

| TEST                                                                                                                                                                                                              | RESULT                                                 | ACTION                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Ignition ON, A/C switch ON, change temperature selection from HOT to COLD. Do the temp. cursors flash?                                                                                                         | No.                                                    | GO to step 2.                                                                                                                                      |
|                                                                                                                                                                                                                   | Yes.                                                   | GO to step 3.                                                                                                                                      |
| 2. While temperature selection is changed from HOT to COLD, visually note motor shaft rotation.                                                                                                                   | Motor operates (shaft turns).                          | CHECK temp door or internal air box for problem.                                                                                                   |
|                                                                                                                                                                                                                   | Motor does not operate (no shaft movement).            | GO to step 3.                                                                                                                                      |
| 3. Disconnect temp. motor connector C222 and install A/C Diagnostic Tester on connector. Install voltmeter across terminals 5 LT BLU (1645) and 6 LT GRN (1644) wires and change temp selection from hot to cold. | A reading of positive or negative 6 to 7.5 volts.      | GO to step 4.                                                                                                                                      |
|                                                                                                                                                                                                                   | A reading of less than positive or negative 6 volts.   | LOCATE and REPAIR open LT BLU (1645) or LT GRN (1644) wires. If wires are good, REPLACE A/C controller.                                            |
|                                                                                                                                                                                                                   | A reading of more than positive or negative 7.5 volts. | LOCATE and REPAIR short to voltage in LT BLU (1645) or LT GRN (1644) wires. If wires are good, REPLACE A/C controller.                             |
| 4. Connect A/C Diagnostic Tester to mode door motor and select defrost then upper vent mode. Does motor and linkage move?                                                                                         | Yes.                                                   | GO to step 5.                                                                                                                                      |
|                                                                                                                                                                                                                   | No.                                                    | REPLACE motor assembly.                                                                                                                            |
| 5. Install voltmeter across terminals 10 TAN (705) and 8 BLK (452) wires at C217.                                                                                                                                 | A reading of 5 volts $\pm$ .3.                         | GO to step 6.                                                                                                                                      |
|                                                                                                                                                                                                                   | A reading of less than 4.7 volts.                      | LOCATE and REPAIR open in TAN (705) and BLK (452) wires between C217 and C230. If good CHECK connections at C230 and if ok REPLACE A/C controller. |
| 6. Ignition OFF. Disconnect A/C Diagnostic Tester from motor and connect ohmmeter from terminal 9 DK BLU (1646) wire of C222 and ground, (set meter to 400 ohm scale or lower).                                   | Continuity reading.                                    | LOCATE and REPAIR short to ground on DK BLU (1646) wire.                                                                                           |
|                                                                                                                                                                                                                   | Out of limits reading.                                 | GO to step 7.                                                                                                                                      |
| 7. Connect ohmmeter across terminal 9 DK BLU (1646) wire of C222 and terminal D DK BLU (1646) wire of C230.                                                                                                       | Less than 10 ohms.                                     | REPLACE motor assembly.                                                                                                                            |
|                                                                                                                                                                                                                   | Greater than 10 ohms.                                  | LOCATE and REPAIR open in DK BLU (1646).                                                                                                           |

**TEST J  
BLOWER MOTOR DOES NOT OPERATE IN LOW SPEED ONLY**

| TEST                                                                                                                           | RESULT                                             | ACTION                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect blower resistor connector C218. Connect ohmmeter from PPL (65) terminal to YEL (51) terminal on blower resistor. | A reading of $1.5 \pm 0.7$ ohms.                   | LOCATE and REPLACE open in YEL (51) wire between blower resistor connector C218 and low blower relay connector C219.                                            |
|                                                                                                                                | A reading less or greater than $1.5 \pm 0.7$ ohms. | REPLACE blower resistor. LOCATE and REPAIR short of boltage in TAN (705) or BLK (452) wires between C217 and C230. If wires are good, REPLACE A/C control head. |

**TEST K  
BLOWER MOTOR DOES NOT OPERATE IN MEDIUM SPEED**

| TEST                                                                                                                                                                           | RESULT                                                     | ACTION                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 1. Place ignition switch OFF and disconnect blower resistor connector C218. Connect ohmmeter across C218 terminals A TAN (63) wire and B PPL (65) wire.                        | Continuity reading.                                        | GO to step 2.                                                                     |
|                                                                                                                                                                                | Greater than 30 ohms reading.                              | LOCATE and REPAIR open in TAN (63) wire, if wire good, REPLACE high blower relay. |
| 2. Connect ohmmeter to A of resistor block and terminal B of resistor block.                                                                                                   | A reading of $1.5 \pm 0.7$ ohms.                           | GO to step 3.                                                                     |
|                                                                                                                                                                                | A reading of less than or greater than $1.5 \pm 0.7$ ohms. | REPLACE resistor block.                                                           |
| 3. Place ignition switch in RUN, A/C controller in vent-upper and blower speed MED. Connect a test lamp to low blower relay connector C219 terminal 1 RED (2) wire and ground. | Test lamp lights.                                          | GO to step 4.                                                                     |
|                                                                                                                                                                                | Test lamp does not light.                                  | LOCATE and REPAIR open in RED (2) wire between connector C219 and junction block. |
| 4. Connect test lamp to terminal 4 of C219 YEL (51) wire and ground.                                                                                                           | Test lamp lights.                                          | GO to step 5.                                                                     |
|                                                                                                                                                                                | Test lamp does not light.                                  | GO to step 6.                                                                     |
| 5. Connect test lamp to terminal C YEL (51) wire of C218 to ground.                                                                                                            | Test lamp lights.                                          | REPLACE resistor block assembly.                                                  |
|                                                                                                                                                                                | Test lamp does not light.                                  | REPAIR open in YEL (51) wire.                                                     |
| 6. Ignition switch in RUN, blower speed MED, disconnect low blower relay and connect a test lamp across C219 terminals 2 LT BLU/BLK (1649) wire and 5 BRN (50) wire.           | Test lamp lights.                                          | REPLACE low blower relay.                                                         |
|                                                                                                                                                                                | Test lamp does not light.                                  | GO to step 7.                                                                     |
| 7. Connect test lamp from terminal 5 BRN (50) wire of C219 to ground.                                                                                                          | Test lamp lights.                                          | REPLACE medium blower relay.                                                      |
|                                                                                                                                                                                | Test lamp does not light.                                  | LOCATE and REPAIR open in BRN (50) wire between C219 and splice S259.             |

## 8A-63-12 HEATER AND A/C CONTROLS

### TEST L BLOWER MOTOR DOES NOT OPERATE IN HIGH SPEED

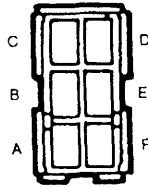
| TEST                                                                                                                                                                 | RESULT                    | ACTION                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in run, and blower speed to HI. Connect test lamp from terminal 4 DK GRN (249) wire of high blower relay connector C220 and ground.         | Test lamp lights.         | GO to step 3.                                                                                      |
|                                                                                                                                                                      | Test lamp does not light. | GO to step 2.                                                                                      |
| 2. Connect test lamp from terminal 3 DK GRN (249) wire of low blower relay connector C219 to ground.                                                                 | Test lamp lights.         | LOCATE and REPAIR open in DK GRN (249) wire between C219 and C220.                                 |
|                                                                                                                                                                      | Test lamp does not light. | REPLACE low blower relay.                                                                          |
| 3. Connect test lamp from terminal 1 PPL (65) wire of high blower relay connector C220 and ground.                                                                   | Test lamp does not light. | GO to step 4.                                                                                      |
|                                                                                                                                                                      | Test lamp lights.         | LOCATE and REPAIR open in PPL (65) wire between connector C220 and blower resistor connector C218. |
| 4. Connect test lamp from terminal 5 BRN (50) wire of high blower relay connector C220 and ground.                                                                   | Test lamp lights.         | GO to step 5.                                                                                      |
|                                                                                                                                                                      | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between C220 and splice S259.                              |
| 5. Ignition switch in RUN, blower speed HI, disconnect high blower relay and connect a test lamp across C220 terminals 2 DK GRN/WHT (1650) wire and 5 BRN (50) wire. | Test lamp lights.         | REPLACE high blower relay.                                                                         |
|                                                                                                                                                                      | Test lamp does not light. | LOCATE and REPAIR open in DK GRN/WHT (1650) wire . If wire is good, REPLACE A/C controller.        |

02965104



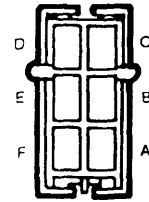
**NATURAL**  
56 Series  
**C218A**  
Blower Resistor B

12034481



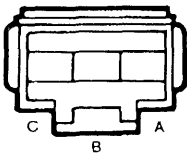
**GRAY**  
Metri-Pack 280  
**C230**  
In-Line Fuse Block to I/P

12034482



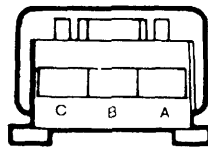
**GRAY**  
Metri-Pack 280  
**C230**  
In-Line I/P to Fuse Block

12020398



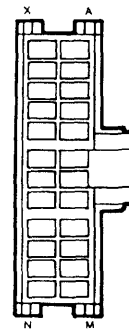
**BLACK**  
Metri-Pack 180  
**C260**  
In-Line Battery Junction Block to I/P

12020397



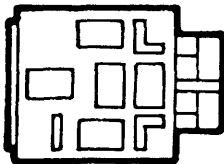
**BLACK**  
Metri-Pack 280  
**C260**  
In-Line I/P to Battery Junction Block

12004702



**BLACK**  
**C230**  
A/C Controller

12034003



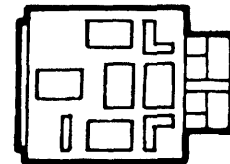
**BLACK**  
Metri-Pack 630  
**C219**  
Low Blower Relay

02965104



**NATURAL**  
56 Series  
**C218**  
Blower Resistor A

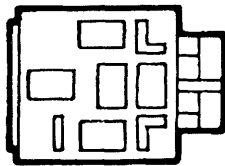
12034003



**BLACK**  
Metri-Pack 630  
**C210A**  
Medium Blower Relay

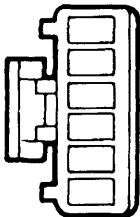
8A-63-14 HEATER AND A/C CONTROLS

12034003



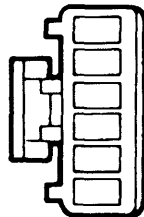
BLACK  
Metri-Pack 630  
C220  
High Blower Relay

12040953



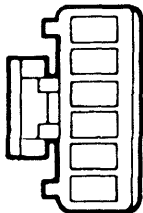
BLACK  
Micro-Pack  
C217  
Mode Door Motor

12040953



BLACK  
Micro-Pack  
C222  
Temperature Door Motor

12040953



BLACK  
Micro-Pack  
C223  
Recirculation Door Motor

12004267



BLACK  
56 Series  
C212  
Blower Motor

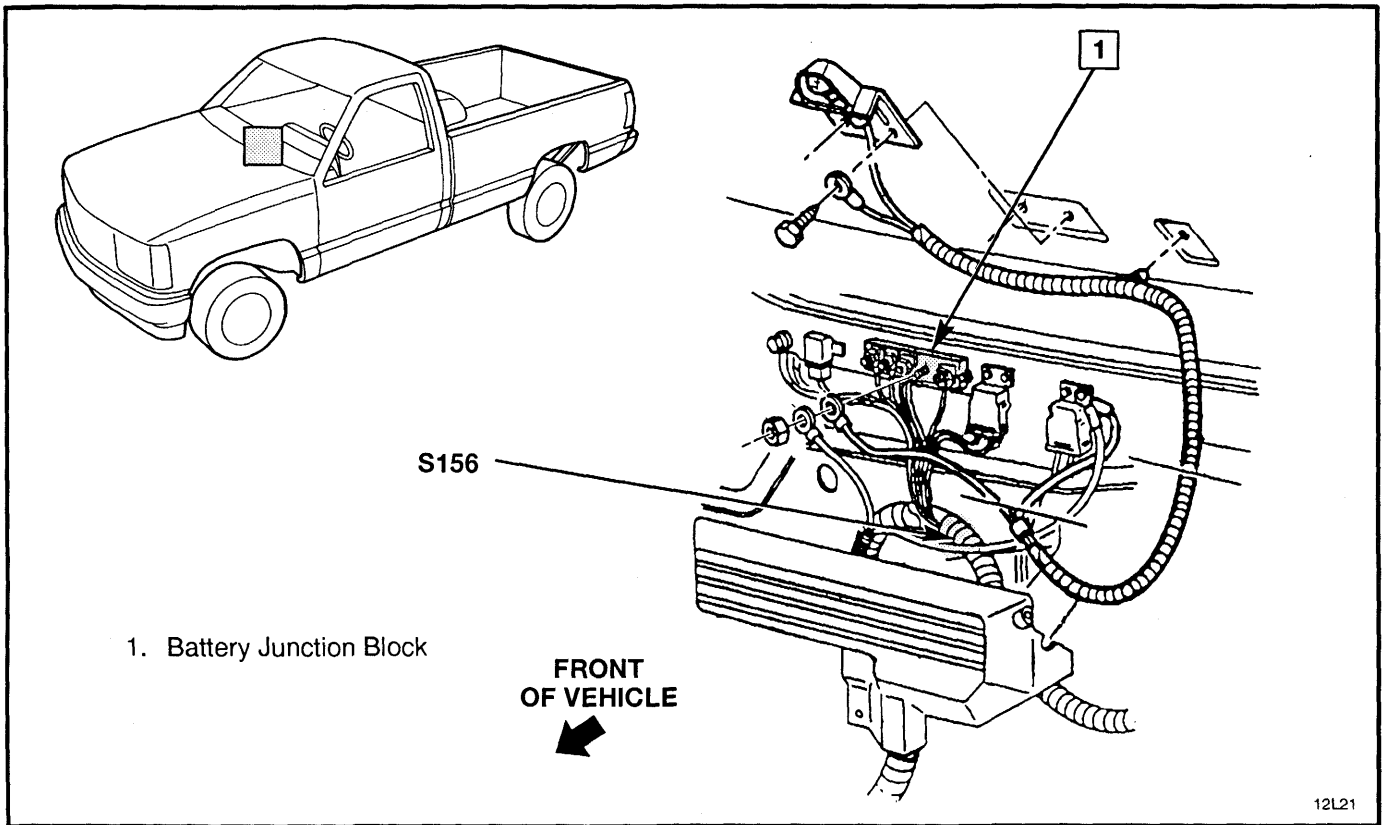


Figure 1 — Junction Block Wiring

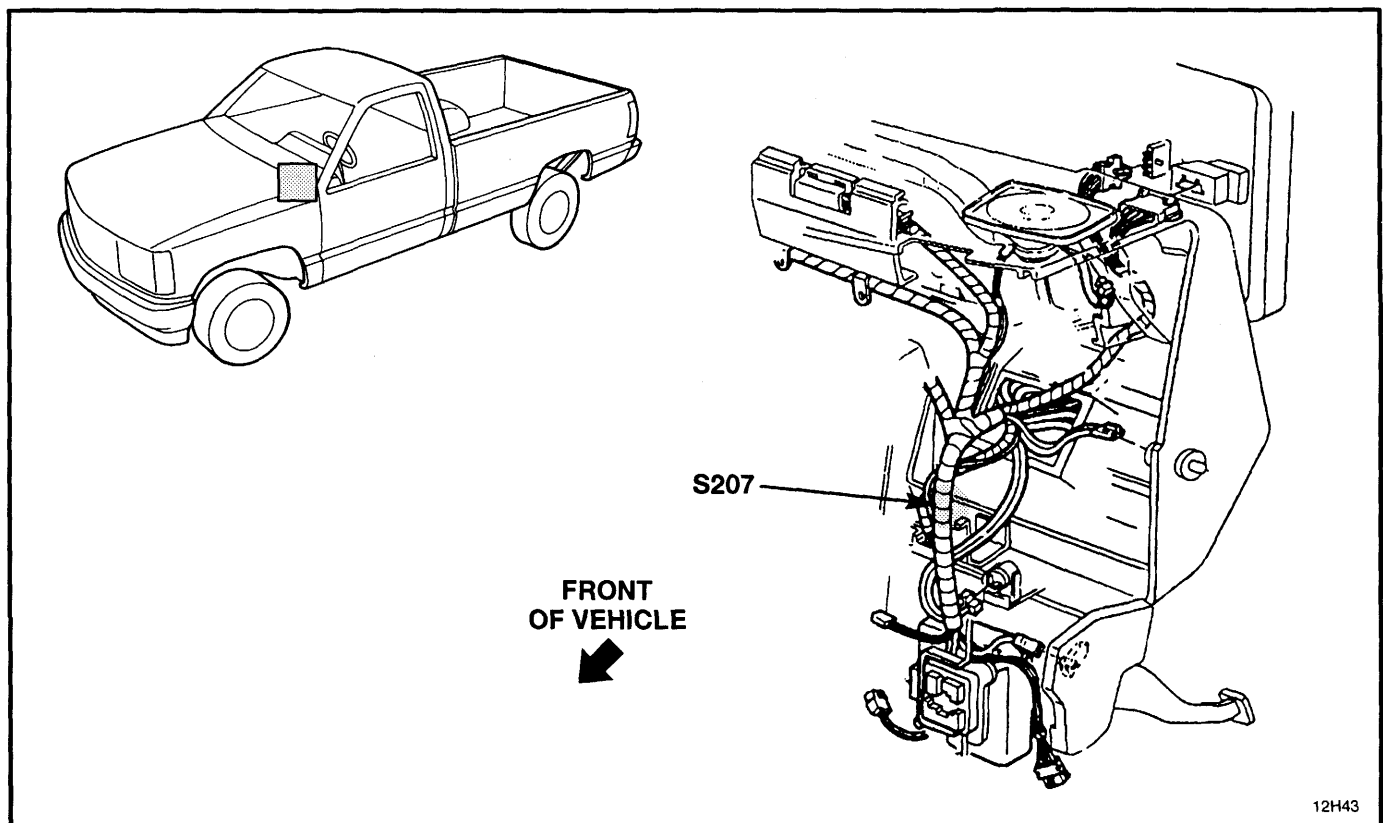


Figure 2 — LH Side of Instrument Panel



## 8A-63-16 HEATER AND A/C CONTROLS

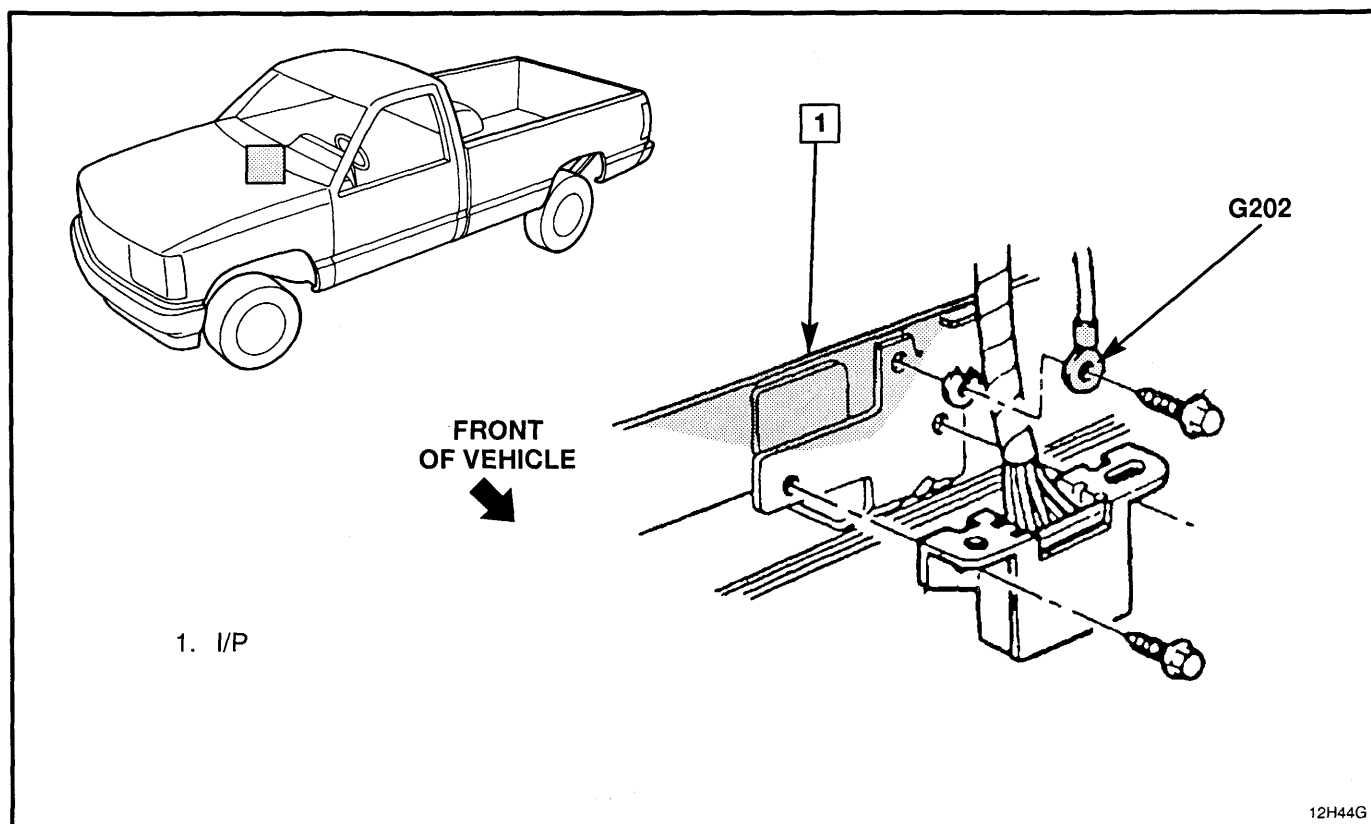


Figure 3 — I/P Ground Wiring

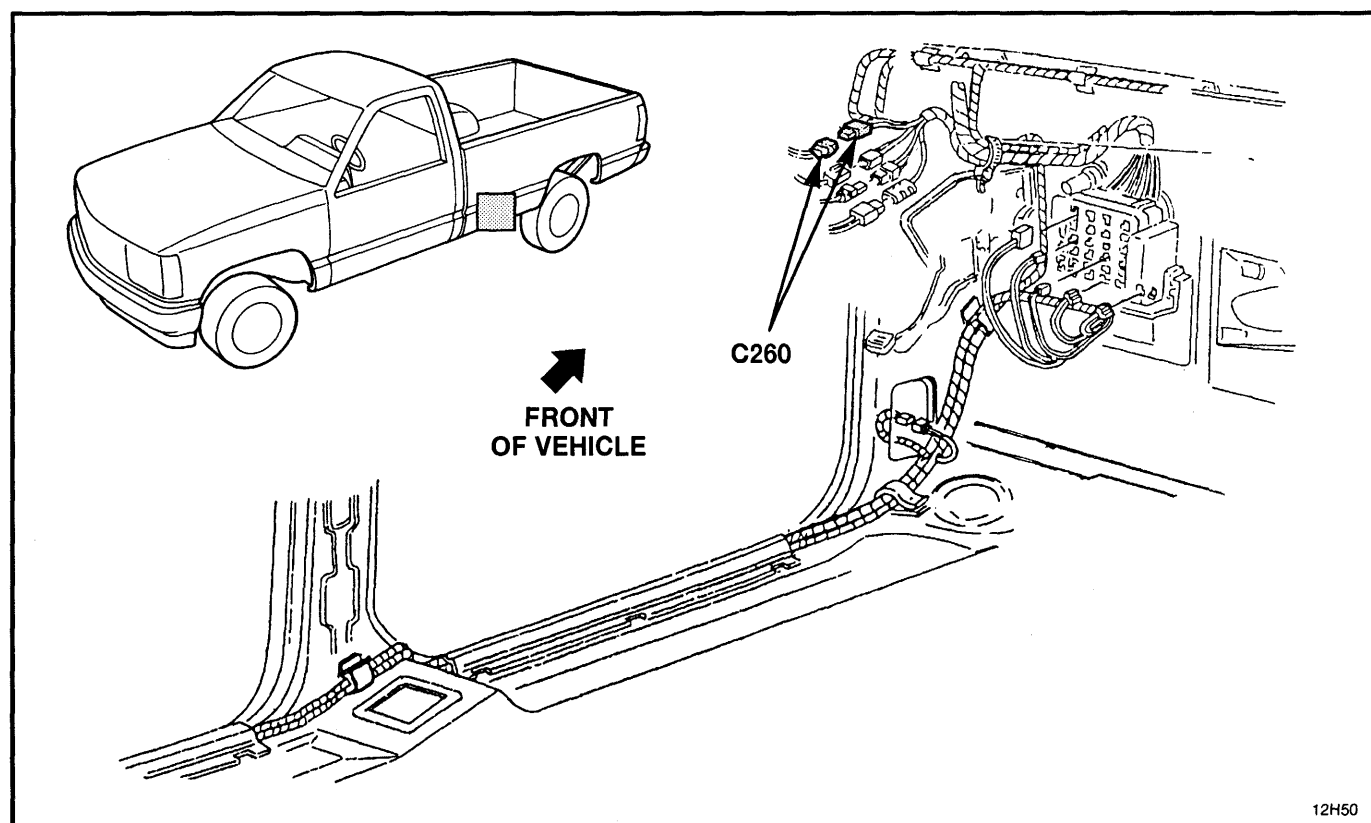


Figure 4 — Body Wiring Harness, Front

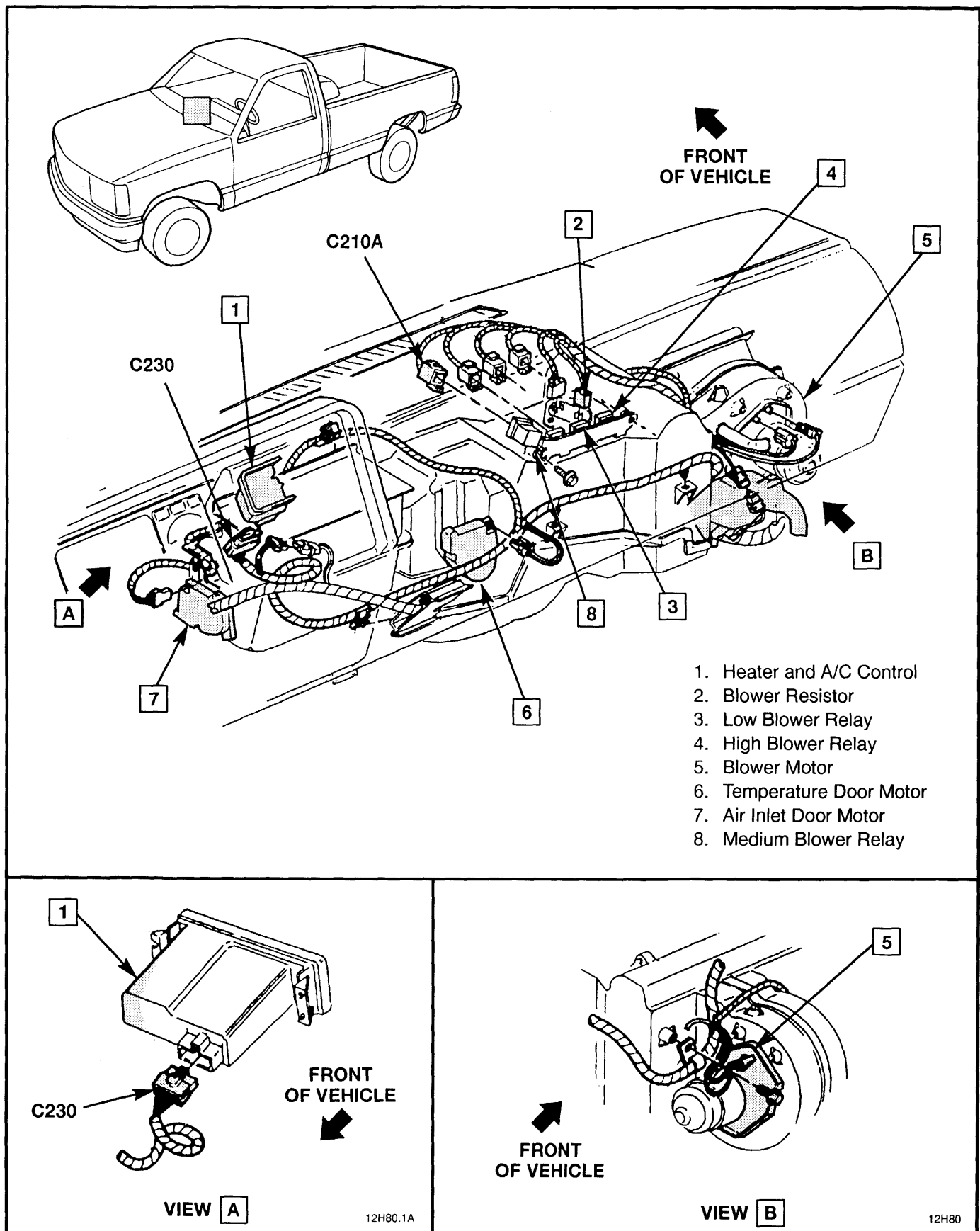


Figure 5 — Heater and A/C Harness Wiring

## 8A-63-18 HEATER AND A/C CONTROLS

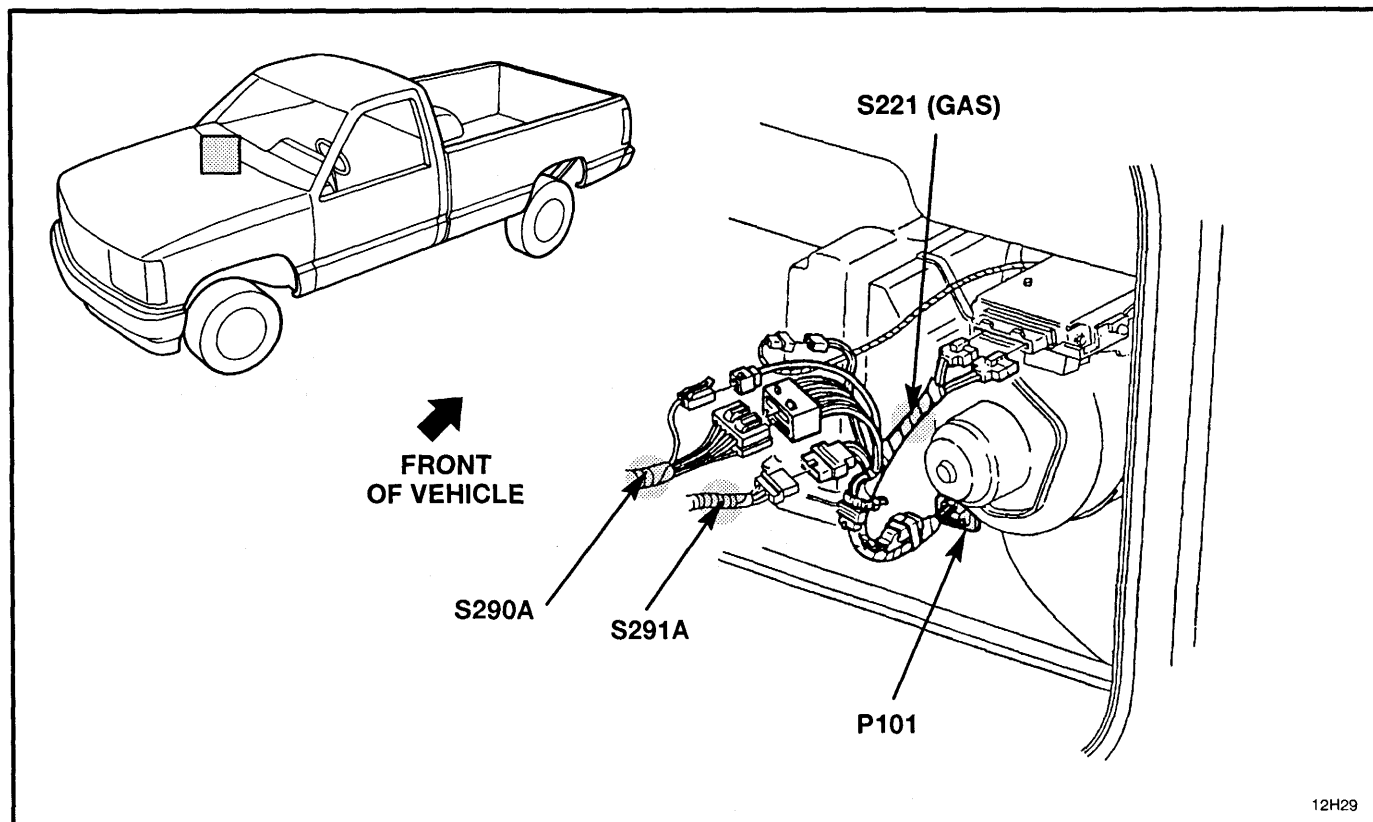


Figure 6 — Heater and A/C Harness Wiring

## CIRCUIT OPERATION

The Compressor for the Air Conditioning System is driven by the engine by means of a belt drive and the A/C Compressor Clutch. The Clutch allows the Compressor to be disengaged when Air Conditioning is not required.

Operation of the Compressor depends on the particular A/C Mode selected at the Heater and A/C Controller. When the Ignition Switch is in RUN, battery voltage is supplied through the A/C HTR Fuse to the coil and contacts of the A/C Clutch Relay. With A/C ON selected, Terminal 1651 of the Heater and A/C Controller is grounded which energizes the A/C Clutch Relay. The contacts of the Relay close and battery voltage is supplied through the closed contacts and the normally closed A/C Accumulator Switch to the coil of the A/C Compressor Clutch. The coil is energized and the A/C Compressor clutch engages.

If the refrigerant pressure drops to a point which may cause icing of the evaporator, the A/C Accumulator Switch opens, de-energizing the A/C Compressor Clutch.

When the refrigerant pressure rises to a point where cooling is required again, the A/C Accumulator Switch closes to re-energized the A/C Compressor Clutch.

The A/C Compressor Clutch Diode is connected across the terminals of the A/C Compressor Clutch.

Whenever the clutch is de-energized, the magnetic field around it collapses, generating and induced voltage in the clutch coil. The Diode provides a path for the current resulting from the induced voltage so that other circuit components are not damaged.

## COMPONENT LOCATION

### Page — Figure

|                              |                                      |           |   |
|------------------------------|--------------------------------------|-----------|---|
| A/C Compressor Clutch        | Front of A/C compressor              | 64-7      | 1 |
| A/C Compressor Clutch Relay  | Under I/P, on top of heater-A/C case | 64-9      | 3 |
| A/C Controller               | Center of I/P                        | 64-9      | 3 |
| A/C Pressure Cycling Switch  | At A/C accumulator                   | Not Shown |   |
| Fuse Block                   | Under LH side of I/P                 | 64-11     | 6 |
| HI Pressure Cutout Switch #1 | Back side of compressor              | Not Shown |   |
| HI Pressure Cutout Switch #2 | Near compressor                      | 64-10     | 5 |
| PCM                          | Under RH side of I/P                 | 64-10     | 5 |

## CONNECTORS:

|                 |                                         |       |   |
|-----------------|-----------------------------------------|-------|---|
| C209            | Below center of I/P, near heater outlet | 64-10 | 4 |
| C260 (Suburban) | LH side of I/P                          | 64-12 | 7 |

## DIODES:

|      |                     |      |   |
|------|---------------------|------|---|
| D100 | Near A/C compressor | 64-7 | 1 |
|------|---------------------|------|---|

## GROMMETS:

|      |                                    |       |   |
|------|------------------------------------|-------|---|
| P101 | RH lower cowl (engine compartment) | 64-10 | 5 |
|------|------------------------------------|-------|---|

## GROUND:

|      |                          |      |   |
|------|--------------------------|------|---|
| G106 | Rear of RH cylinder head | 64-8 | 2 |
|------|--------------------------|------|---|

## 8A-64-2 A/C COMPRESSOR CONTROLS

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### COMPONENT LOCATION

Page — Figure

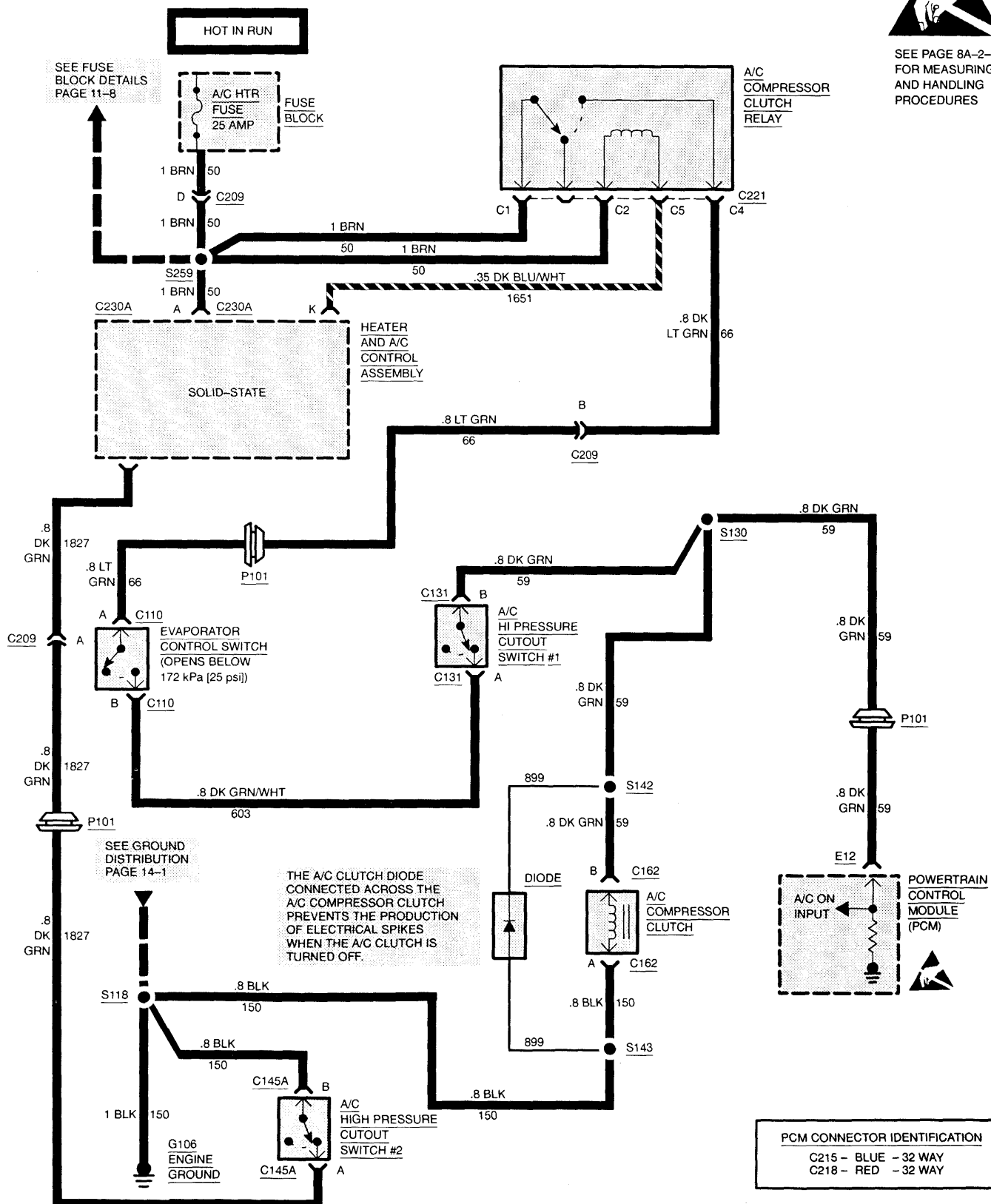
#### SPLICES:

|      |                                          |           |   |
|------|------------------------------------------|-----------|---|
| S118 | Engine harness, near cowl LH rear engine | 64-8      | 2 |
| S130 | RH rear engine compartment, near P101    | Not Shown |   |
| S142 | Near A/C compressor                      | Not Shown |   |
| S143 | Near A/C compressor                      | Not Shown |   |
| S259 | RH upper side of engine                  | Not Shown |   |

# A/C COMPRESSOR CONTROLS 8A-64-3



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## 8A-64-4 A/C COMPRESSOR CONTROLS

### DIAGNOSIS — AIR CONDITIONING COMPRESSOR CONTROLS

#### PRELIMINARY CHECKS:

1. Check the condition of the refrigerant to ensure adequate system pressure.
2. Check to ensure connector contacts are not out of place or missing and that connectors are firmly seated.
3. Check condition of A/C HTR Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

#### TEST A – A/C CLUTCH DOES NOT ENGAGE

| TEST                                                                                                                                                              | RESULT                                      | ACTION                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------|
| <b>NOTE:</b> Outside temperature must be above 16°C (60°F) in order to properly diagnose.                                                                         | A/C indicator turns on (steady).            | GO to step 2.                                                                  |
|                                                                                                                                                                   | A/C indicator flashing.                     | GO to Test B.                                                                  |
| 1. Ignition On, A/C switch On, does A/C indicator turn on?                                                                                                        | A/C indicator not on when button selected.  | Replace control head.                                                          |
| 2. Disconnect A/C clutch connector C162. Place ignition in RUN position and A/C switch ON. Connect test lamp to terminal B (DK GRN 59) to ground.                 | Test lamp lights.                           | GO to step 3.                                                                  |
|                                                                                                                                                                   | Test lamp does not light.                   | GO to step 5.                                                                  |
| 3. Install test lamp across terminals A (BLK 150) and B (DK GRN 59) of C162.                                                                                      | Test lamp lights.                           | GO to step 4.                                                                  |
|                                                                                                                                                                   | Test lamp does not light.                   | CHECK and REPAIR ground circuit 150 (to circuit 151).                          |
| 4. Apply battery feed (through a fused jumper) and ground to the A/C clutch assembly.                                                                             | Clutch engages.                             | GO to step 5.                                                                  |
|                                                                                                                                                                   | Clutch does not engage.                     | Replace clutch.                                                                |
| 5. Remove jumper and check refrigerant pressure.                                                                                                                  | Low side below 50 psi.                      | See Section 1B refrigeration diagnosis.                                        |
|                                                                                                                                                                   | Low side above 50 psi.                      | GO to step 5.                                                                  |
| 6. Reconnect A/C clutch connector C162, and disconnect pressure cycling switch connector C110. Connect a test lamp to terminal B (LT GRN 66) to ground.           | Test lamp lights.                           | GO to step 7.                                                                  |
|                                                                                                                                                                   | Test lamp does not light.                   | GO to step 8.                                                                  |
| 7. Jumper terminals A and B with a fused jumper.                                                                                                                  | Clutch engages.                             | Replace pressure cycling switch.                                               |
|                                                                                                                                                                   | Clutch does not engage.                     | GO to step 8.                                                                  |
| 8. Backprobe A/C clutch relay connector C221 (with relay installed) and ignition in RUN, and A/C switch on, with a test lamp to terminal 4 (LT GRN 66) to ground. | Test lamp lights.                           | REPAIR open in circuit 66 between C221 and pressure cycling switch C110.       |
|                                                                                                                                                                   | Test lamp does not light.                   | GO to step 9.                                                                  |
| 9. Backprobe A/C clutch relay connector C221 (with relay installed) at terminals 1 and 2 (both BRN 50) to ground.                                                 | Test lamp lights for both.                  | GO to step 10.                                                                 |
|                                                                                                                                                                   | Test lamp does not light on either or both. | REPAIR open in circuit 50. (If blower operates open is between S259 and C221.) |

## A/C COMPRESSOR CONTROLS 8A-64-5

### TEST A – A/C CLUTCH DOES NOT ENGAGE (CONTINUED)

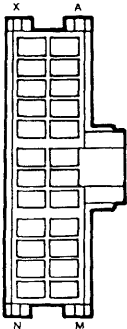
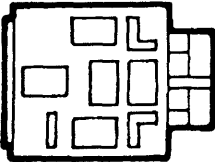
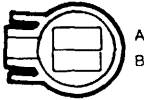
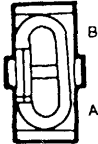
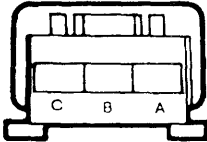
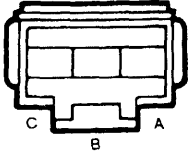
| TEST                                                                                                                                                         | RESULT                                                 | ACTION                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------|
| 10. Remove A/C clutch relay and install a test lamp across terminals 2 and 5 (BRN 50 and DK BLU/WHT 1651).                                                   | Test lamp lights.                                      | REPLACE relay.               |
|                                                                                                                                                              | Test lamp does not light.                              | GO to step 11.               |
| 11. Ignition switch off, remove control head, and measure resistance from connector C230, terminal K (DK BLU/WHT 1651) to C221 terminal 5 (DK BLU/WHT 1651). | Less than 10 ohms (continuity of circuit 1651)         | REPLACE control head.        |
|                                                                                                                                                              | Greater than 10 ohms (poor continuity of circuit 1651) | REPAIR open in circuit 1651. |

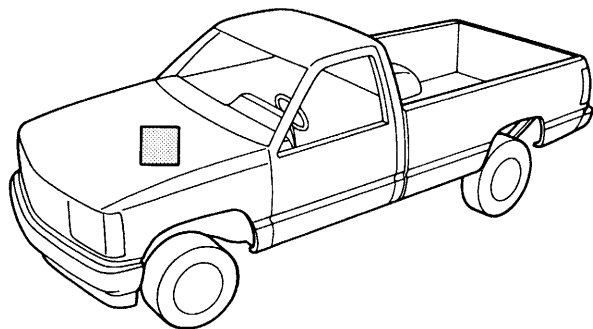
### TEST B – A/C CLUTCH INDICATOR FLASHING

| TEST                                                                                                                                                | RESULT                                                        | ACTION                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|
| <b>NOTE:</b> Outside temp. must be above 16°C (60°F) in order to properly diagnose.<br><br>1. Ignition ON, A/C switch ON, does A/C indicator flash? | Yes.                                                          | GO to step 2.                                               |
|                                                                                                                                                     | No.                                                           | GO to Test A.                                               |
| 2. Refer to 1B and perform system performance test to determine proper refrigerant charge (look for excess cycling).                                | OK.                                                           | GO to step 3.                                               |
|                                                                                                                                                     | Low charge/poor performance (determined by performance test). | SERVICE refrigeration system as per 1B and retest.          |
| 3. Check wiring from A/C clutch relay to A/C clutch (circuits 50, 66, 1651) and circuit 59 for loose conditions.                                    | Loose connections/wiring identified.                          | REPAIR wiring/connections.                                  |
|                                                                                                                                                     | OK.                                                           | REFER to PSB (intermittent false excess cycling condition). |

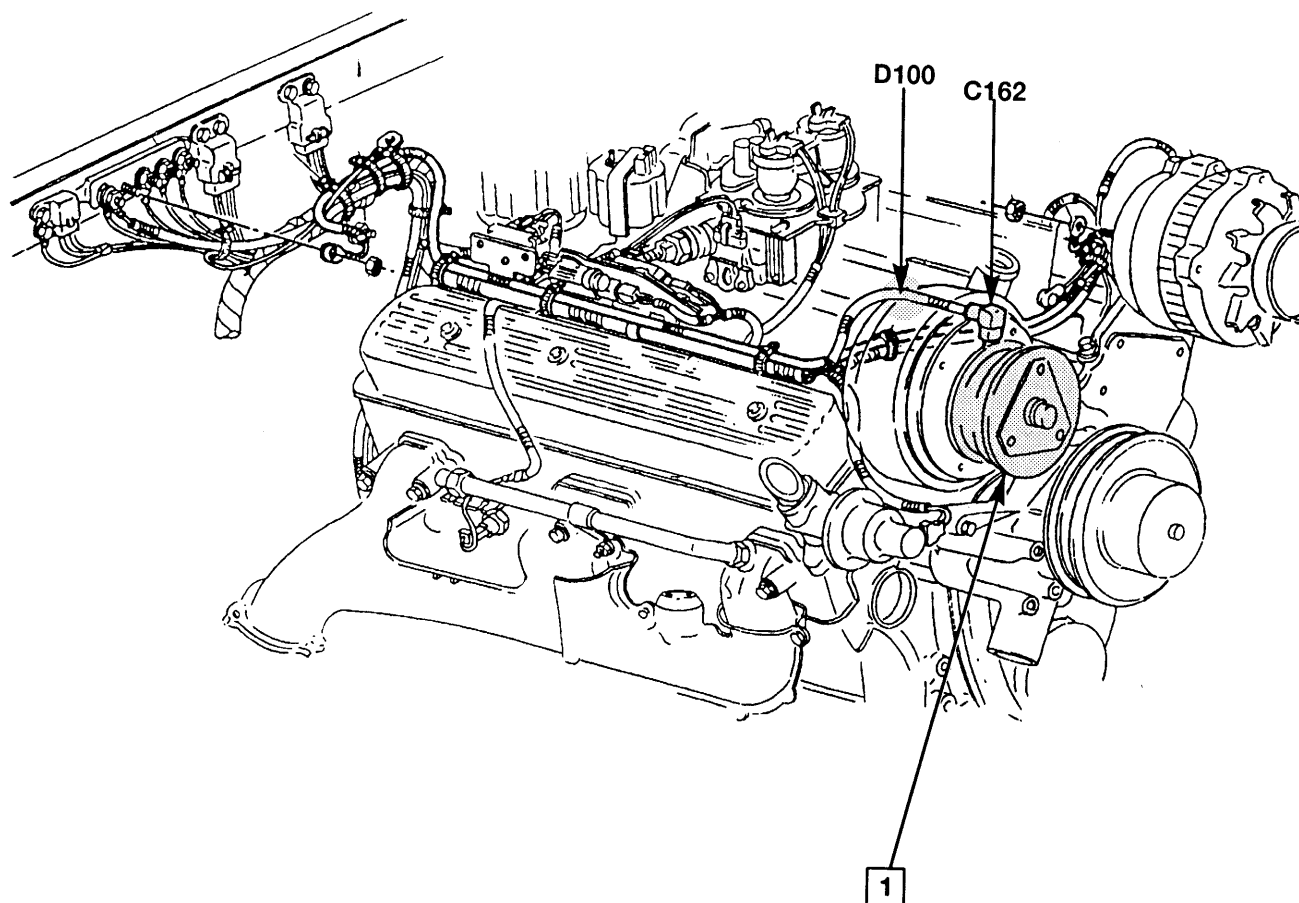


8A-64-6 A/C COMPRESOR CONTROLS

|                                                                                                                                                                                                         |                                                                                                                                                                                           |                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>12004702</div> <div></div> <div>BLACK</div> <div>C230A<br/>Heater-A/C Controller</div>                            | <div>12034003</div> <div></div> <div>BLACK<br/>Metri-Pack 630</div> <div>C221<br/>A/C Clutch Relay</div> | <div>12078086</div> <div></div> <div>C110<br/>Evaporator Control Switch</div>                               |
| <div>12052643</div> <div></div> <div>RED<br/>Metri-Pack 150</div> <div>C145A<br/>High Pressure Cutout Switch #2</div> | <div>12066603</div> <div></div> <div>GRAY<br/>Metri-Pack 150</div> <div>C162<br/>A/C Clutch</div>       | <div>12020397</div> <div></div> <div>BLACK<br/>Metri-Pack 280</div> <div>C260<br/>In-Line I/P to A/C</div> |
| <div>12020398</div> <div></div> <div>BLACK<br/>Metri-Pack 180</div> <div>C260<br/>In-Line A/C to I/P</div>           |                                                                                                                                                                                           |                                                                                                                                                                                                |



5.0L AND 5.7L ENGINES  
SHOWN, ALL OTHER  
ENGINES SIMILAR



1. A/C Compressor Clutch

Figure 1 — RH Side of Engine, 5.0L (305 CID) and 5.7L (350 CID) V8 Gasoline Engines

## 8A-64-8 A/C COMPRESSOR CONTROLS

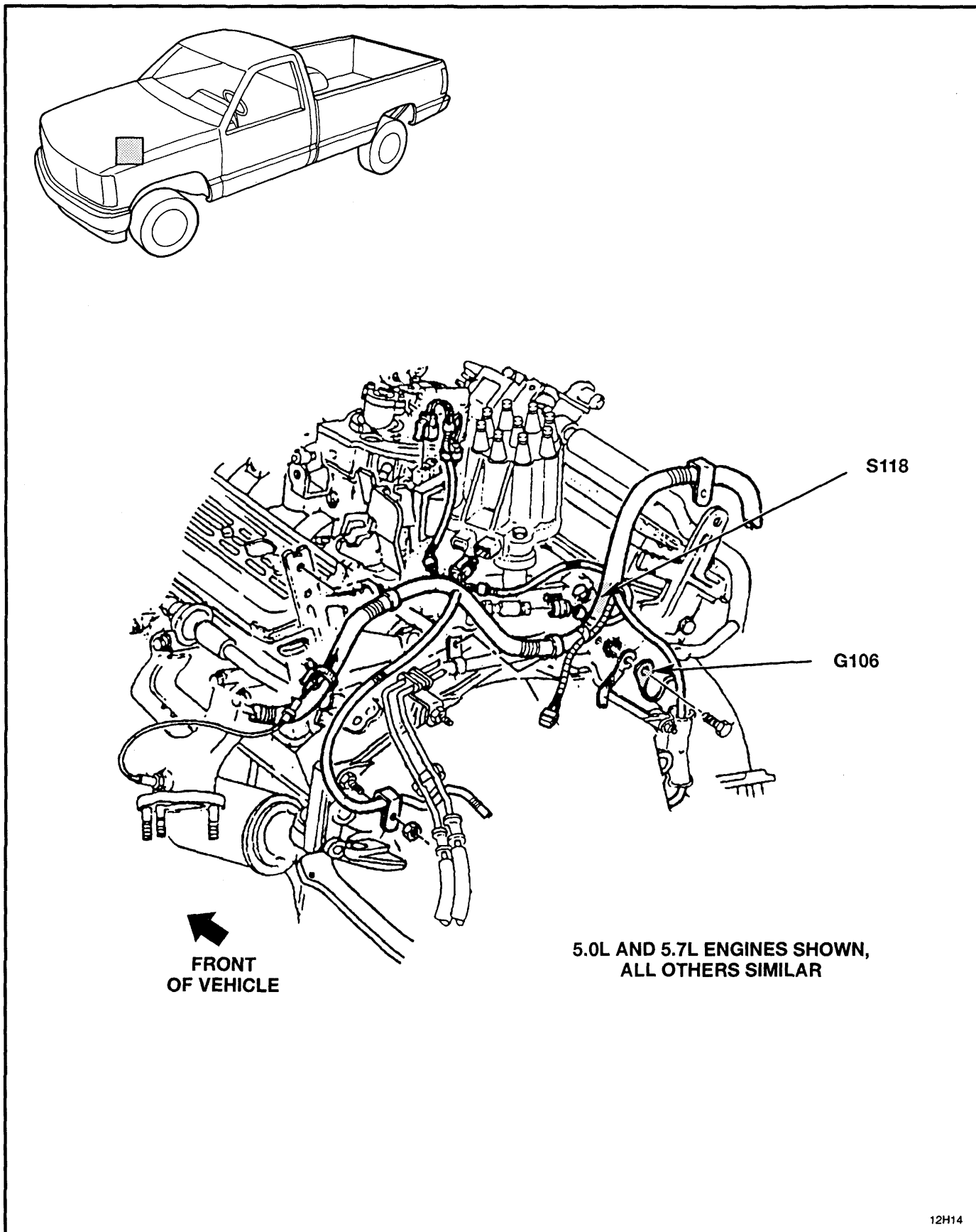


Figure 2 — LH Side of Engine, 5.0L (305 CID) and 5.7L (350 CID) Gasoline Engines

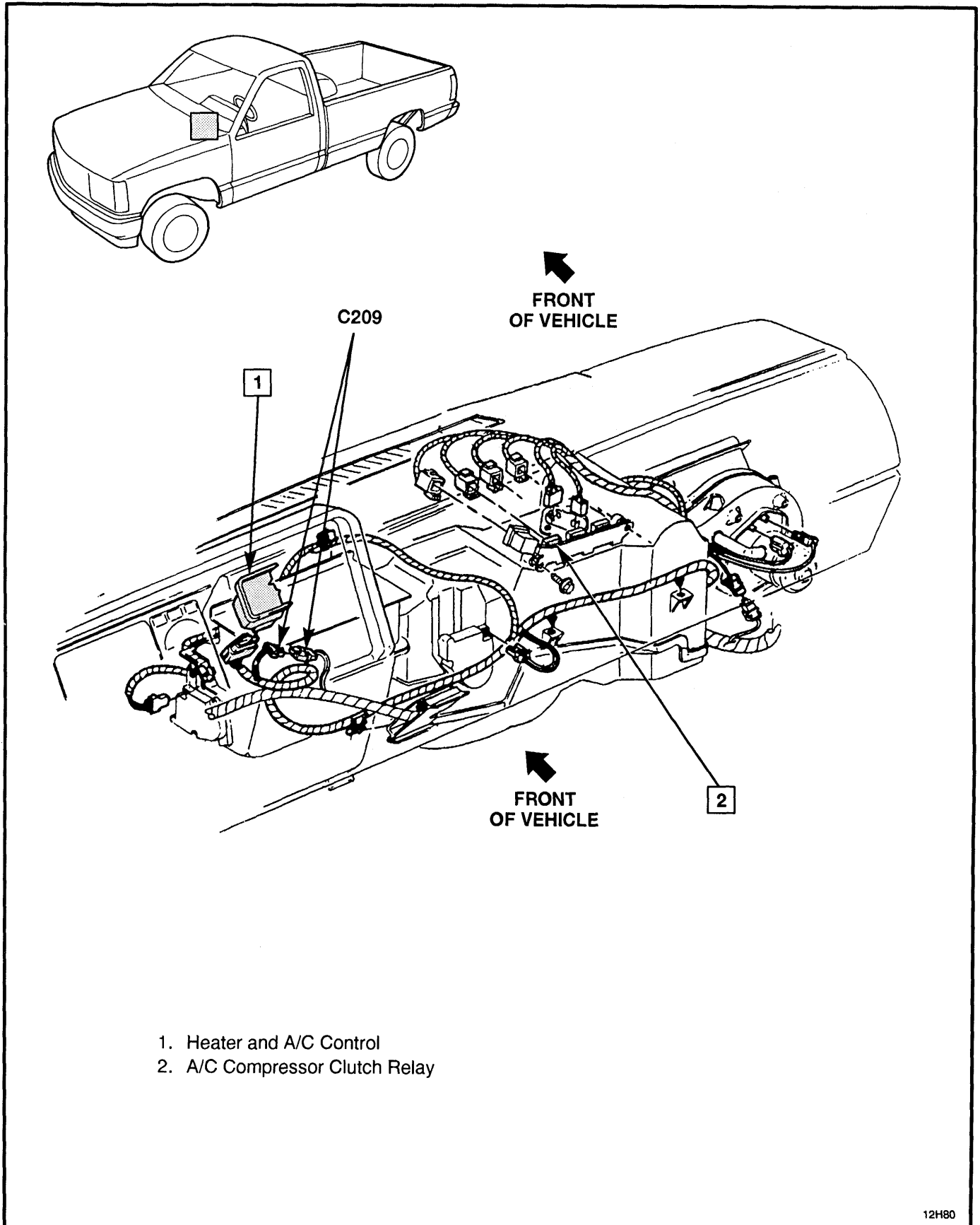


Figure 3 — Heater and A/C Harness Wiring

8A-64-10 A/C COMPRESSOR CONTROLS

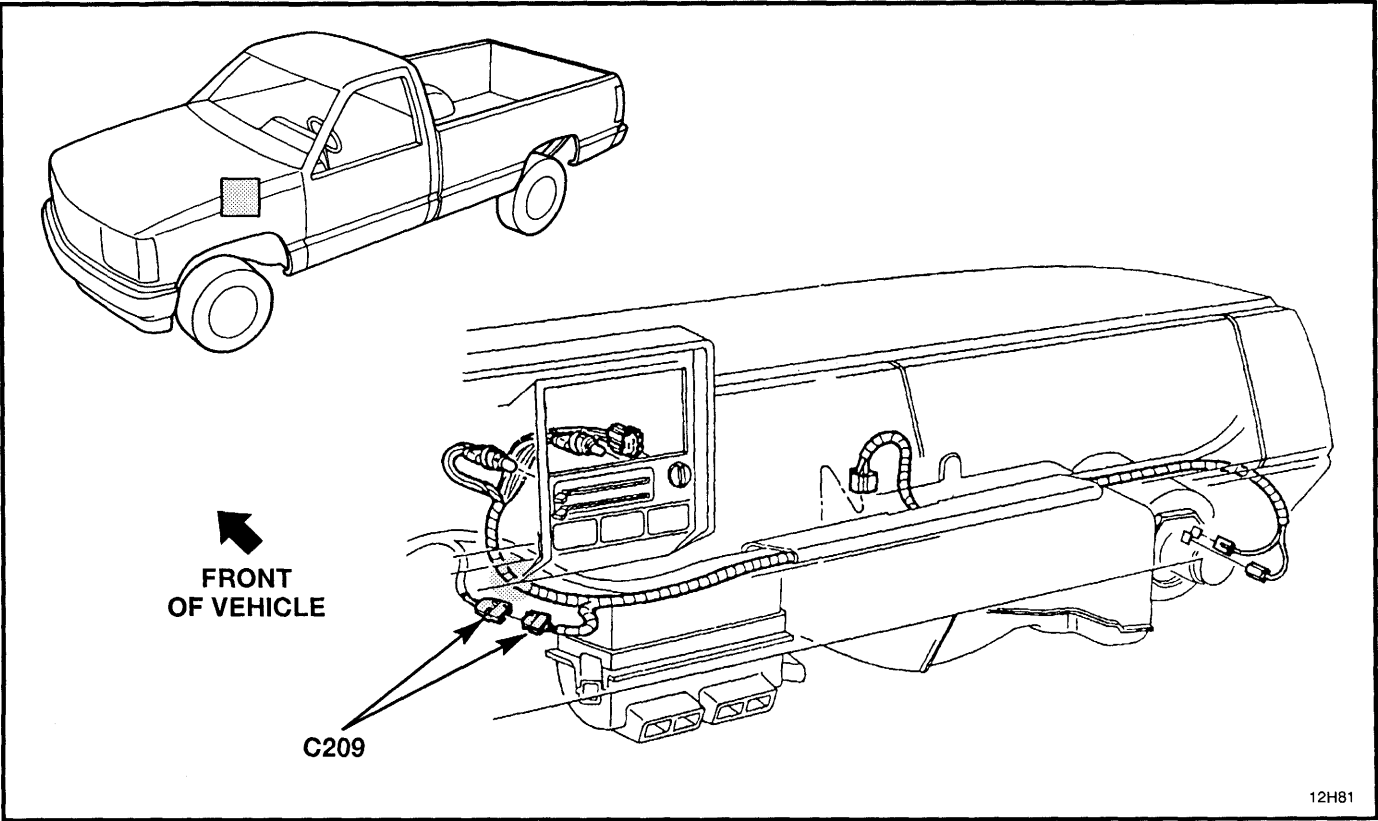


Figure 4 — Heater Wiring

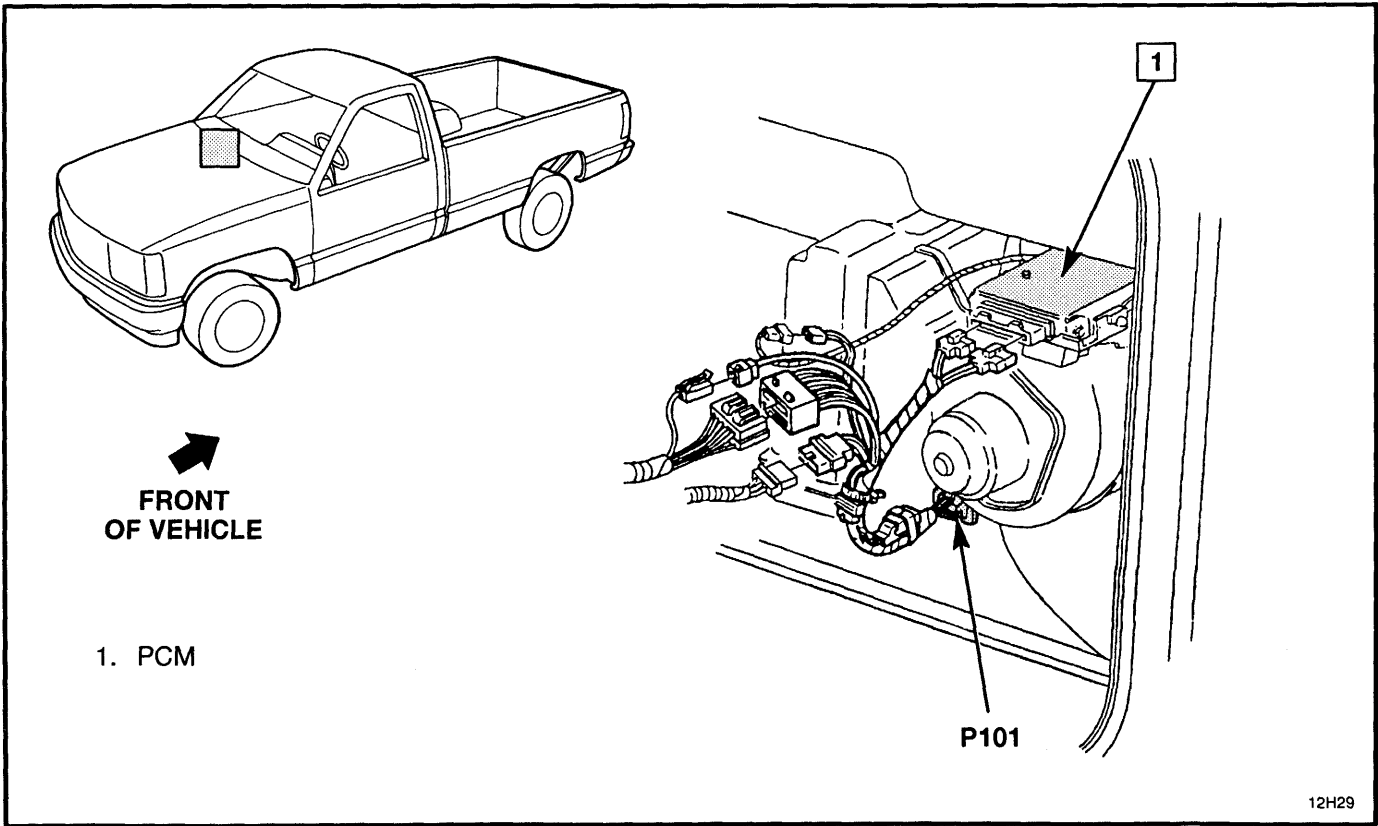


Figure 5 — Behind RH Side of I/P

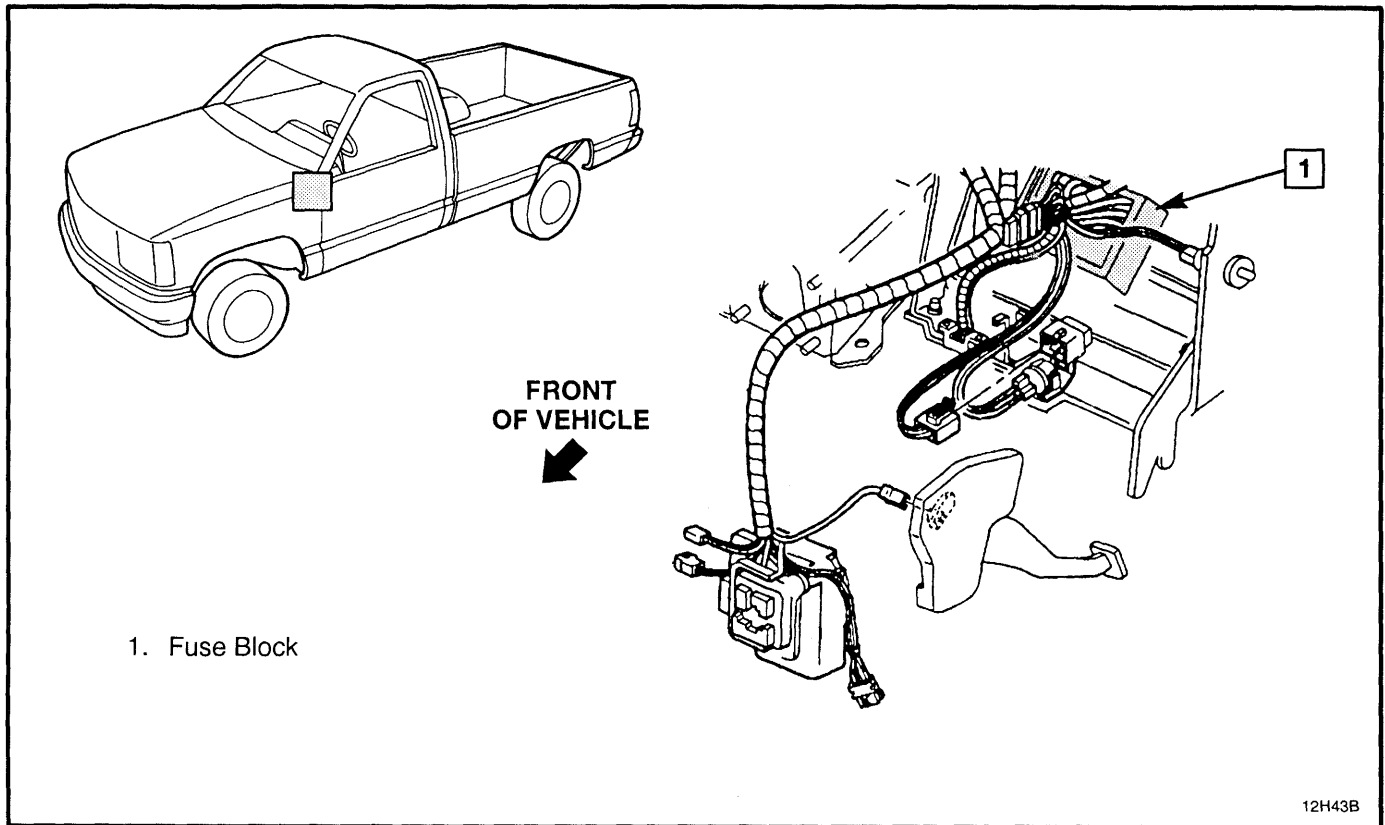


Figure 6 — Instrument Panel, LH Side

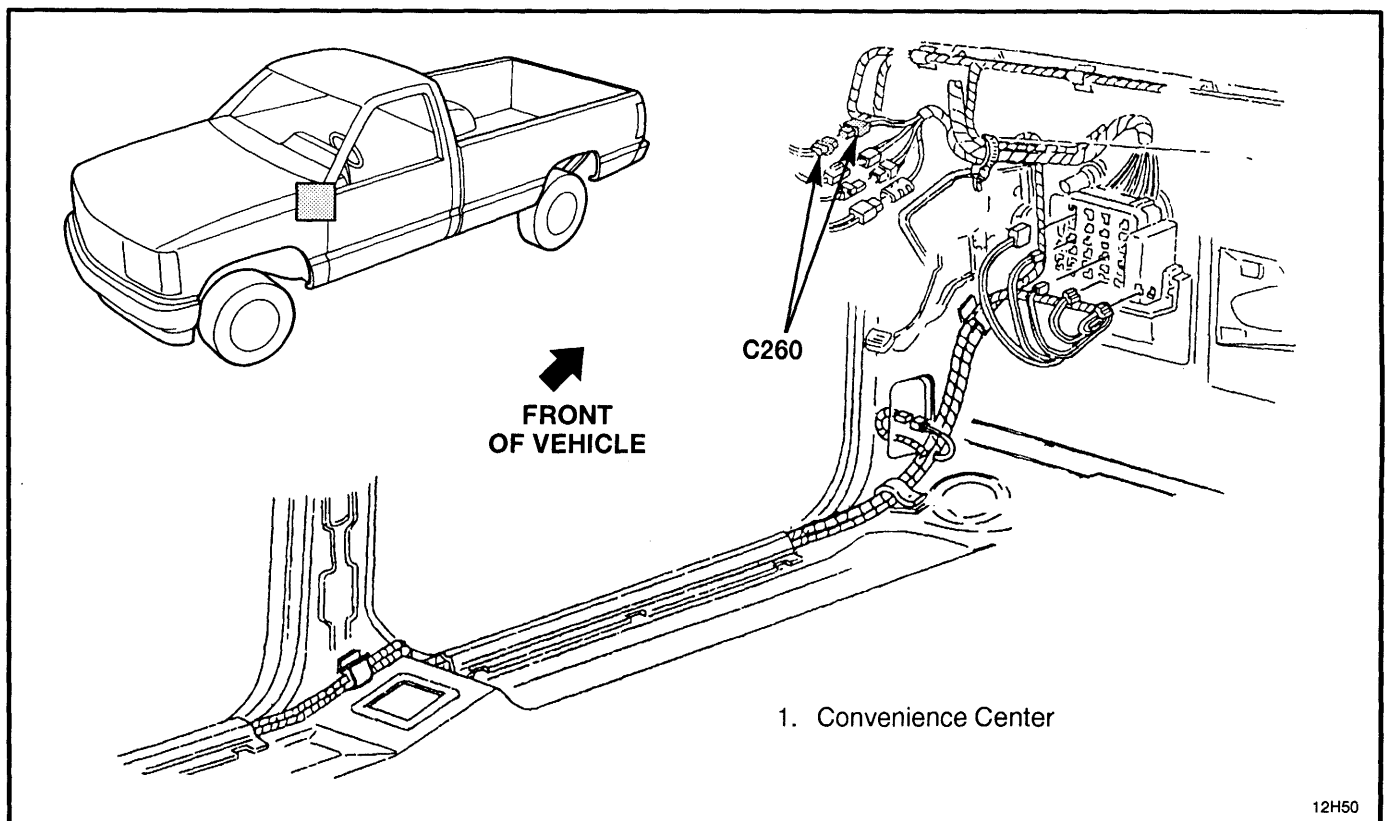


Figure 7 — Body Wiring Harness, Front

**BLANK**

## CIRCUIT OPERATION

### REAR AUXILIARY AIR CONDITIONING

The Rear Auxiliary Air Conditioning Module is operated by either of two control panels in the overhead console. The front control has the capability to override the rear control settings. The controls select the blower fan's three operating speeds: LO, MED and HI.

The fan speeds are controlled by the selector control and the selected speed blower relay. Battery voltage is supplied from the battery junction block to each relay through the RED (2) wire. Battery voltage is also supplied

to each relay through the RR HVAC fuse and the BRN (50) wire. The blower speed control switch grounds the relays through the YEL (51) LO speed, LT BLU (72) MED speed or the ORN (52) HI speed wire. The BLK (150) wire completes the path to ground from the blower speed switch to the I/P ground lug.

The front and rear control switch panels in the overhead console are both backlit. With the park lamps on, battery voltage is supplied to the lamps by the PANEL LPS fuse and the GRA (8) wire. Ground is provided by the BLK (150) wire from the I/P ground lug. The panel dimmer switch controls the lamp's illumination intensity.

### COMPONENT LOCATION

### Page — Figure

|                              |                                     |        |   |
|------------------------------|-------------------------------------|--------|---|
| Auxiliary A/C Control, Front | At front of roof                    | 67A-14 | 6 |
| Auxiliary A/C Control, Rear  | At rear of roof                     | 67A-14 | 6 |
| Battery Junction Block       | RH rear engine compartment, at cowl | 67A-10 | 1 |
| Blower Motor                 | Under RH side of I/P                | 67A-11 | 2 |
| Blower Motor Resistor        | Under I/P on heater housing         | 67A-11 | 2 |
| Convenience Center           | Under LH side of I/P                | 67A-13 | 5 |
| Fuse Block                   | Under LH side of I/P                | 67A-12 | 3 |
| HI Blower Relay, Rear        | On auxiliary heater and A/C module  | 67A-13 | 4 |
| Low Blower Relay, Rear       | On auxiliary heater and A/C module  | 67A-13 | 4 |
| Medium Blower Relay, Rear    | On auxiliary heater and A/C module  | 67A-13 | 4 |

### CONNECTORS:

|       |                                   |        |   |
|-------|-----------------------------------|--------|---|
| C206A | At convenience center             | 67A-13 | 5 |
| C228  | At convenience center             | 67A-13 | 5 |
| C231  | At convenience center             | 67A-13 | 5 |
| C382  | At roof bow, near front dome lamp | 67A-14 | 6 |
| C475  | At RH D-pillar                    | 67A-13 | 4 |
| C476  | At RH D-pillar                    | 67A-13 | 4 |

### GROMMETS:

|      |                                    |           |
|------|------------------------------------|-----------|
| P101 | RH lower cowl (engine compartment) | Not Shown |
|------|------------------------------------|-----------|

### GROUNDS:

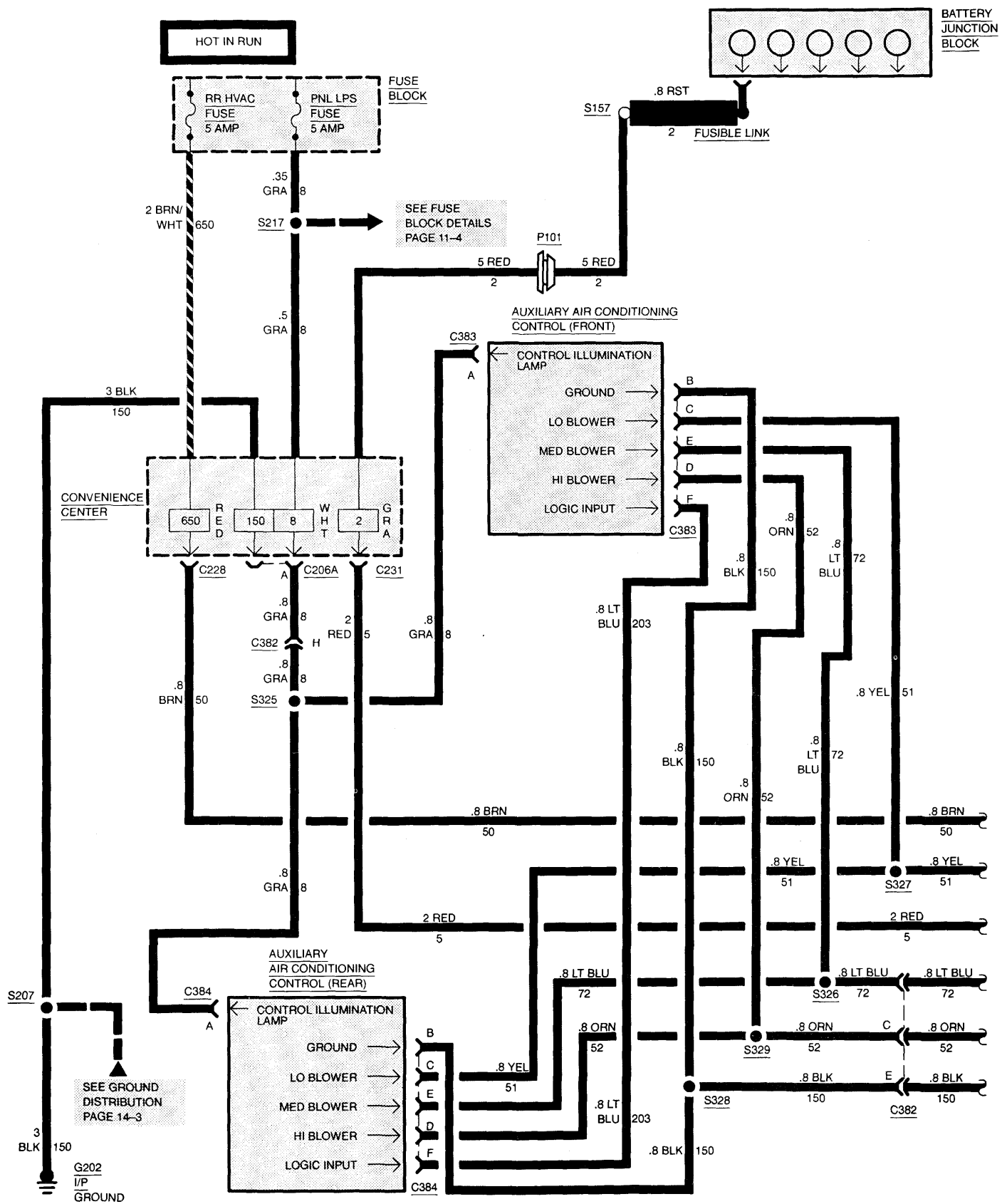
|      |                |           |
|------|----------------|-----------|
| G400 | At RH D-pillar | Not Shown |
|------|----------------|-----------|

### SPLICES:

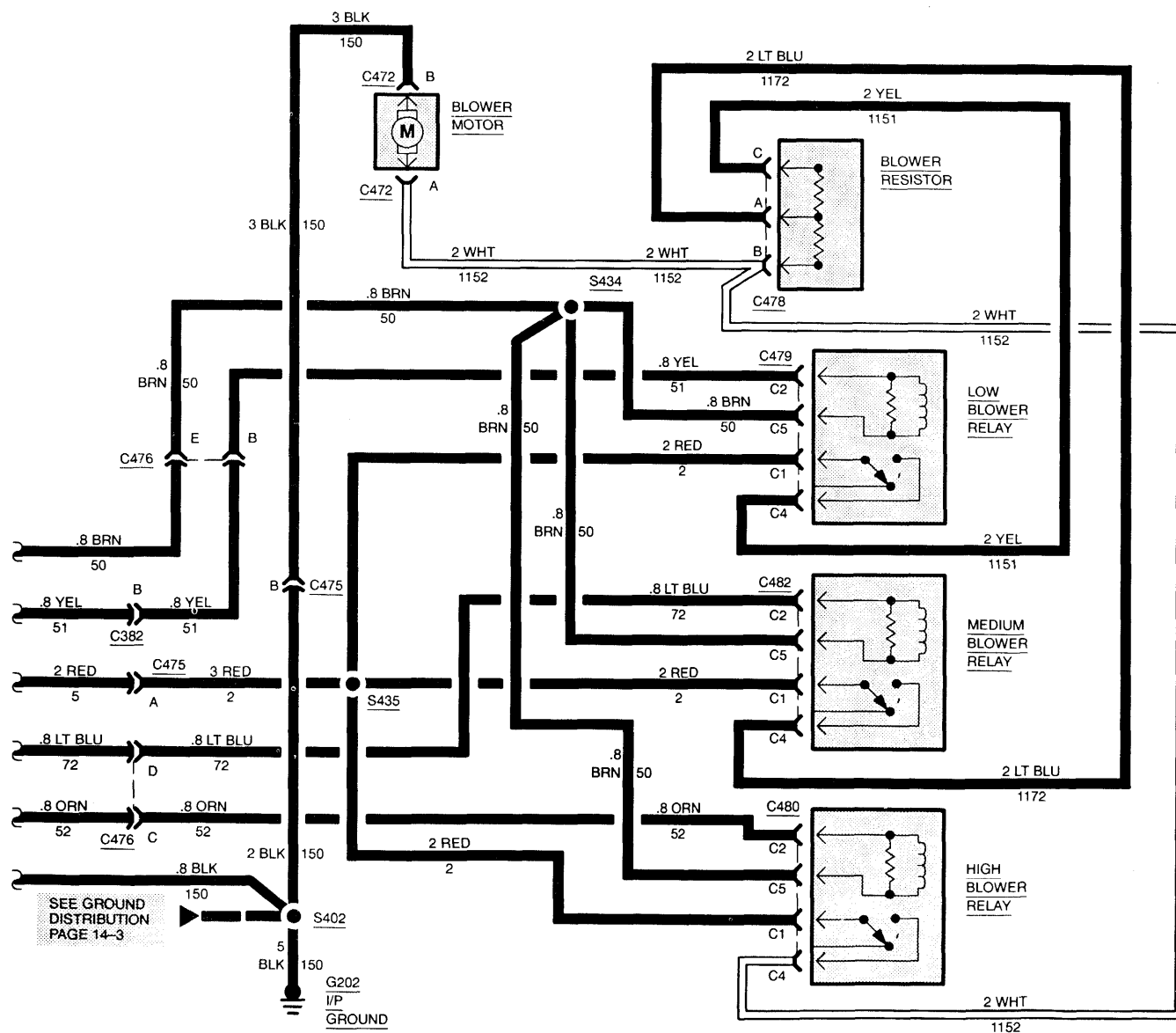
|      |                                                     |           |   |
|------|-----------------------------------------------------|-----------|---|
| S157 | Center of cowl, below battery junction block        | 67A-10    | 1 |
| S217 | Behind LH side of I/P                               | 67A-12    | 3 |
| S325 | Auxiliary A/C control harness, behind roof console  | 67A-14    | 6 |
| S326 | Auxiliary A/C control harness, behind roof console  | 67A-14    | 6 |
| S327 | Auxiliary A/C control harness, behind roof console  | 67A-14    | 6 |
| S328 | Auxiliary A/C control harness, behind roof console  | Not Shown |   |
| S329 | Auxiliary A/C control harness, at rear control lead | 67A-14    | 6 |
| S402 | Above rear liftgate glass opening                   | 67A-15    | 7 |
| S434 | Auxiliary A/C harness, near relay leads             | 67A-13    | 4 |
| S435 | Auxiliary A/C harness, near relay leads             | 67A-13    | 4 |



# 8A-67A-2 REAR AUXILIARY AIR CONDITIONING



# REAR AUXILIARY AIR CONDITIONING 8A-67A-3



## 8A-67A-4 REAR AUXILIARY AIR CONDITIONING

### DIAGNOSIS — REAR AUXILIARY AIR CONDITIONING

#### PRELIMINARY CHECKS:

1. Check condition of RR HVAC, PNL LPS Fuses. If fuse(s) is blown, locate and repair source of overload. Replace fuse.

#### REAR BLOWER OPERATES IN LO AND MED FROM BOTH SWITCHES BUT DOES NOT OPERATE IN HI FROM EITHER SWITCH

| TEST                                                                                                                                                        | RESULT                    | ACTION                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and blower switch in HI speed position. Connect test lamp from WHT (1152) wire at HI blower relay connector C480 to ground. | Test lamp lights.         | LOCATE and REPAIR open in WHT (1152) wire between HI blower relay connector C480 and blower resistor connector C478.                                                          |
|                                                                                                                                                             | Test lamp does not light. | GO to step 2.                                                                                                                                                                 |
| 2. Connect test lamp from RED (2) wire at HI blower relay connector C480 to ground.                                                                         | Test lamp lights.         | GO to step 3.                                                                                                                                                                 |
|                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between HI blower relay connector C480 and splice S435.                                                                                |
| 3. Connect test lamp from BRN (50) wire at HI blower relay connector C480 to ground.                                                                        | Test lamp lights.         | GO to step 4.                                                                                                                                                                 |
|                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between HI blower relay connector C480 and splice S434.                                                                               |
| 4. Connect test lamp from BRN (50) wire to ORN (52) wire at HI blower relay connector C480.                                                                 | Test lamp lights.         | REPLACE HI blower relay.                                                                                                                                                      |
|                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in ORN (52) wire between HI blower relay connector C480 and connector C476, from connector C476 to connector C382, from connector C382 to splice S329. |

## REAR AUXILIARY AIR CONDITIONING 8A-67A-5

### REAR A/C BLOWER DOES NOT OPERATE IN ANY SPEED FROM EITHER SWITCH (REAR A/C ONLY)

| TEST                                                                                                                                                           | RESULT                    | ACTION                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and rear A/C switch in HI speed position. Connect test lamp from WHT (152) wire at rear blower motor connector C477 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                  |
|                                                                                                                                                                | Test lamp does not light. | GO to step 3.                                                                                                                                                                                  |
| 2. Connect test lamp from WHT (1152) wire to BLK (150) wire at rear blower motor connector C477.                                                               | Test lamp lights.         | REPLACE blower motor.                                                                                                                                                                          |
|                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear blower motor connector C477 and connector C475, from connector C475 to splice S402 or from splice S402 to ground G400.                   |
| 3. Connect test lamp from WHT (1152) wire at blower resistor connector C478 to ground.                                                                         | Test lamp lights.         | LOCATE and REPAIR open in WHT (1152) wire between blower resistor connector C478 and blower motor connector C477.                                                                              |
|                                                                                                                                                                | Test lamp does not light. | GO to step 4.                                                                                                                                                                                  |
| 4. Connect test lamp from BRN (50) wire at HI blower relay connector C480 to ground.                                                                           | Test lamp lights.         | GO to step 5.                                                                                                                                                                                  |
|                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between splice S434 and connector C476, from connector C476 to convenience center connector C228 or from convenience center to fuse block.             |
| 5. Connect test lamp from RED (2) wire at HI blower relay connector to ground.                                                                                 | Test lamp lights.         | GO to step 6.                                                                                                                                                                                  |
|                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between splice S435 and connector C475, from connector C475 to convenience center connector C231, or from convenience center to battery junction block. |
| 6. Connect test lamp from BRN (50) wire to ORN (52) wire at HI blower relay connector C480.                                                                    | Test lamp lights.         | CHECK all connections.                                                                                                                                                                         |
|                                                                                                                                                                | Test lamp does not light. | GO to step 7.                                                                                                                                                                                  |
| 7. Connect test lamp from positive battery voltage source to BLK (150) wire at rear blower switch connector C382 or C383.                                      | Test lamp lights.         | REPLACE switches.                                                                                                                                                                              |
|                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between splice S328 and connector C382, from connector C382 to splice S402 or from splice S402 to ground G400.                                        |

## 8A-67A-6 REAR AUXILIARY AIR CONDITIONING

### REAR BLOWER MOTOR OPERATES IN HI SPEED FROM BOTH SWITCHES BUT DOES NOT OPERATE IN LO/MED SPEEDS FROM EITHER SWITCH

| TEST                                                                                                                                                                                    | RESULT                    | ACTION                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and rear blower switch in LO or MED. Connect test lamp from YEL (1151) wire (LO) or LT BLU (72) wire (MED) at blower resistor connector C478 to ground. | Test lamp lights.         | REPLACE blower resistor.                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                         | Test lamp does not light. | GO to step 2.                                                                                                                                                                                                                                                            |
| 2. Connect test lamp from RED (2) wire at LO blower relay connector C479 or MED blower connector C482 to ground.                                                                        | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire between LO blower relay connector C479 or MED blower connector C482 and splice S435.                                                                                                                                              |
| 3. Connect test lamp from BRN (50) wire at LO blower relay connector C479 or MED blower connector C482 to ground.                                                                       | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between LO blower relay connector C479 or MED blower relay connector C482 and splice S434.                                                                                                                                       |
| 4. Connect test lamp from BRN (50) wire to YEL (51) wire at LO blower relay connector C479 or to LT BLU (72) wire at MED blower relay connector C482.                                   | Test lamp lights.         | GO to step 5.                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in YEL (51) or LT BLU (72) wire(s) between LO blower relay connector C479 or MED blower relay connector C482 and connector C467, from connector C476 to connector C382 or from connector C382 to splice S327 YEL (51) or splice S326 LT BLU (72). |
| 5. Connect test lamp from YEL (1151) wire at LO blower relay connector C479 or LT BLU (72) wire at MED blower relay connector C482 to ground.                                           | Test lamp lights.         | REPLACE relay.                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in YEL (1151) LO or LT BLU (72) MED wire(s) between LO blower relay connector C479 or MED blower relay connector C482 and blower resistor connector C478.                                                                                         |

## REAR AUXILIARY AIR CONDITIONING 8A-67A-7

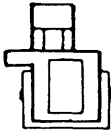
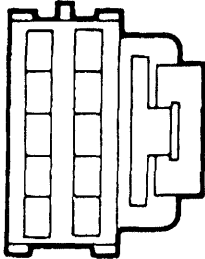
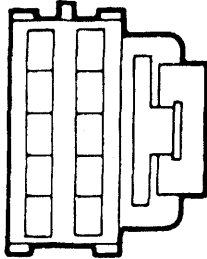
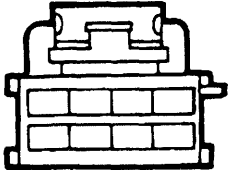
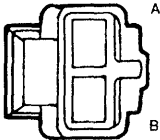
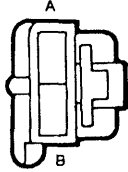
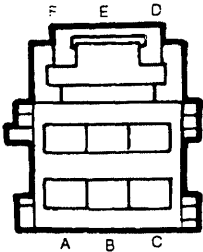
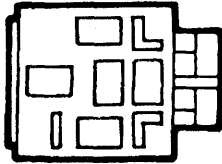
### ALL REAR BLOWER SPEEDS OPERATE BUT ONLY FROM CONSOLE FRONT CONTROL SWITCH

| TEST                                                                                                                                                                                                                                          | RESULT                    | ACTION                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and rear blower switch in LO, MED or HI speed position and front blower switch in OFF. Connect test lamp from positive battery voltage source to BLK (150) wire at rear blower control switch connector C384. | Test lamp lights.         | GO to step 2.                                                                                                                                  |
|                                                                                                                                                                                                                                               | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear blower switch and splice S328.                                                           |
| 2. Connect test lamp from positive battery voltage source to LT BLU (203) wire at rear blower switch connector C384.                                                                                                                          | Test lamp lights.         | LOCATE and REPAIR short in LT BLU (203) wire between rear blower control switch connector C384 and front blower control switch connector C383. |
|                                                                                                                                                                                                                                               | Test lamp does not light. | REPLACE rear blower switch.                                                                                                                    |

### ALL BLOWER SPEEDS OPERATE BUT ONLY FROM CONSOLE REAR CONTROL SWITCH

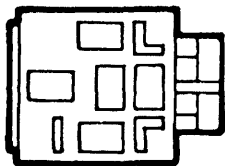
| TEST                                                                                                                                                                                                       | RESULT                    | ACTION                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and front blower switch in LO, MED or HI speed position. Connect test lamp from positive battery voltage source to BLK (150) wire at blower control switch connector C383. | Test lamp lights.         | REPLACE switch.                                                                                        |
|                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between blower control switch connector C383 and splice S328. |

8A-67A-8 REAR AUXILIARY AIR CONDITIONING

|                                                                                                              |                                                                                                               |                                                                                                               |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <p>12089856</p>             | <p>12064871</p>              | <p>12064871</p>            |
| <p>C231<br/>Rear Auxiliary A/C Battery Tap at Convenience Center</p>                                         | <p>C383<br/>Front Auxiliary A/C Controls</p>                                                                  | <p>C384<br/>Rear Auxiliary A/C Controls</p>                                                                   |
| <p>12064766</p>            | <p>12064750</p>             | <p>12064749</p>           |
| <p>BLUE<br/>Metri-Pack 150<br/>C382<br/>In-Line Rear Auxiliary A/C Controls to Extension Harness</p>         | <p>BLACK<br/>Metri-Pack 480<br/>C475<br/>In-Line Rear A/C Heater Control Extension Harness to Rear Module</p> | <p>BLACK<br/>Metri-Pack 480<br/>C475<br/>In-Line Rear Module to Rear A/C Heater Control Extension Harness</p> |
| <p>12064762</p>           | <p>02965104</p>            | <p>12034003</p>          |
| <p>GRAY<br/>Metri-Pack 150<br/>C476<br/>In-Line Rear Module to Rear A/C Heater Control Extension Harness</p> | <p>NATURAL<br/>56 Series<br/>C478<br/>Blower Resistor</p>                                                     | <p>BLACK<br/>Metri-Pack 630<br/>C479<br/>Blower Relay</p>                                                     |

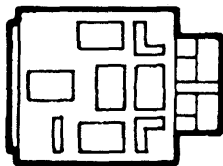
REAR AUXILIARY AIR CONDITIONING 8A-67A-9

12034003



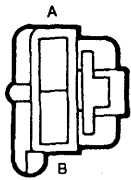
**BLACK**  
Metri-Pack 630  
**C480**  
Blower Relay

12034003



**BLACK**  
Metri-Pack 630  
**C482**  
Blower Relay

12064749



**BLACK**  
Metri-Pack 480  
**C472**  
Blower Motor



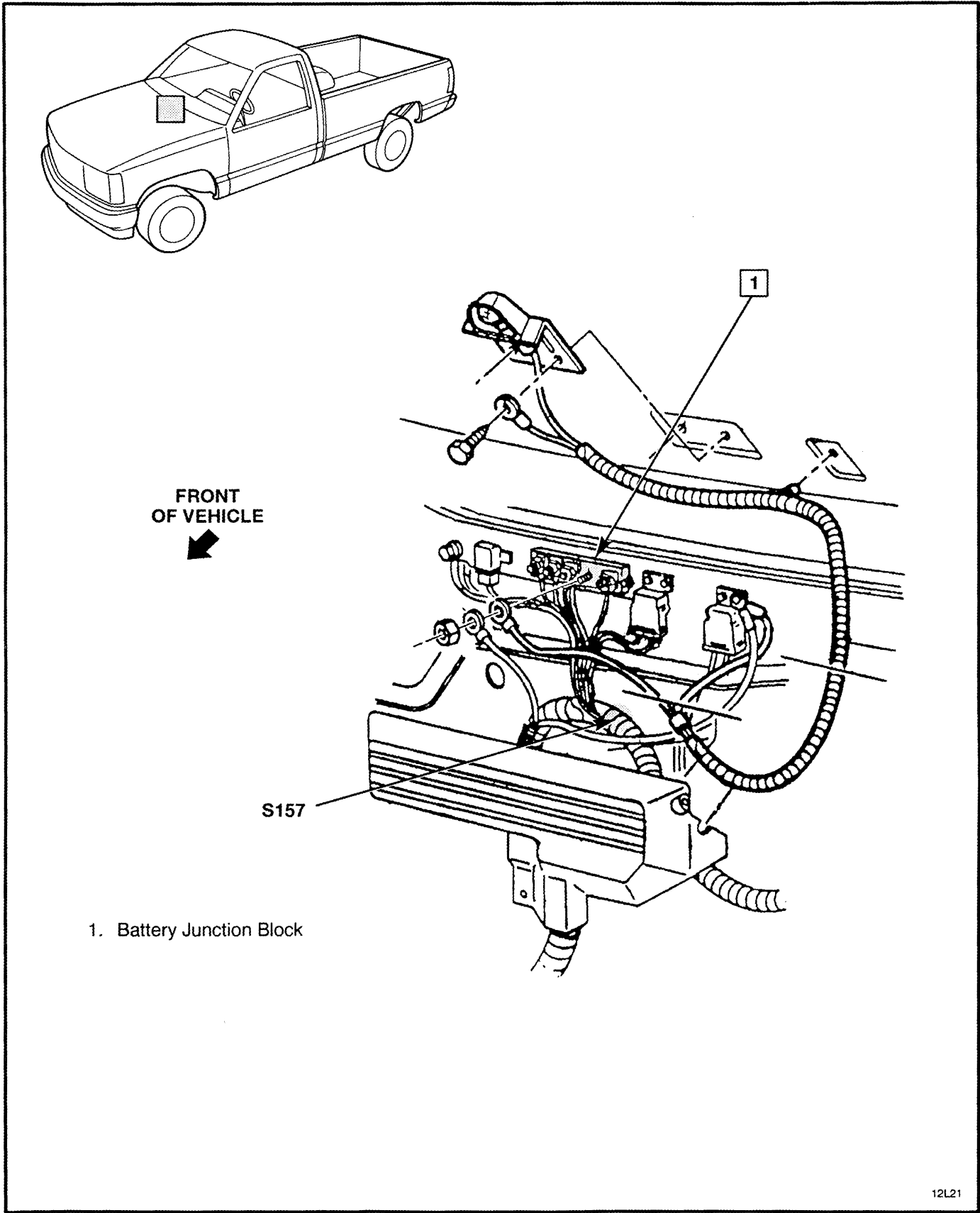


Figure 1 — Battery Junction Block

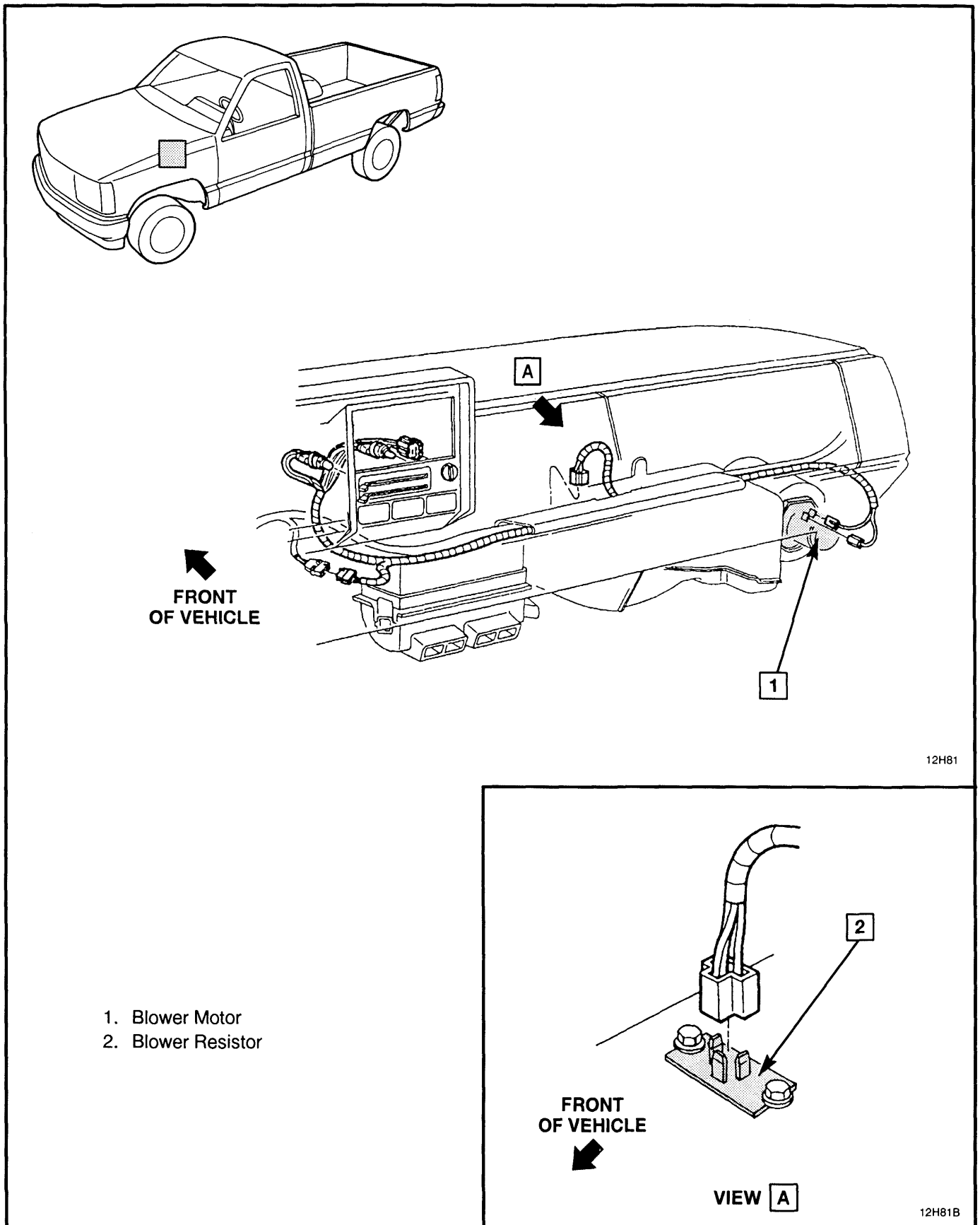


Figure 2 — Heater A/C Wiring

## 8A-67A-12 REAR AUXILIARY AIR CONDITIONING

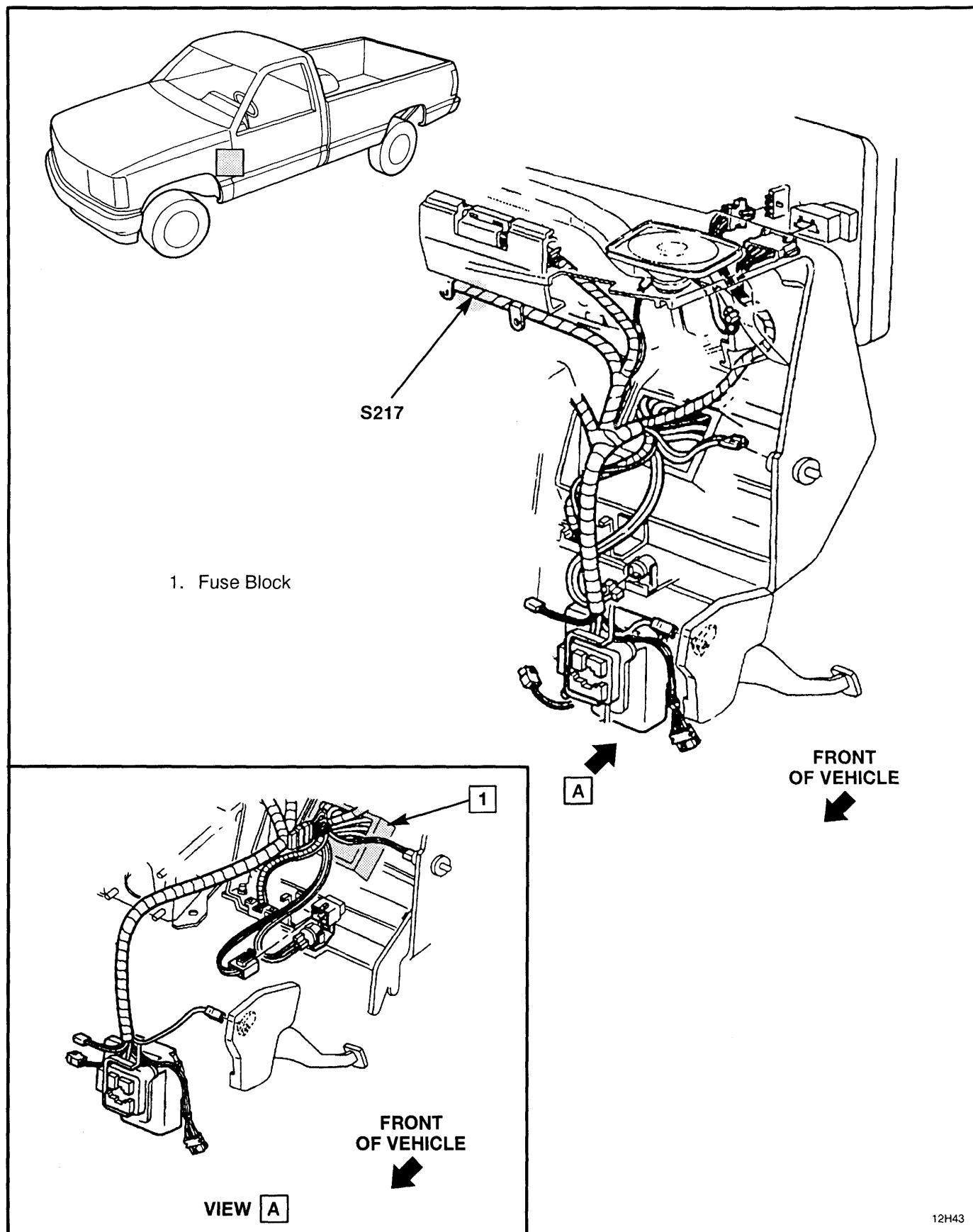


Figure 3 — LH Side of Instrument Panel

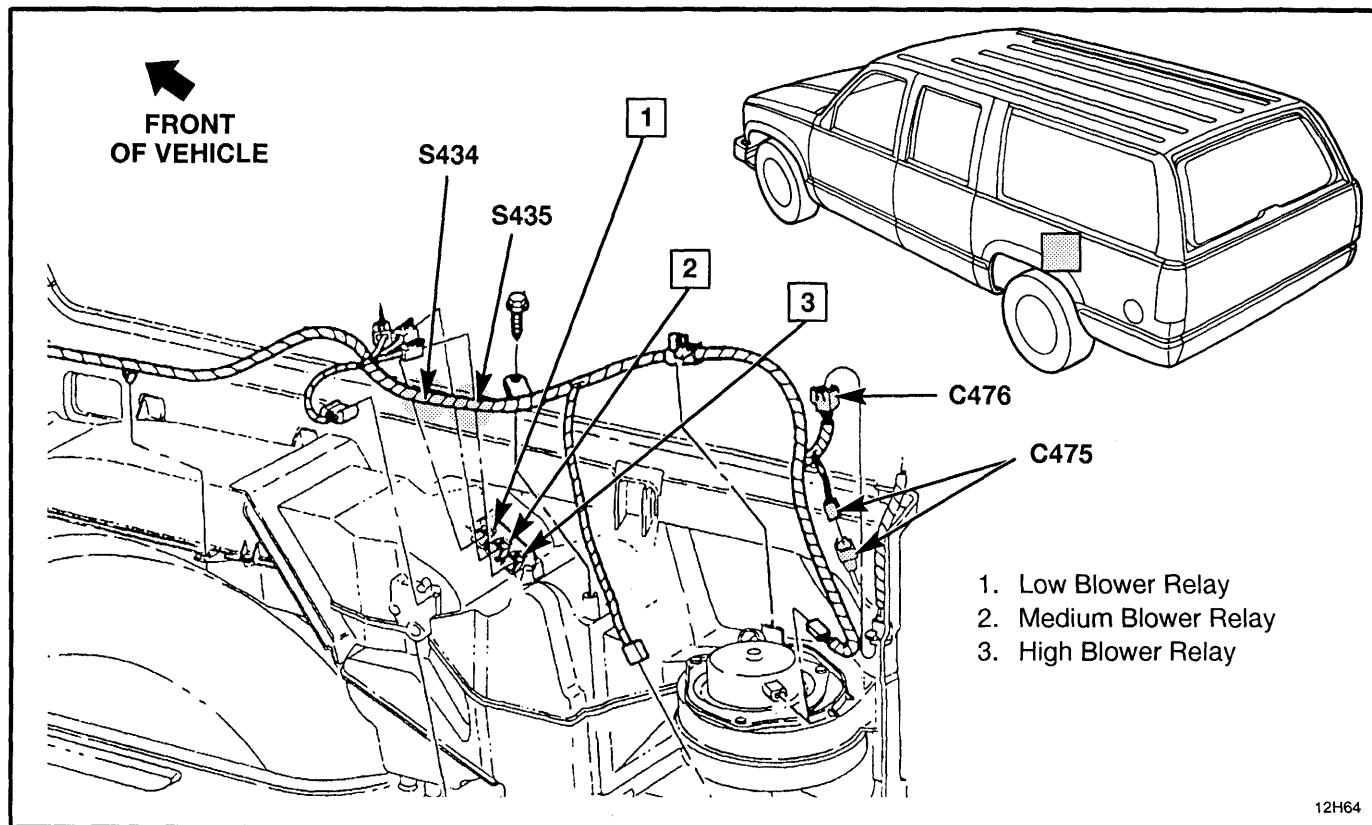


Figure 4 — Auxiliary Heater and A/C Wiring

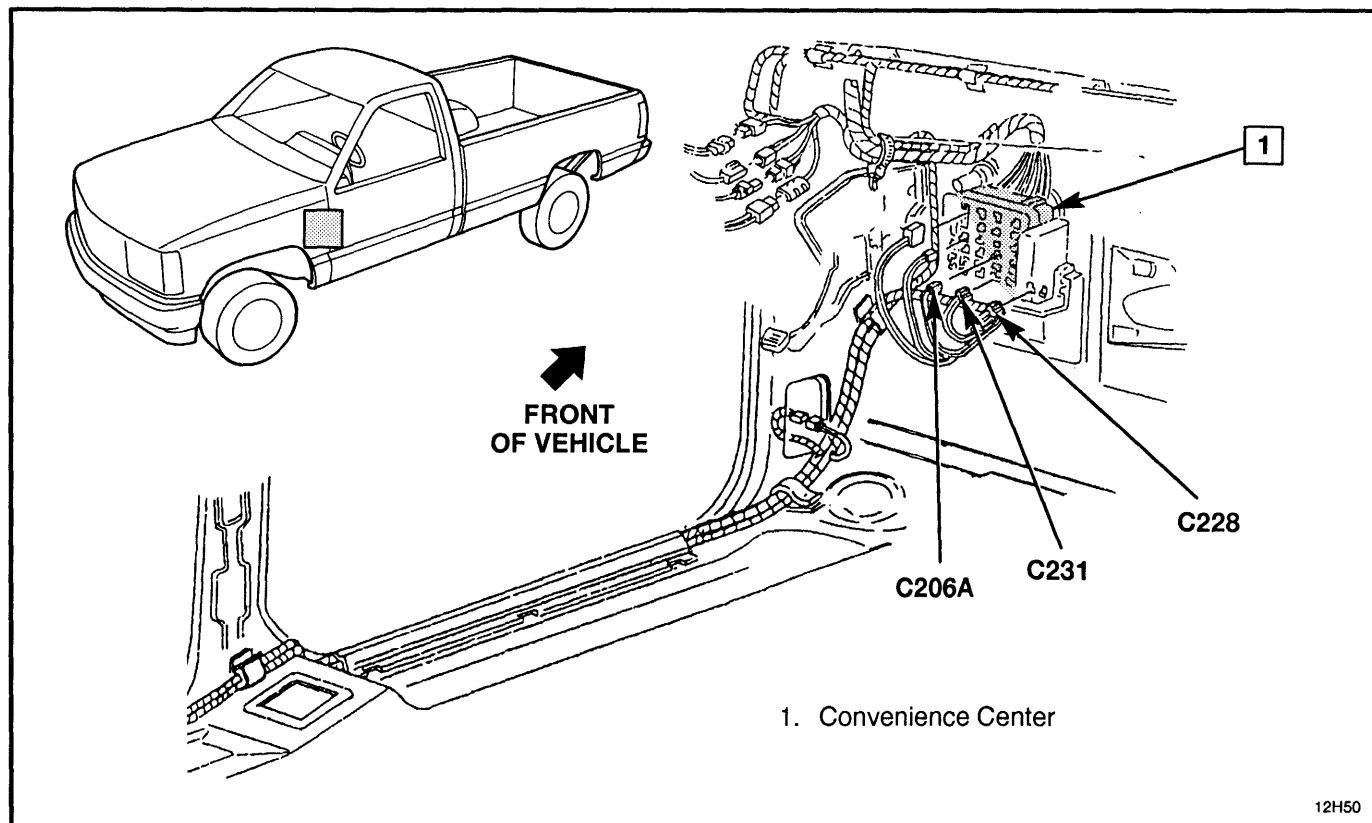
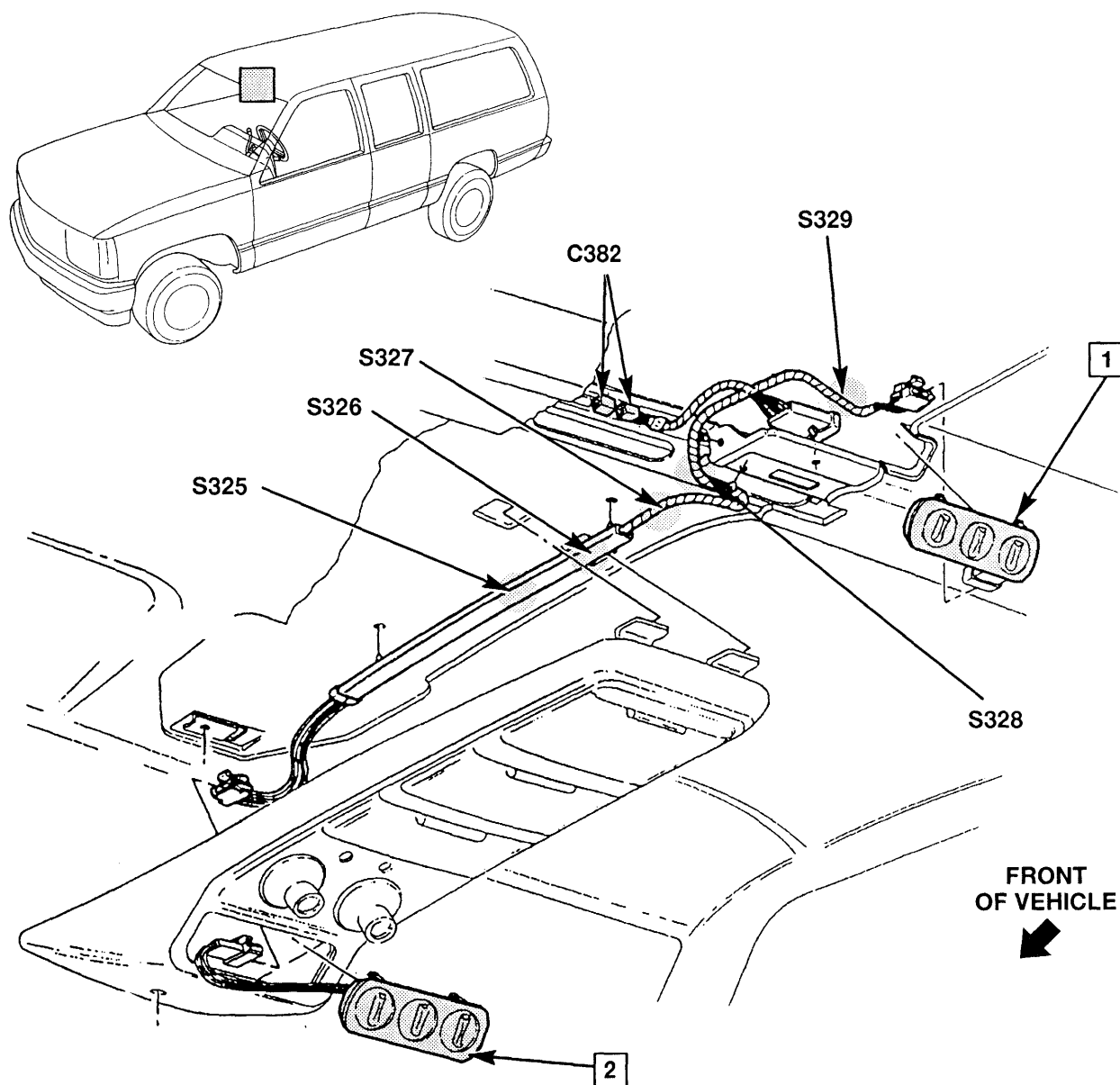


Figure 5 — Body Wiring Harness, Front

## 8A-67A-14 REAR AUXILIARY AIR CONDITIONING



1. Auxiliary Heater and A/C Front Control
2. Auxiliary Heater and A/C Rear Control

Figure 6 — Auxiliary Heater and A/C Controls

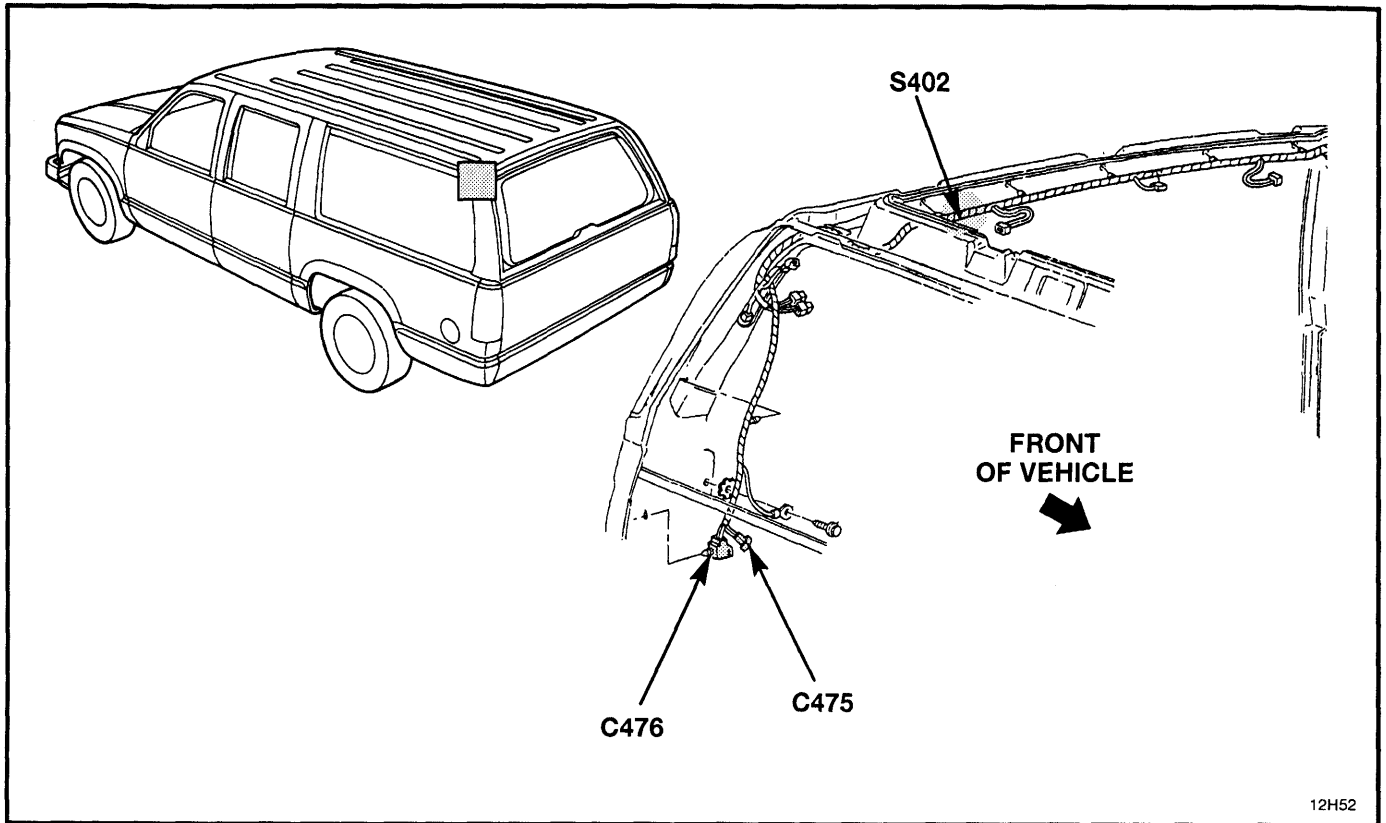


Figure 7 — Body Wiring — Rear — Suburban

12H52

**BLANK**

## CIRCUIT OPERATION

### REAR AUXILIARY HEATER AND AIR CONDITIONING

The Rear Auxiliary Heater and Air Conditioning Module is operated by either of two control panels in the overhead console. The front control has the capability to override the rear control settings. The controls select the blower fan's three operating speeds: LO, MED and HI.

The fan speeds are controlled by the selector control and the selected speed blower relay. Battery voltage is supplied from the battery junction block to each relay through the RED (2) wire. Battery voltage is also supplied

to each relay through the RR HVAC fuse and the BRN (50) wire. The blower speed control switch grounds the relays through the YEL (51) LO speed, LT BLU (72) MED speed or the ORN (52) HI speed wire. The BLK (150) wire completes the path to ground from the blower speed switch to the I/P ground lug.

The front and rear control switch panels in the overhead console are both backlit. With the park lamps on, battery voltage is supplied to the lamps by the PANEL LPS fuse and the GRA (8) wire. Ground is provided by the BLK (150) wire from the I/P ground lug. The panel dimmer switch controls the lamp's illumination intensity.

### COMPONENT LOCATION

### Page — Figure

|                                      |                                           |                              |           |
|--------------------------------------|-------------------------------------------|------------------------------|-----------|
| Auxiliary Heater and A/C Control,    |                                           |                              |           |
| Front .....                          | At front of roof .....                    | 67B-16                       | 9         |
| Auxiliary Heater and A/C Control,    |                                           |                              |           |
| Rear .....                           | At rear of roof .....                     | 67B-16                       | 9         |
| Battery Junction Block .....         | RH rear engine compartment, at cowl ..... | 67B-11                       | 1         |
| Blower Motor .....                   | Under RH side of I/P .....                | 67B-14                       | 6         |
| Blower Motor Resistor .....          | Under I/P on heater housing .....         | 67B-14                       | 6         |
| Convenience Center .....             | Under LH side of I/P .....                | 67B-12                       | 2         |
| Front/Rear Heater, A/C Control Logic |                                           |                              |           |
| Module (W/Rear A/C and               |                                           |                              |           |
| Heater Only) .....                   |                                           | Above overhead console ..... | Not Shown |
| Fuse Block .....                     | Under LH side of I/P .....                | 67B-13                       | 5         |
| HI Blower Relay, Rear .....          | On auxiliary heater and A/C module .....  | 67B-15                       | 7         |
| Low Blower Relay, Rear .....         | On auxiliary heater and A/C module .....  | 67B-15                       | 7         |
| Medium Blower Relay, Rear .....      | On auxiliary heater and A/C module .....  | 67B-15                       | 7         |

### CONNECTORS:

|             |                                         |        |   |
|-------------|-----------------------------------------|--------|---|
| C206A ..... | At convenience center .....             | 67B-12 | 2 |
| C228 .....  | At convenience center .....             | 67B-12 | 3 |
| C231 .....  | At convenience center .....             | 67B-12 | 3 |
| C382 .....  | At roof bow, near front dome lamp ..... | 67B-16 | 9 |
| C475 .....  | At RH D-pillar .....                    | 67B-15 | 7 |
| C476 .....  | At RH D-pillar .....                    | 67B-15 | 7 |

### GROMMETS:

|            |                                          |           |
|------------|------------------------------------------|-----------|
| P101 ..... | RH lower cowl (engine compartment) ..... | Not Shown |
|------------|------------------------------------------|-----------|

### GROUNDING:

|            |                      |           |
|------------|----------------------|-----------|
| G400 ..... | At RH D-pillar ..... | Not Shown |
| G202 ..... | At DLC bracket ..... | 67B-13 4  |



## 8A-67B-2 REAR AUXILIARY HEATER AND AIR CONDITIONING

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### COMPONENT LOCATION

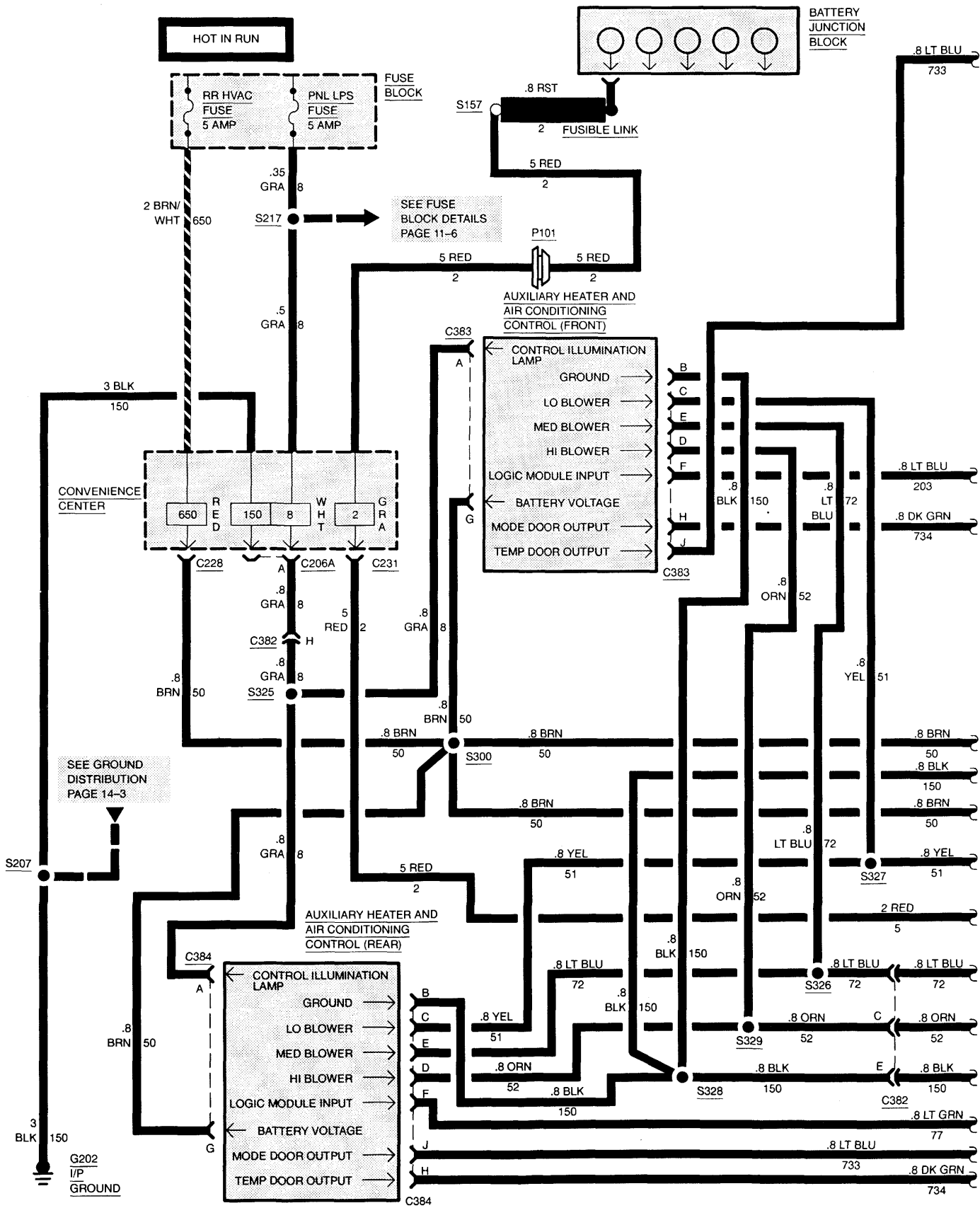
Page — Figure

#### SPLICES:

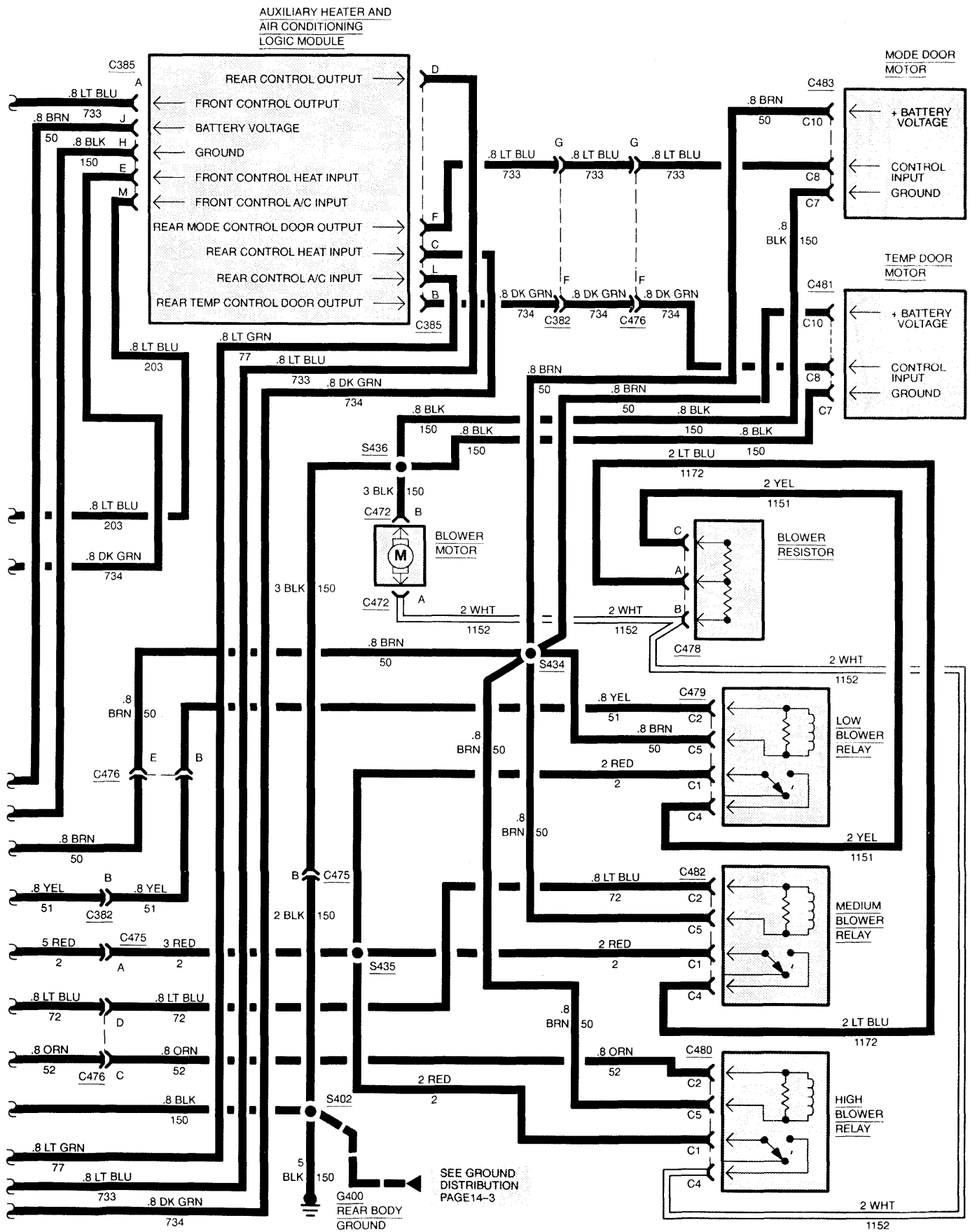
|      |                                                            |           |   |
|------|------------------------------------------------------------|-----------|---|
| S157 | Center of cowl, below battery junction block               | 67B-11    | 1 |
| S300 | LH door sill area                                          | 67B-11    | 5 |
| S325 | Auxiliary heater-A/C control harness, behind roof console  | 67B-16    | 9 |
| S326 | Auxiliary heater-A/C control harness, behind roof console  | 67B-16    | 9 |
| S327 | Auxiliary heater-A/C control harness, behind roof console  | 67B-16    | 9 |
| S328 | Auxiliary heater-A/C control harness, behind roof console  | 67B-16    | 9 |
| S329 | Auxiliary heater-A/C control harness, at rear control lead | 67B-16    | 9 |
| S330 | Auxiliary heater-A/C control harness, at rear control lead | 67B-16    | 9 |
| S402 | Above rear liftgate glass opening                          | 67B-15    | 8 |
| S434 | Auxiliary heater-A/C harness, near relay leads             | 67B-15    | 7 |
| S435 | Auxiliary heater-A/C harness, near relay leads             | 67B-15    | 7 |
| S436 | Auxiliary heater-A/C harness, near blower resistor lead    | Not Shown |   |

**BLANK**

## 8A-67B-4 REAR AUXILIARY HEATER AND AIR CONDITIONING



# REAR AUXILIARY HEATER AND AIR CONDITIONING 8A-67B-5



## 8A-67B-6 REAR AUXILIARY HEATER AND AIR CONDITIONING

### DIAGNOSIS — REAR AUXILIARY HEATER AND AIR CONDITIONING

#### PRELIMINARY CHECKS:

1. Check condition of RR HVAC, PNL LPS Fuses. If fuse(s) is blown, locate and repair source of overload. Replace fuse.

#### TEMPERATURE CONTROL MODE DOOR OPERATES BUT REAR AIRFLOW MODE DOOR DOES NOT OPERATE FROM EITHER CONSOLE CONTROL (W/REAR HEATER AND A/C)

| TEST                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and overhead console front control in A/C position. Connect test lamp from DK GRN (734) wire at airflow mode door motor connector C483 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                               |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in DK GRN (734) wire between airflow mode door motor connector C483 and connector C476, from C476 to C483, from C382 to logic module connector C385. |
| 2. Connect test lamp from DK GRN (734) wire to BLK (150) wire at airflow mode door motor connector C483.                                                                          | Test lamp lights.         | REPLACE airflow mode door motor.                                                                                                                                            |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between airflow mode door motor connector C483 and splice S436. If wire is good, REPLACE logic controller.                         |

#### REAR TEMPERATURE AND AIRFLOW MODE DOOR MOTORS OPERATE FROM ROOF CONSOLE FRONT CONTROL ONLY — BLOWER OPERATES FROM BOTH CONTROLS (W/REAR HEATER AND A/C)

| TEST                                                                                                                                                                                                                   | RESULT                    | ACTION                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and console rear control switch in A/C and front control switch in OFF. Connect test lamp from positive battery voltage source to LT GRN (77) wire at rear A/C control connector C384. | Test lamp lights.         | GO to step 2.                                                                                            |
|                                                                                                                                                                                                                        | Test lamp does not light. | REPLACE rear control switch.                                                                             |
| 2. Connect test lamp from positive battery voltage source to LT GRN (77) wire at logic module connector C385.                                                                                                          | Test lamp lights.         | REPLACE logic module.                                                                                    |
|                                                                                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in LT GRN (77) wire between rear control connector C384 and logic connector C385. |

## REAR AUXILIARY HEATER AND AIR CONDITIONING 8A-67B-7

### REAR TEMPERATURE AND AIRFLOW MODE DOOR MOTORS OPERATE FROM ROOF CONSOLE REAR CONTROL ONLY — BLOWER MOTOR OPERATES FROM BOTH CONTROLS (W/REAR HEATER AND A/C)

| TEST                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and console front switch in A/C. Connect test lamp from positive battery voltage source to LT BLU (203) wire at front A/C control connector C383. | Test lamp lights.         | GO to step 2.                                                                                                            |
|                                                                                                                                                                                   | Test lamp does not light. | REPLACE front control switch.                                                                                            |
| 2. Connect test lamp from positive battery source to LT BLU (203) wire at logic control module connector C385.                                                                    | Test lamp lights.         | REPLACE logic module.                                                                                                    |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in LT BLU (203) wire between front control switch connector C383 and logic module connector C385. |

### REAR TEMPERATURE DOOR MOTOR DOES NOT OPERATE FROM EITHER CONTROL (W/REAR HEATER AND A/C)

| TEST                                                                                                                                                                           | RESULT                    | ACTION                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN and overload console front control in MAX cooling. Connect test lamp from LT BLU (733) wire at rear temperature door connector C481 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in LT BLU (733) wire between temperature door motor connector C481 and connector C476, from connector C476 to connector C382 or from connector C382 to logic controller connector C385. If wire is good, GO to step 3.                                                        |
| 2. Connect test lamp from LT BLU (733) wire to BLK (150) wire at temperature door connector C481.                                                                              | Test lamp lights.         | REPLACE temperature door motor.                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear temperature door motor connector C481 and splice S436, from splice S436 to connector C475, from connector C475 to splice S402 or from splice S402 to ground G400.                                                                              |
| 3. Connect test lamp from BRN (50) wire at front control connector C383 to ground.                                                                                             | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between front control connector C383 and splice S330, from splice S330 to connector C382, from connector C382 to splice S300, from splice S300 to convenience center connector C228 or from convenience center to fuse block. If wire is good, GO to step 4. |

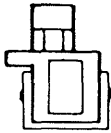
## 8A-67B-8 REAR AUXILIARY HEATER AND AIR CONDITIONING

### REAR TEMPERATURE DOOR MOTOR DOES NOT OPERATE FROM EITHER CONTROL (W/REAR HEATER AND A/C) (CONTINUED)

| TEST                                                                                      | RESULT                    | ACTION                                                                                        |
|-------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------|
| 4. Connect test lamp from BRN (50) wire at logic connector C385 to ground.                | Test lamp lights.         | GO to step 5.                                                                                 |
|                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in BRN (50) wire between logic module connector C385 and splice S330.  |
| 5. Connect test lamp from BRN (50) wire to BLK (150) wire at logic module connector C385. | Test lamp lights.         | REPLACE logic module.                                                                         |
|                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between logic module connector C385 and splice S328. |

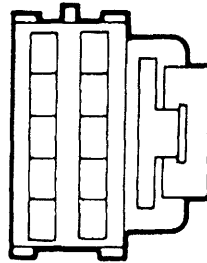
# REAR AUXILIARY HEATER AND AIR CONDITIONING 8A-67B-9

12089856



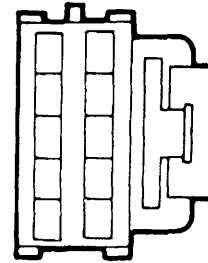
**C231**  
Rear Auxiliary Heater & A/C  
Battery Tap at Convenience  
Center

12064871



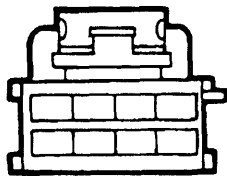
**C383**  
Front Auxiliary Heater & A/C  
Controls

12064871



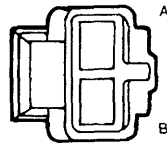
**C384**  
Rear Auxiliary Heater & A/C  
Controls

12064766



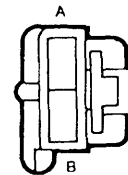
**BLUE**  
Metri-Pack 150  
**C382**  
In-Line Rear Auxiliary Heater &  
A/C Controls to Extension  
Harness

12064750



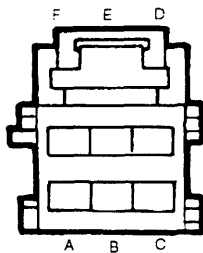
**BLACK**  
Mteri-Pack 480  
**C475**  
In-Line Rear Auxiliary & A/C  
Heater Control Extension  
Harness to Rear Module

12064749



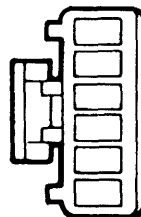
**BLACK**  
Metri-Pack 480  
**C475**  
In-Line Rear Auxiliary Heater &  
A/C Module to Control Extension  
Harness

12064762



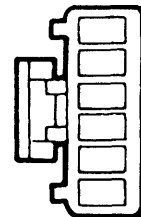
**GRAY**  
Metri-Pack 150  
**C476**  
In-Line Rear Auxiliary & A/C  
Heater Control Extension  
Harness to Rear Module

12040953



**BLACK**  
Micro-Pack  
**C483**  
Mode Door Motor

12040953



**BLACK**  
Micro-Pack  
**C481**  
Temp Door Motor



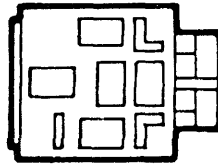
## 8A-67B-10 REAR AUXILIARY HEATER AND AIR CONDITIONING

02965104



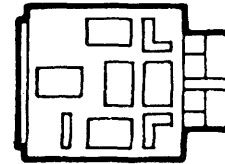
**NATURAL**  
56 Series  
**C478**  
**Blower Resistor**

12034003



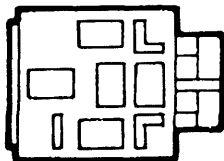
**BLACK**  
Metri-Pack 630  
**C479**  
**Blower Relay**

12034003



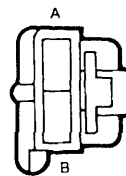
**BLACK**  
Metri-Pack 630  
**C480**  
**Blower Relay**

12034003



**BLACK**  
Metri-Pack 630  
**C482**  
**Blower Relay**

12064749



**BLACK**  
Metri-Pack 480  
**C472**  
**Blower Motor**

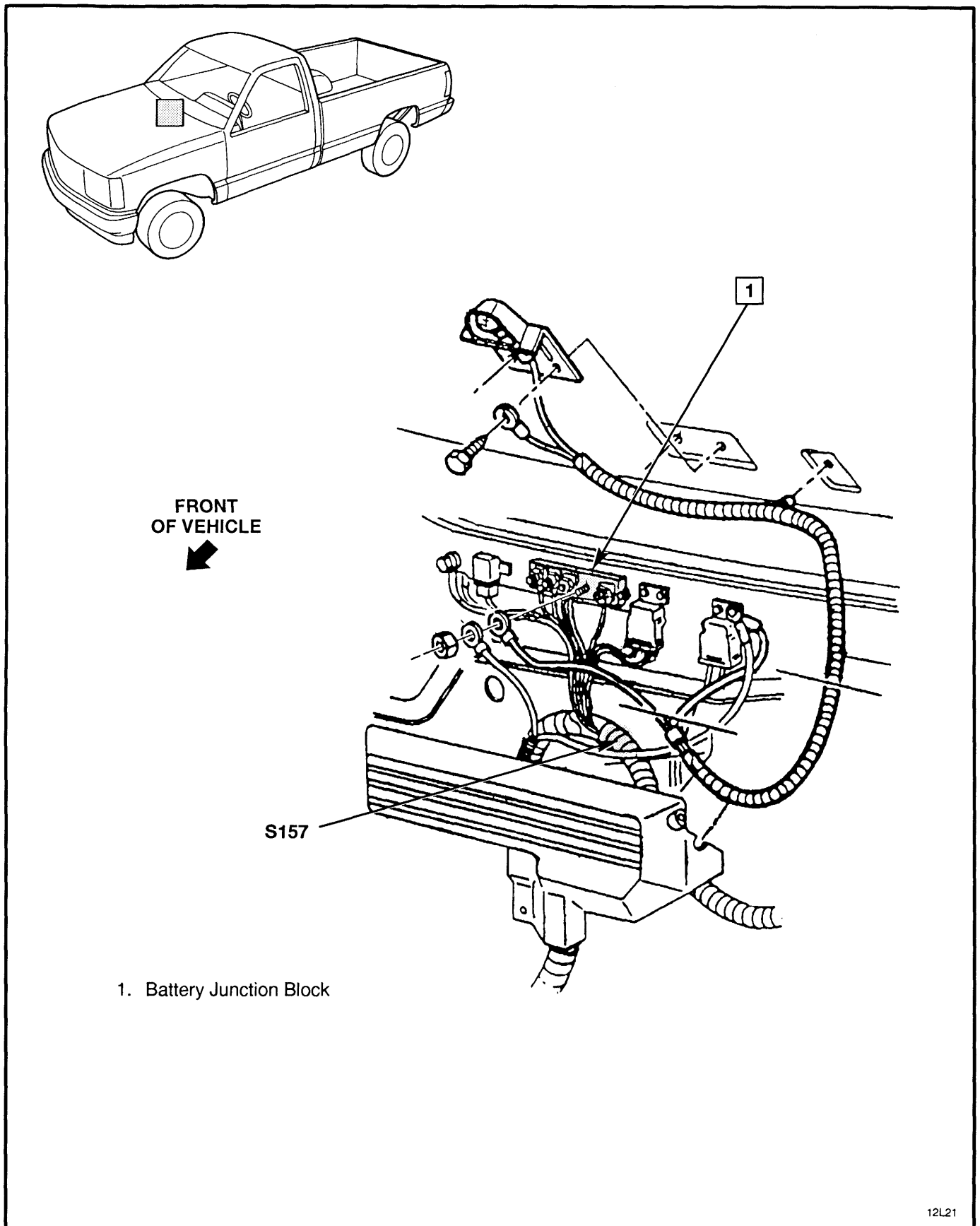


Figure 1 — Battery Junction Block

## 8A-67B-12 REAR AUXILIARY HEATER AND AIR CONDITIONING

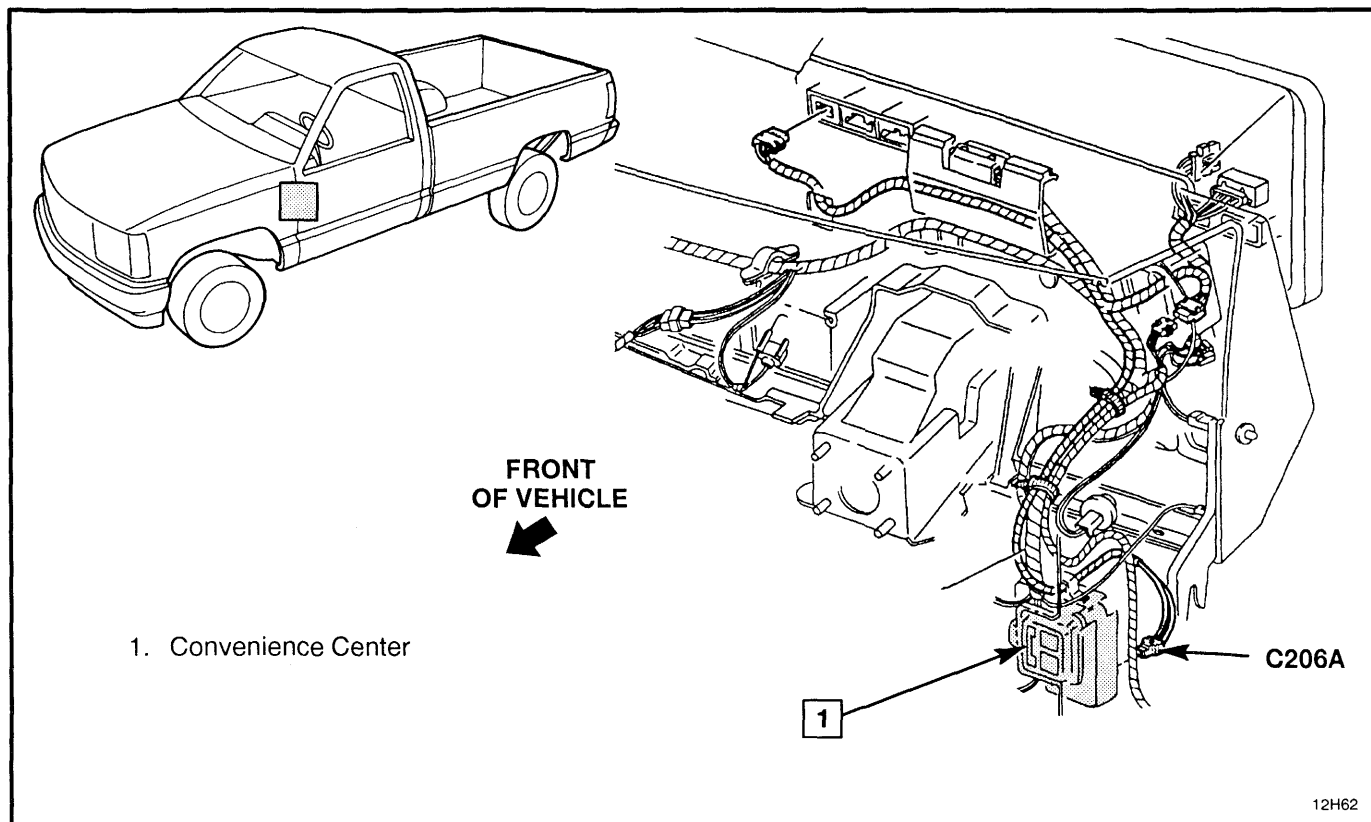


Figure 2 — Auxiliary Heater Front Wiring

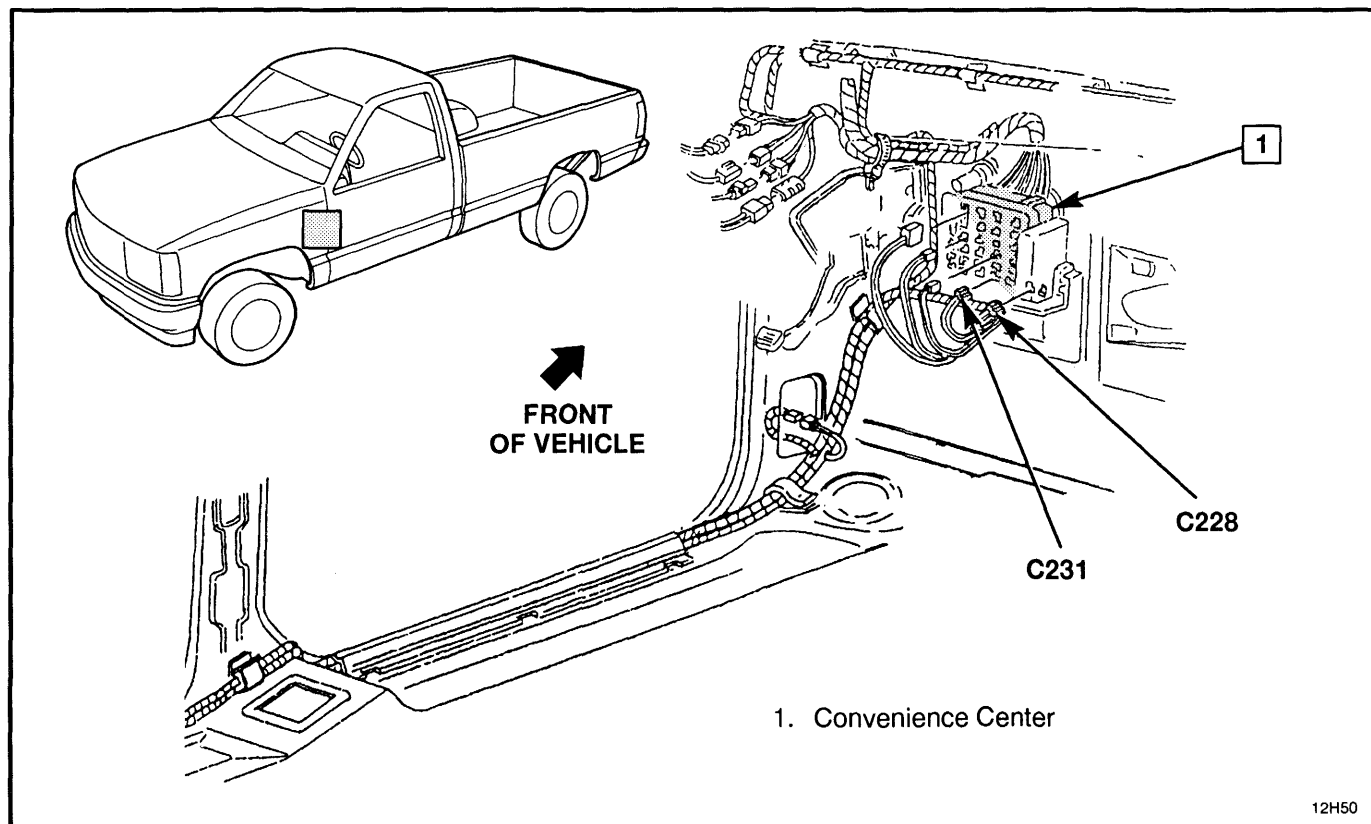


Figure 3 — Body Wiring Harness, Front

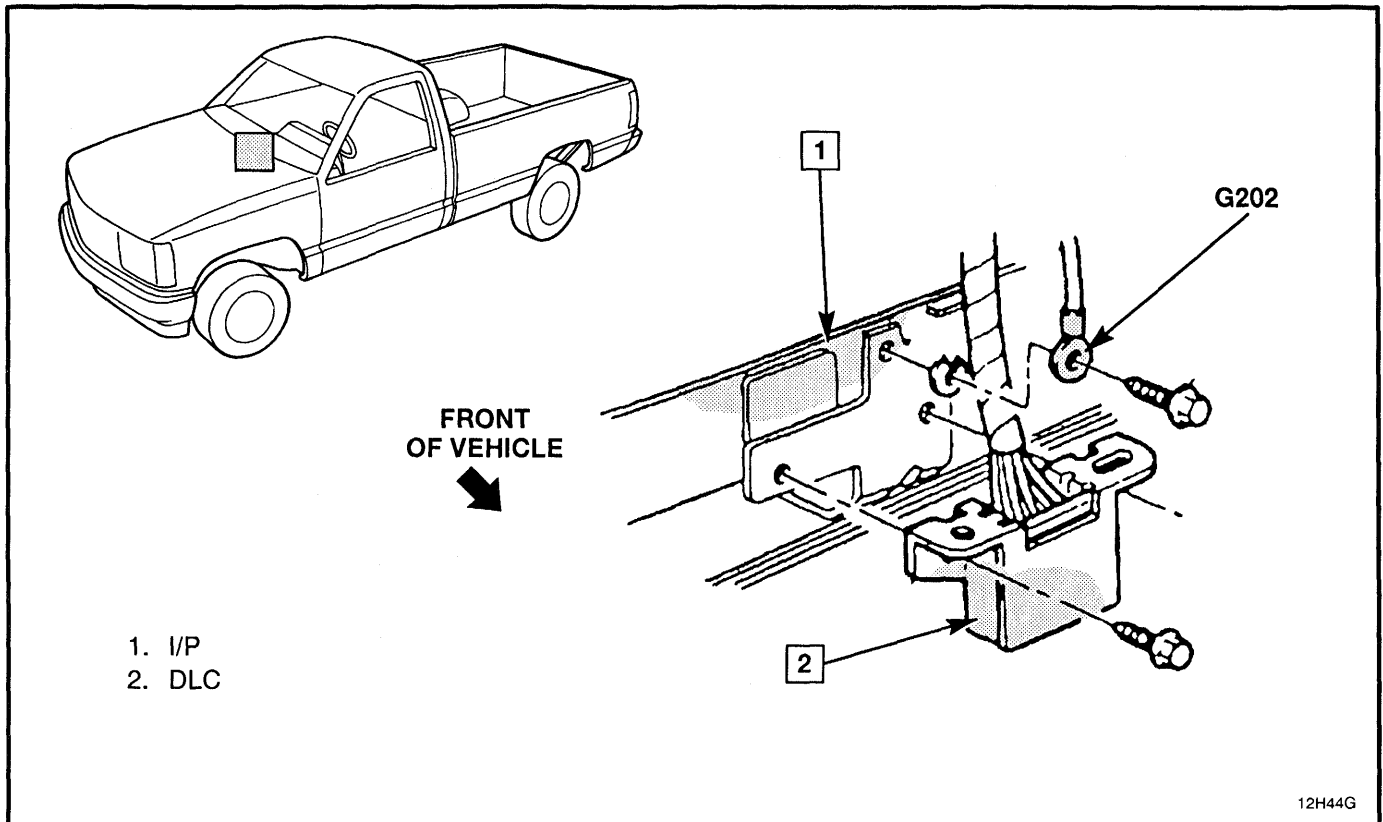


Figure 4 — Instrument Panel Ground

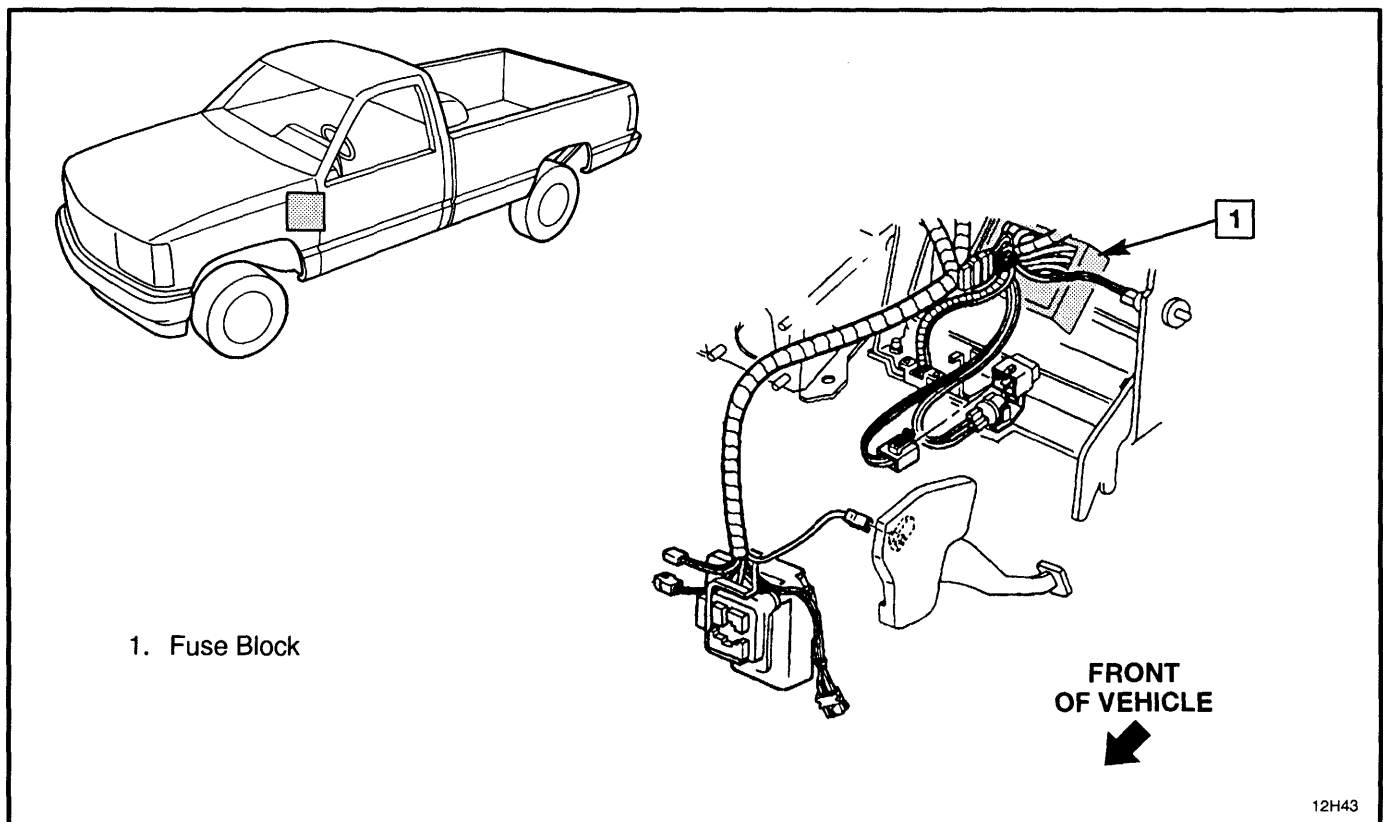


Figure 5 — LH Side of Instrument Panel

## 8A-67B-14 REAR AUXILIARY HEATER AND AIR CONDITIONING

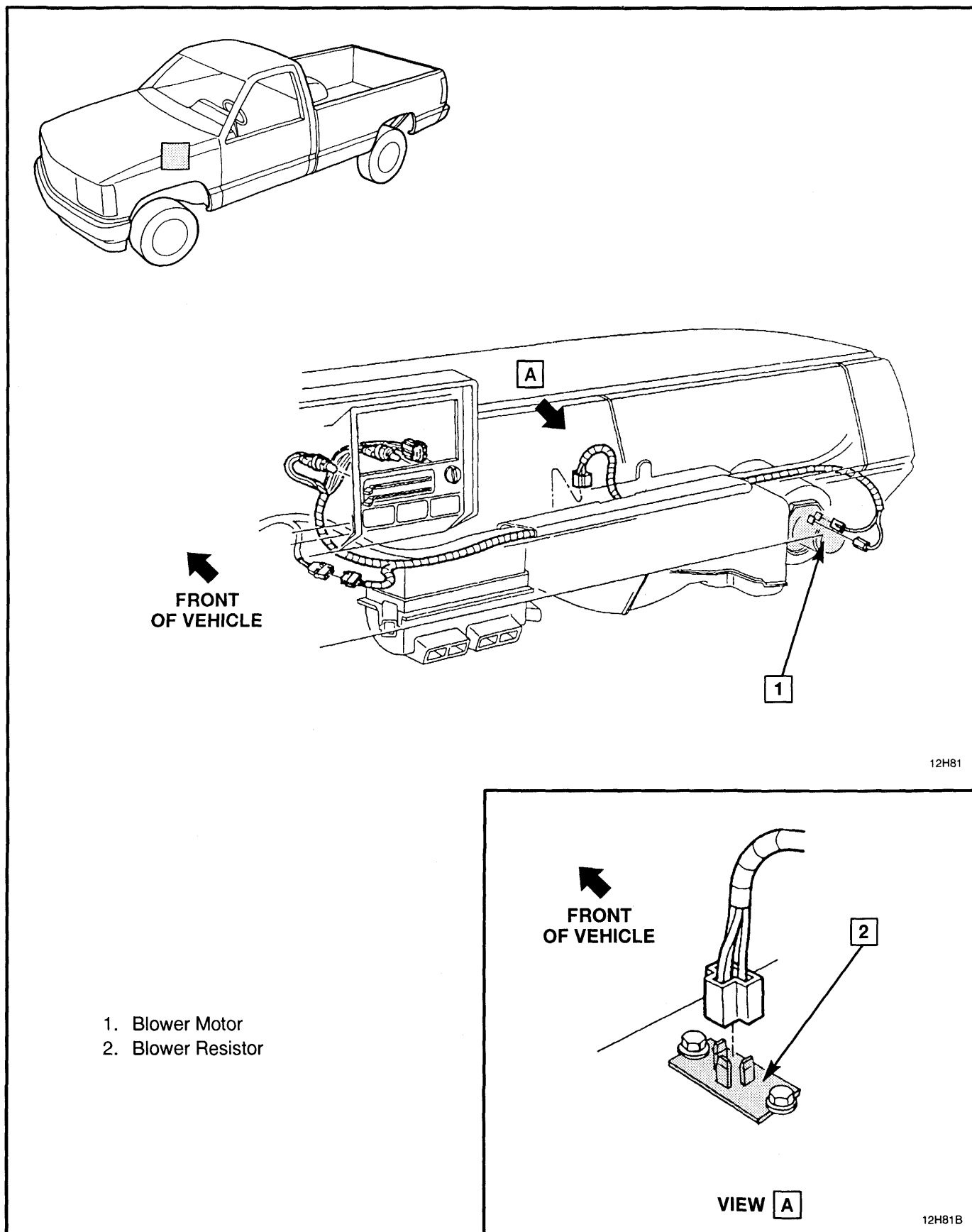


Figure 6 — Heater Wiring

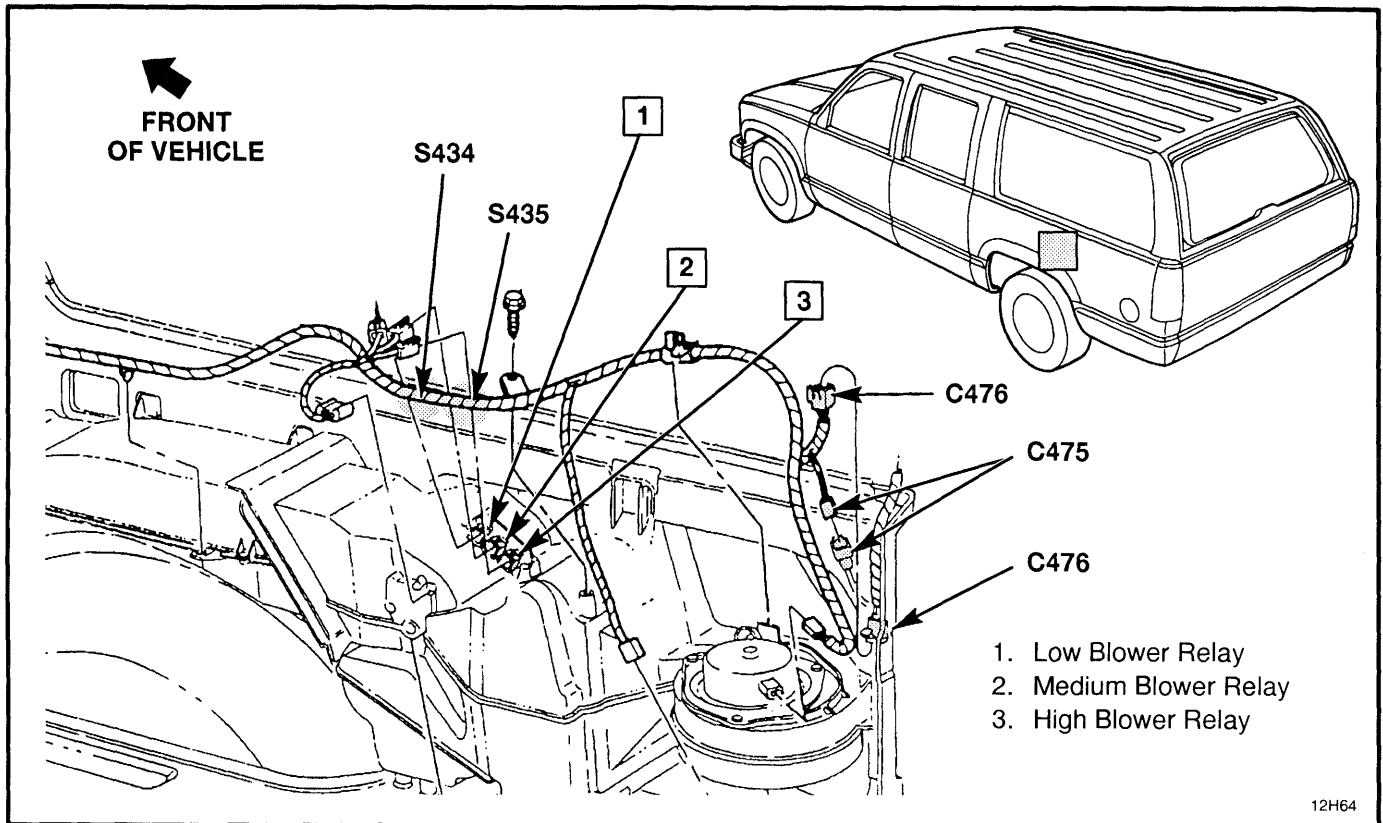


Figure 7 — Auxiliary Heater and A/C Wiring

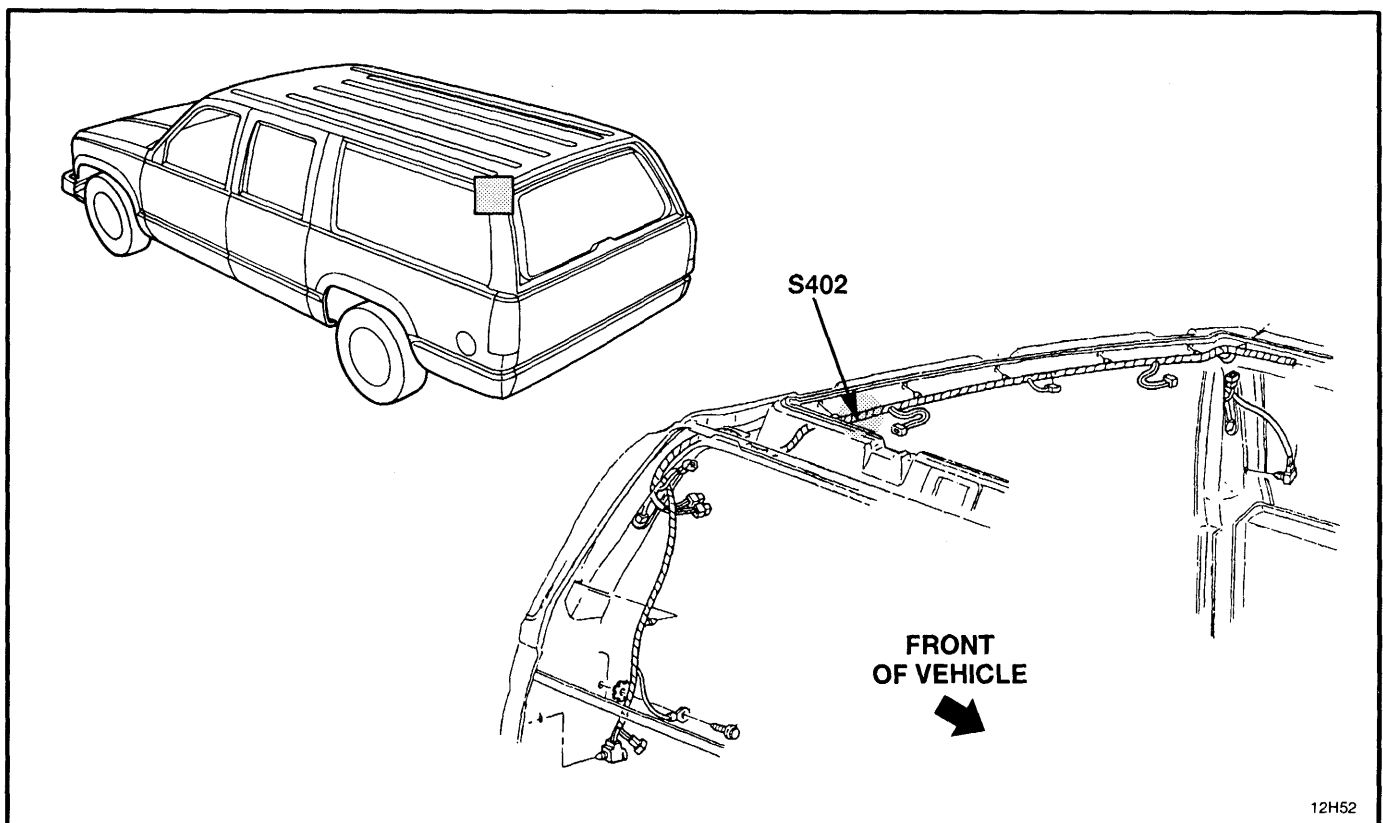
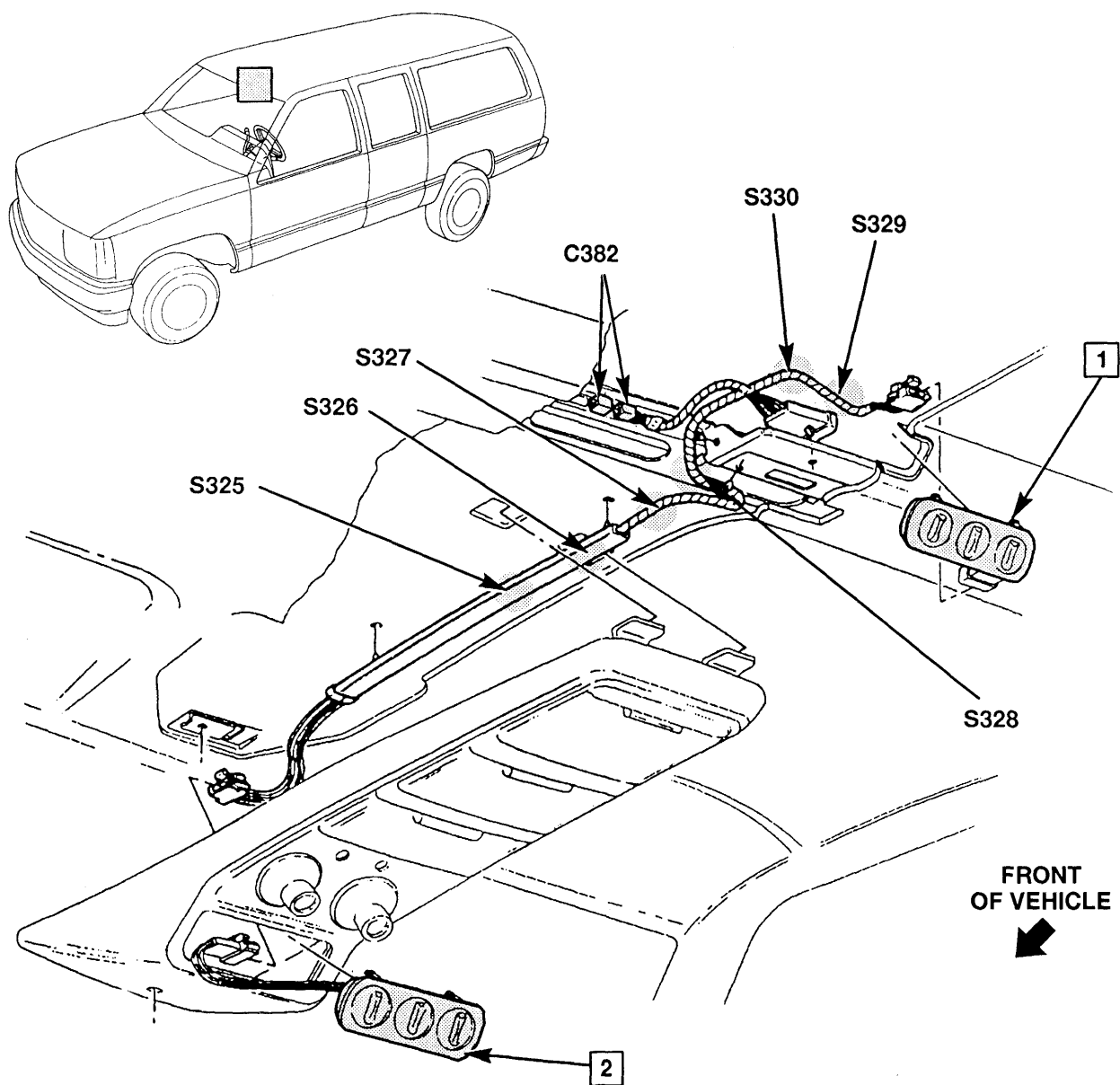


Figure 8 — Body Wiring, Rear - Suburban

## 8A-67B-16 REAR AUXILIARY HEATER AND AIR CONDITIONING



1. Auxiliary Heater and A/C Front Control
2. Auxiliary Heater and A/C Rear Control

Figure 9 — Auxiliary Heater and A/C Controls

## **CIRCUIT OPERATION**

### **SAFETY BELT WARNING BUZZER**

With the Ignition Switch in START or RUN, voltage is supplied to the Audio Alarm Module (buzzer or chime) through the GAGES Fuse and the PNK/BLK (39) wire. When the Ignition Switch is first turned to START or RUN, voltage from the Audio Alarm Module is supplied to the Fasten Safety Belt Indicator in the instrument cluster through the YEL (237) wire. The indicator stays lit for about five seconds.

If the driver's safety belt is not buckled, a ground is applied to the Audio Alarm Module through the WHT (238) wire from the Safety Belt Retractor Switch. The chime or buzzer will sound for about five seconds.

### **KEY-IN WARNING BUZZER**

Voltage is supplied at all times to the Audio Alarm Module through the STOP-HAZ Fuse and the ORN (140) wire. With the key in the Ignition Switch and the Ignition Switch in ACC, LOCK or OFF, the chime or buzzer will sound if the left door is open.

With the door open, the LH Door Jamb Switch closes to ground. This provides a ground to the Audio Alarm Module through the TAN (158) wire, the Key-In Ignition Switch and the LT GRN (80) wire. The chime or buzzer will sound as long as the door is open or the key is in the Ignition Switch.

### **LAMPS-ON WARNING BUZZER**

When the Light Switch is in HEAD or PARK, and the Panel Dimmer Switch is not at the dimmest setting, voltage is applied through the PANEL LPS Fuse to the Audio Alarm Module through the GRA (8) wire. With the Panel Dimmer Switch at its dimmest setting, the current to the Audio Alarm module may not be enough to be sensed by the module. When the Ignition Switch is turned to RUN or START, voltage is supplied through the GAGES Fuse to the Module through the PNK/BLK (39) wire. These two voltages are sensed and the alarm is not sounded.

When the Ignition Switch is turned to LOCK, OFF or ACC, the GAGES Fuse loses voltage. The Audio Alarm Module senses the change. If voltage is still available from the PANEL LPS Fuse, voltage from the STOP-HAZ Fuse is supplied to sound the alarm through the ORN (140) wire. The alarm can be turned off by turning the Light Switch off. The Module no longer senses voltage from the Light Switch, so the alarm does not sound.

## **COMPONENT LOCATION**

## **Page — Figure**

|                                    |                                      |           |   |
|------------------------------------|--------------------------------------|-----------|---|
| Audio Alarm Module .....           | On convenience center .....          | 76-9      | 5 |
| Convenience Center .....           | Under LH side of I/P .....           | 76-9      | 5 |
| Door Jamb Switch, LH Front .....   | At LH end of I/P .....               | 76-7      | 1 |
| I/P Cluster .....                  | LH side of I/P .....                 | Not Shown |   |
| Multi-Function Switch .....        | On upper steering column .....       | Not Shown |   |
| Safety Belt Retractor Switch ..... | At driver's safety belt buckle ..... | 76-8      | 4 |

## **CONNECTORS:**

|            |                                      |      |   |
|------------|--------------------------------------|------|---|
| C206 ..... | At steering column, under cowl ..... | 76-7 | 1 |
| C340 ..... | At safety belt retractor .....       | 76-7 | 1 |

## **GROUND:**

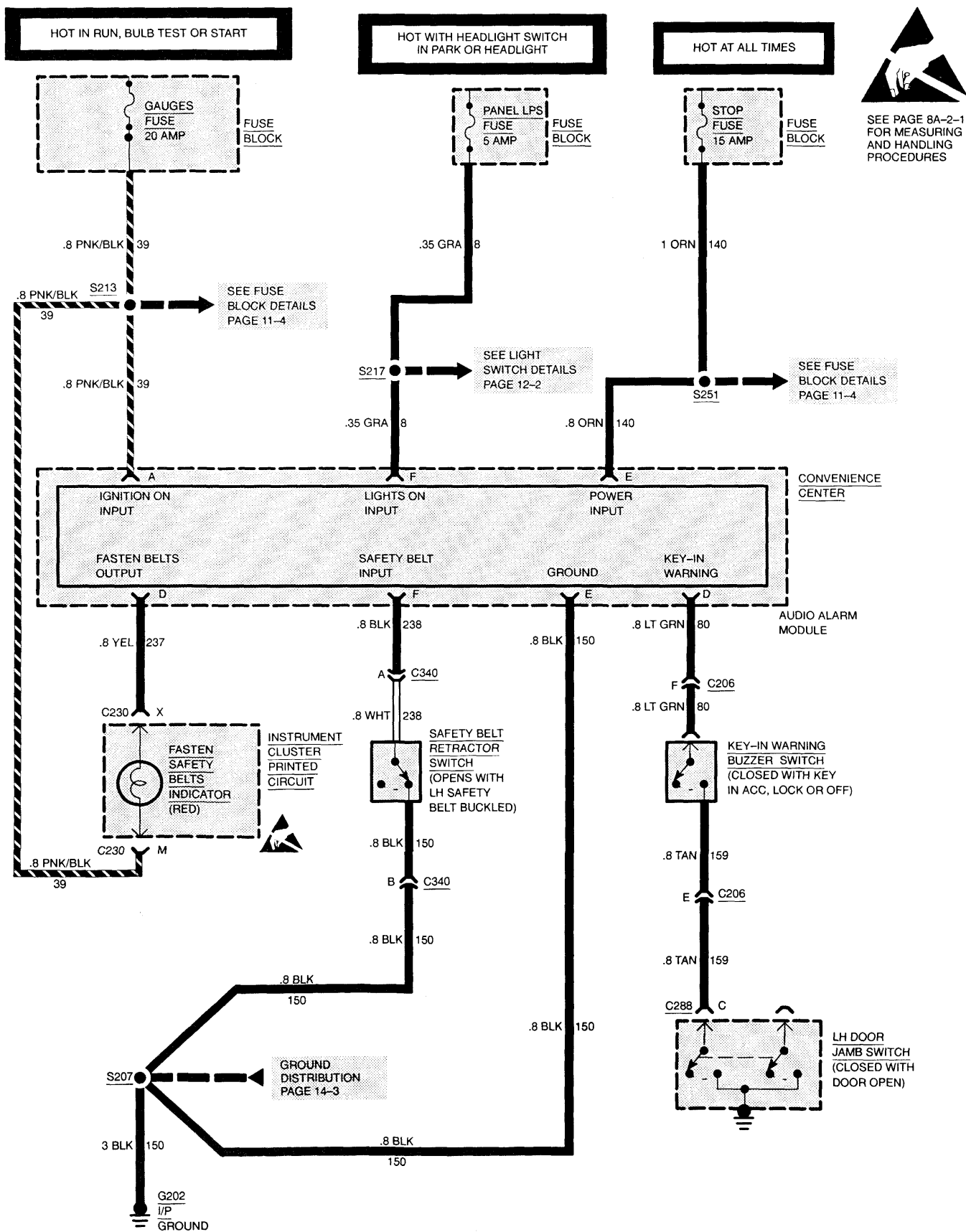
|            |                        |      |   |
|------------|------------------------|------|---|
| G202 ..... | At DLC connector ..... | 76-8 | 3 |
|------------|------------------------|------|---|

## **SPLICES:**

|            |                            |      |   |
|------------|----------------------------|------|---|
| S207 ..... | Under LH side of I/P ..... | 76-7 | 1 |
| S213 ..... | Under LH side of I/P ..... | 76-7 | 1 |
| S217 ..... | Under LH side of I/P ..... | 76-7 | 1 |
| S251 ..... | Under LH side of I/P ..... | 76-7 | 1 |



# 8A-76-2 AUDIO ALARM MODULE



## DIAGNOSIS — AUDIO ALARMS

### PRELIMINARY CHECKS:

1. Check condition of PARK-LPS, PNL LPS, STOP, and GAUGES Fuse(s). If fuse(s) are blown, locate and repair source of overload. Replace fuse(s).

#### THE FASTEN BELTS WARNING ALARM OPERATES WHEN SAFETY BELT IS BUCKLED

| TEST                                                       | RESULT                       | ACTION                                                                                                                                                         |
|------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect safety belt retractor switch connector C340. | Safety belt alarm stops.     | REPLACE safety belt retractor switch.                                                                                                                          |
|                                                            | Safety belt alarm continues. | LOCATE and REPAIR short in WHT (238) wire to ground between belt retractor connector C340 and convenience center. If wire is good, REPLACE Audio Alarm Module. |

#### THE FASTEN BELTS WARNING ALARM DOES NOT OPERATE

| TEST                                                                                                                                     | RESULT                    | ACTION                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1. With ignition switch in RUN and audio alarm module removed, connect test lamp from PNK/BLK (39) wire at convenience center to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                |
|                                                                                                                                          | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire from convenience center to fuse block.                                                           |
| 2. Connect self-powered test lamp from BLK (238) wire at convenience center to ground.                                                   | Test lamp lights.         | REPLACE audio alarm module.                                                                                                                  |
|                                                                                                                                          | Test lamp does not light. | GO to step 3.                                                                                                                                |
| 3. Connect self-powered test lamp from BLK (238) wire at safety belt retractor switch connector C340 to ground.                          | Test lamp lights.         | GO to step 4.                                                                                                                                |
|                                                                                                                                          | Test lamp does not light. | LOCATE and REPAIR open in BLK (238) wire from safety belt retractor switch connector C340 to convenience center.                             |
| 4. Buckle safety belt. Connect self-powered test lamp from BLK (150) wire at safety belt retractor switch connector C340 to ground.      | Test lamp lights.         | REPLACE safety belt retractor switch.                                                                                                        |
|                                                                                                                                          | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from safety belt retractor switch connector C340 to splice S207 or from splice S207 to ground G202. |

## 8A-76-4 AUDIO ALARM MODULE

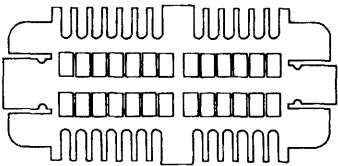
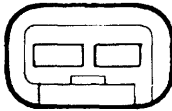
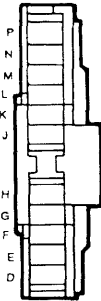
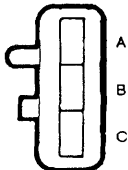
### KEY-IN WARNING ALARM DOES NOT OPERATE

| TEST                                                                                                                                                                         | RESULT                    | ACTION                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Turn ignition switch OFF. Leave key in ignition switch. Open left door. Remove audio alarm module. Connect voltmeter from ORN (140) wire at convenience center to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                          |
|                                                                                                                                                                              | Test lamp does not light. | REPAIR open in ORN (140) wire between convenience center and fuse block. INSTALL audio alarm module.                                                   |
| 2. Connect self-powered test lamp from LT GRN (80) wire at convenience center to ground.                                                                                     | Test lamp lights.         | REPLACE audio alarm module.                                                                                                                            |
|                                                                                                                                                                              | Test lamp does not light. | GO to step 3.                                                                                                                                          |
| 3. Connect self-powered test lamp from LT GRN (80) wire at multi-function switch connector C206 to ground.                                                                   | Test lamp lights.         | LOCATE and REPAIR open in LT GRN (80) wire from multi-function switch connector C206 to convenience center. INSTALL audio alarm module.                |
|                                                                                                                                                                              | Test lamp does not light. | GO to step 4.                                                                                                                                          |
| 4. Connect self-powered test lamp from TAN (159) wire at multi-function switch connector C206 to ground.                                                                     | Test lamp lights.         | REPLACE multi-function switch. INSTALL audio alarm module.                                                                                             |
|                                                                                                                                                                              | Test lamp does not light. | GO to step 5.                                                                                                                                          |
| 5. Connect self-powered test lamp from TAN (159) wire at left door jamb switch connector C288 to ground.                                                                     | Test lamp lights.         | LOCATE and REPAIR open in TAN (159) wire between door jamb switch connector C288 and multi-function switch connector C206. INSTALL audio alarm module. |
|                                                                                                                                                                              | Test lamp does not light. | REPLACE door jamb switch. INSTALL audio alarm module.                                                                                                  |

**LAMPS-ON WARNING ALARM DOES NOT OPERATE**

| TEST                                                                                                                                                        | RESULT           | ACTION                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Remove audio alarm module. Place ignition switch in RUN. Turn lamps switch ON. Connect voltmeter from PNK/BLK (39) wire at convenience center to ground. | Battery voltage. | GO to step 2.                                                                                                                                                                                                           |
|                                                                                                                                                             | No voltage.      | LOCATE and REPAIR open in PNK/BLK (39) wire between convenience center and splice S213 or between splice S213 and fuse block.                                                                                           |
| 2. Connect voltmeter from GRA (8) wire at convenience center to ground.                                                                                     | Battery voltage. | GO to step 3.                                                                                                                                                                                                           |
|                                                                                                                                                             | No voltage.      | LOCATE and REPAIR open in GRA (8) wire between convenience center and splice S217 or between splice S217 and fuse block. Refer to "INSTRUMENT PANEL ILLUMINATION" Diagnosis in this manual. INSTALL audio alarm module. |
| 3. Connect ohmmeter from BLK (150) wire at convenience center to ground.                                                                                    | Low resistance.  | REPLACE audio alarm module.                                                                                                                                                                                             |
|                                                                                                                                                             | High resistance. | LOCATE and REPAIR cause of high resistance in BLK (150) wire between convenience center and splice S207 or between splice S207 and ground G202.                                                                         |

8A-76-6 AUDIO ALARM MODULE

|                                                                                                                                                                                         |                                                                                                                                                                                                             |                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>12089908</div> <div></div> <div>BLACK<br/>Bow Series<br/>C230<br/>I/P Cluster</div>               | <div>12047662</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C340<br/>In-Line I/P to Seat Belt Retractor Switch</div> | <div>12047663</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C340<br/>In-Line Seat Belt Retractor Switch to I/P</div> |
| <div>12004147</div> <div></div> <div>BLACK<br/>Pac/on<br/>C206<br/>I/P to Multi-Function Switch</div> | <div>12047781</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C288<br/>LH Door Jamb Switch</div>                      |                                                                                                                                                                                                               |

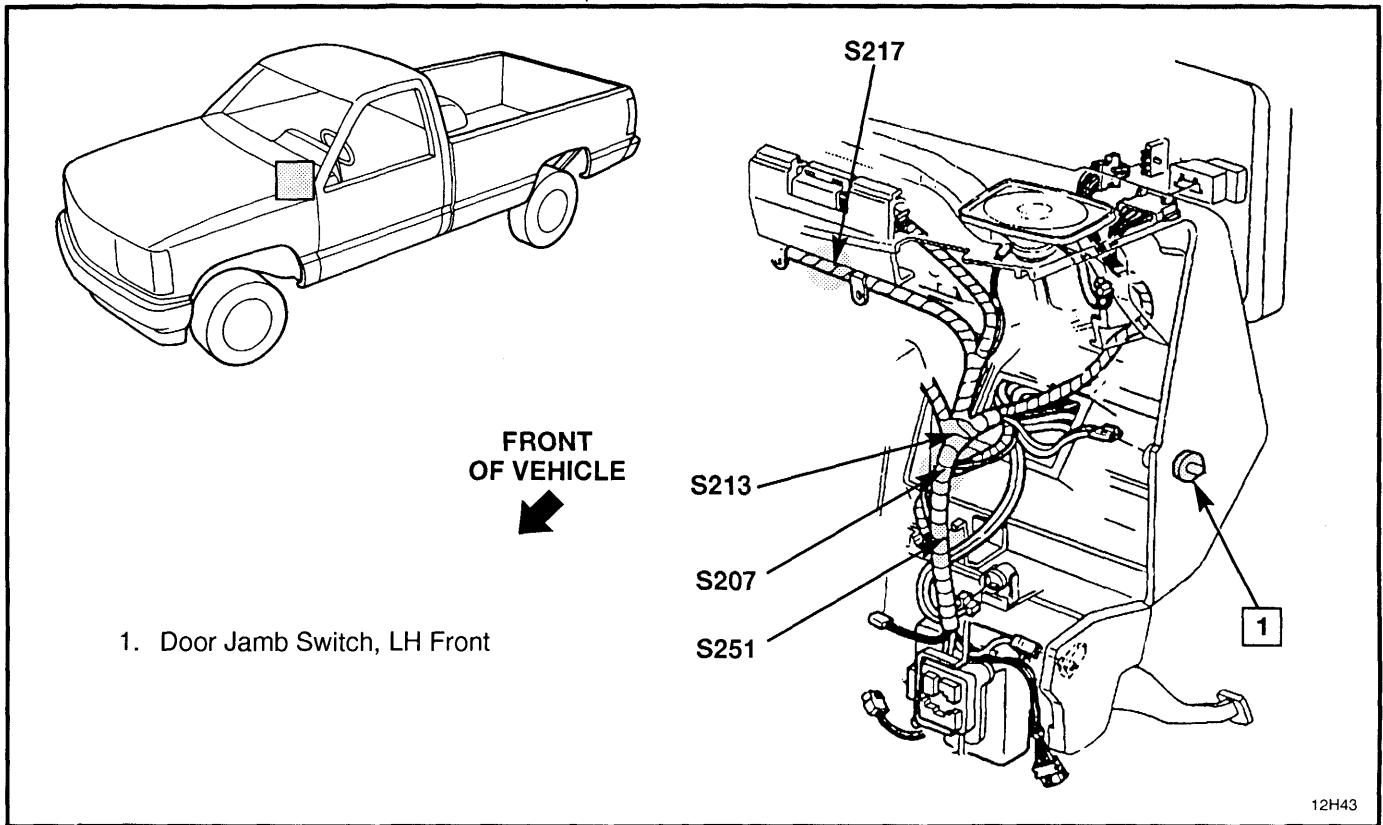


Figure 1 — Instrument Panel, LH Side

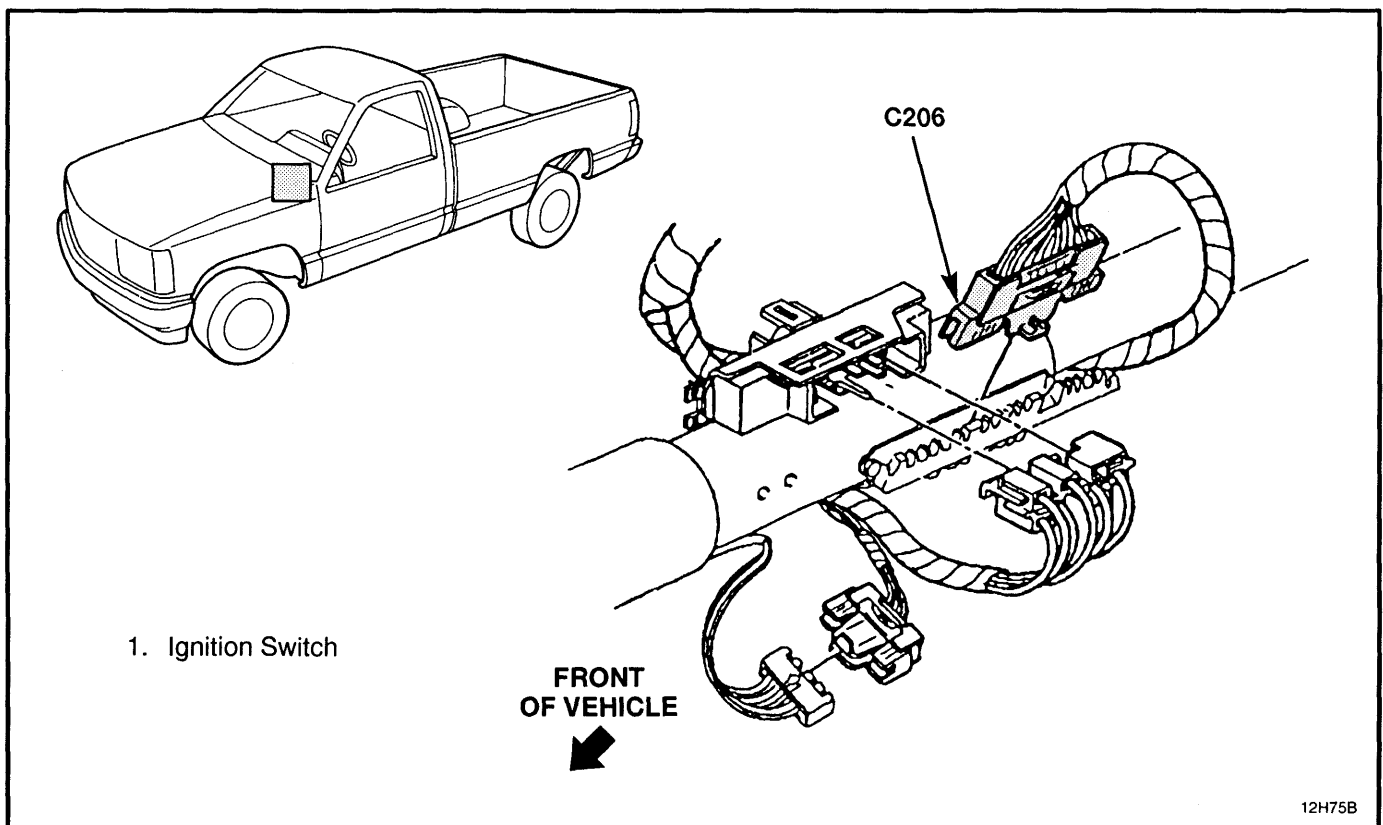


Figure 2 — Steering Column Wiring, RH Side

## 8A-76-8 AUDIO ALARM MODULE

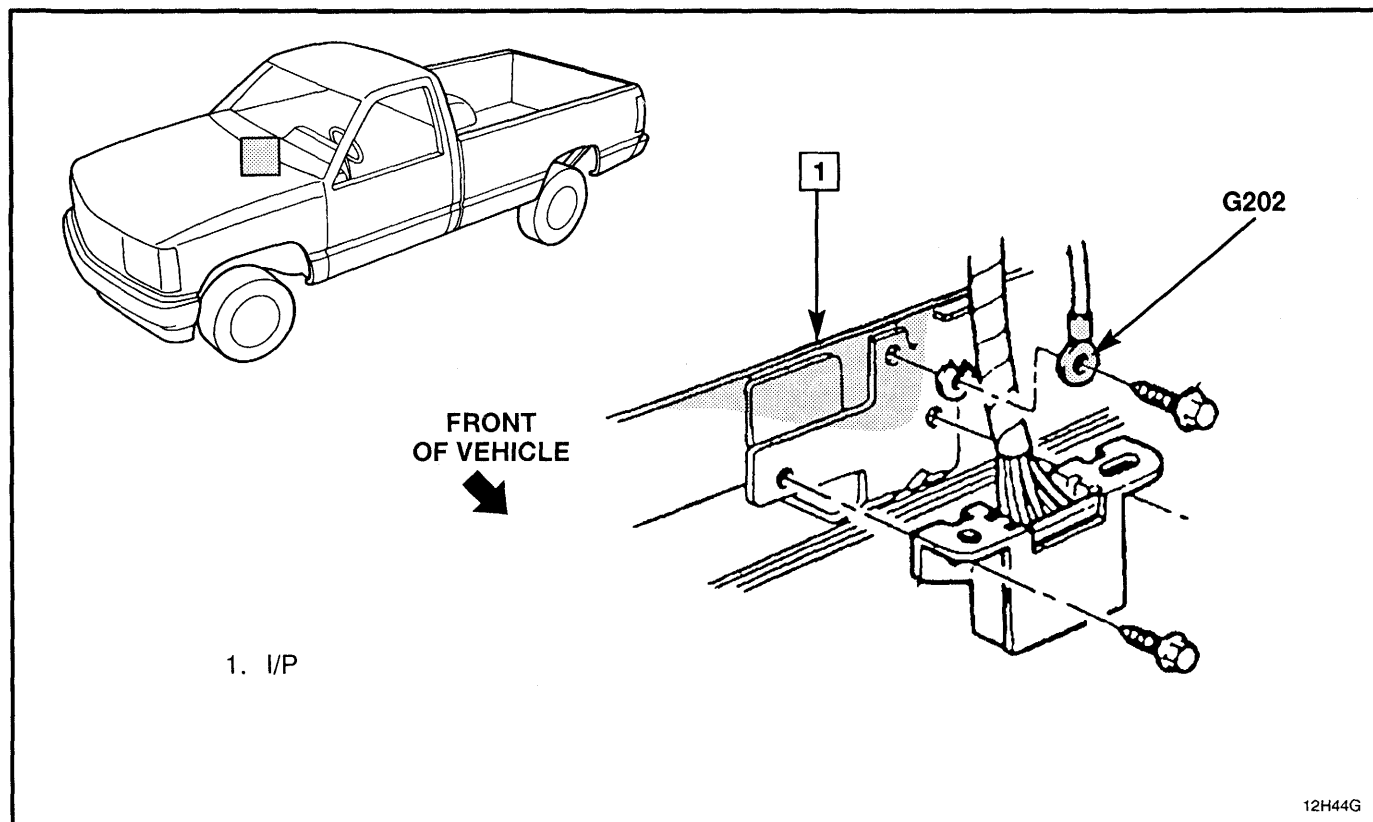


Figure 3 — I/P Ground

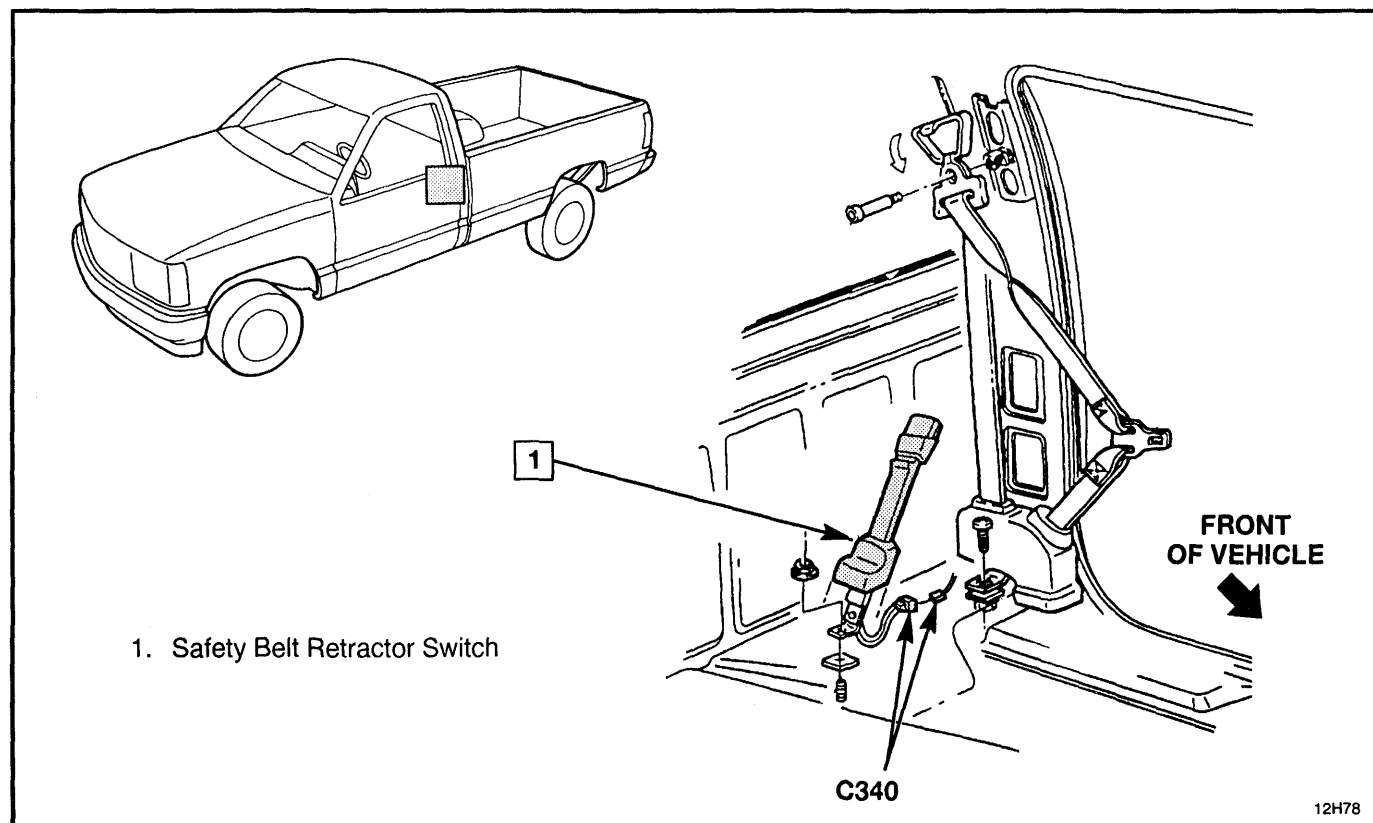


Figure 4 — Safety Belt Switch Wiring

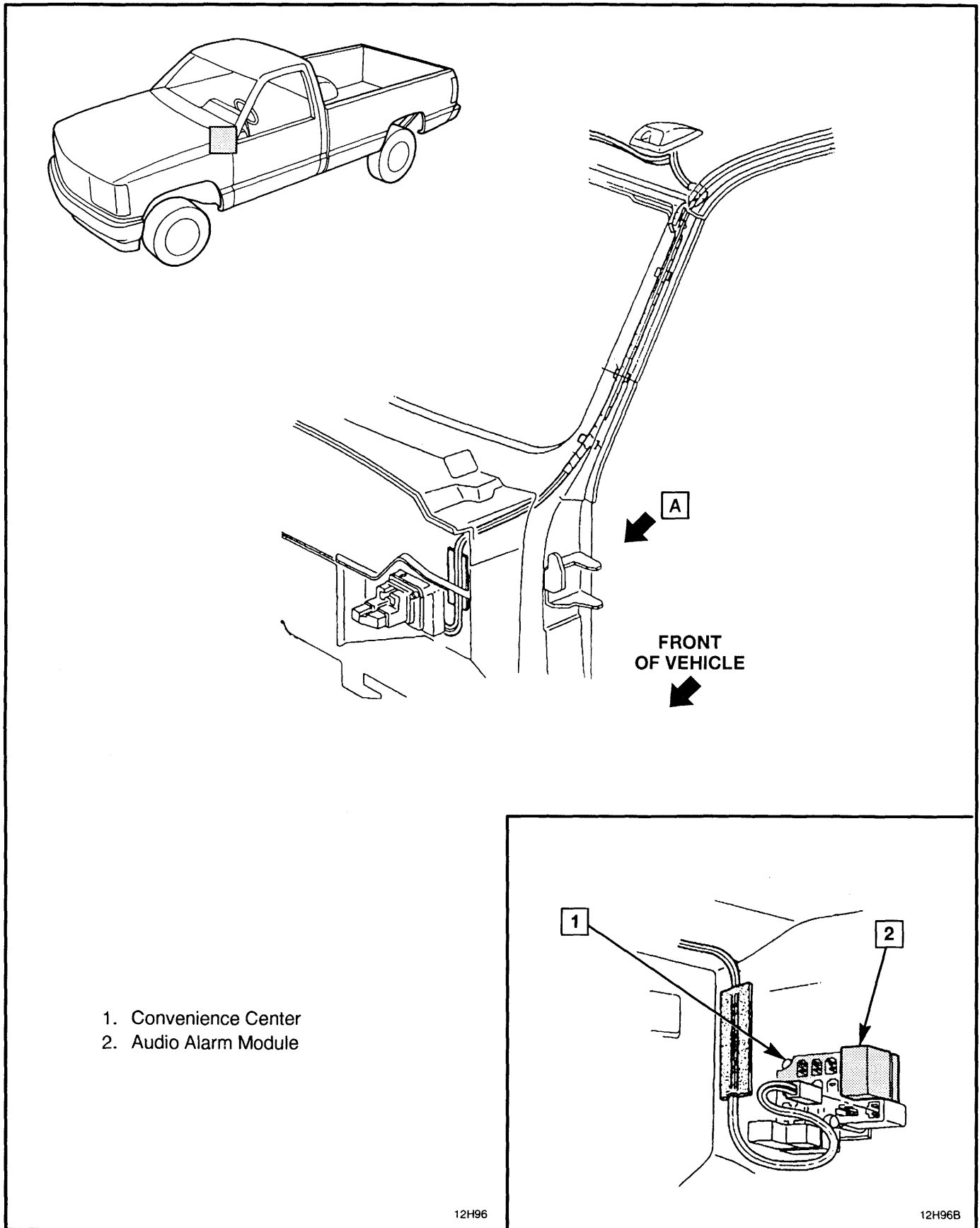


Figure 5 — Convenience Center Wiring



**BLANK**

## **CIRCUIT OPERATION**

### **FUEL GAGE**

The pointer of the Fuel Gage is moved by the magnetic fields of two coils. The coils are at right angles to each other. Battery voltage is applied to the E-coil and the circuit divides at the opposite end of the coil. One path continues to ground through the F-coil. Another goes to ground through the variable resistor of the Fuel Gage Sender.

When the tank is low, the resistance of the Sender is low. A large flow of current passes through the E-coil and the Fuel Gage Sender resistor. This moves the pointer toward E on the scale. When the tank is full, the Sender resistance is high. More current now flows through the F-coil, moving the pointer toward F on the scale.

With two coils operating the pointer, the Gage is not affected by changes in the system's battery voltage.

### **OIL PRESSURE GAGE**

The engine oil pressure is displayed by the Oil Pressure Gage. The pointer of the Gage is moved by two coils, and its operation is similar to that of the Fuel Gage.

The Oil Pressure Sender is connected to the junction of the two coils. It has low resistance when the oil pressure is low, and 90 ohms resistance when the oil pressure is high. This changing resistance changes the current flow through the coils. The magnetic fields of the coils move the pointer from low to high.

### **TEMPERATURE GAGE**

The Temperature Gage is also operated by two coils. Battery voltage is applied to both coils. One is grounded directly and the other is grounded through the Engine Temperature Sender. This has 55 ohms resistance at 123°C (260°F) (hot coolant) and its resistance becomes greater at low temperatures. It is approximately 1400 ohms at 47°C (100°F). This causes the current through the Sender and one coil to increase as the coolant temperature increases. This moves the pointer.

### **VOLTMETER**

The Voltmeter measures the electrical system's voltage with the Ignition Switch in RUN or START. With the engine stopped, the Voltmeter indicates Battery condition. With the engine running, the Voltmeter indicates Charging System operation.

### **ENGINE COOLANT LEVEL INDICATOR**

The Engine Coolant Level Indicator comes on to warn the driver when a low level of coolant exists in the radiator. Battery voltage is applied to the Engine Coolant Level Indicator Module. When a low coolant condition exists, a signal is sent to the Engine Coolant Level Indicator Module from the Engine Coolant Level Sensor. The Engine Coolant Level Indicator Module will provide a ground to the Engine Coolant Level Indicator.

The Engine Coolant Level Sensor is not a switch that opens and closes. It has a very high resistance to ground, more than 50,000 ohms, when the engine coolant level is low. This causes the Engine Coolant Level Indicator Module to illuminate the Engine Coolant Level Indicator. With more of the Sensor covered by coolant, its resistance decreases. When the fluid level is good, the resistance will be less than 10,000 ohms. With the Sensor resistance between 10,000 and 50,000 ohms, the Sensor is partly covered and the fluid is not low enough to cause the warning to be displayed.

### **OIL PRESSURE INDICATOR**

The Oil Pressure Indicator comes on to warn the driver when the engine oil pressure is low. Battery voltage is applied to one side of the bulb. A ground path is provided by the Oil Pressure Switch. It is closed when the oil pressure is below 27 kPa (4 psi). This tests the bulb when the Ignition Switch is turned on to start the engine. After the engine starts and normal oil pressure builds up, the Oil Pressure Switch opens. The Oil Pressure Indicator goes out.

### **SHIFT INDICATOR**

With Manual Transmission, the SHIFT Indicator illuminates when the vehicle should be shifted to the next higher gear for better fuel economy. Battery voltage is applied to one side of the bulb. The other side of the bulb is switched to ground by the ECM which uses engine data such as rpm, vehicle speed and intake manifold vacuum to compute an efficient shift point.

## 8A-81-2 INSTRUMENT PANEL

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### COMPONENT LOCATION

Page — Figure

|                                |                                          |           |   |
|--------------------------------|------------------------------------------|-----------|---|
| Engine Coolant Level Indicator |                                          |           |   |
| Module                         | Under center of I/P                      | Not Shown |   |
| Engine Coolant Level Sensor    | RH rear side of radiator                 | Not Shown |   |
| Fuel Pump and Sender           | Inside fuel tank                         | Not Shown |   |
| Fuel Pump Oil Pressure Switch  |                                          |           |   |
| and Sender                     | LH rear of engine under exhaust manifold | 81-19     | 2 |
| Generator                      | LH top front of engine                   | Not Shown |   |
| Ignition Switch                | Under I/P on steering column             | 81-22     | 8 |
| Instrument Cluster             | LH upper end of I/P                      | 81-21     | 6 |

### CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C100  | At bulkhead connector                   | 81-19     | 3 |
| C102  | At bulkhead connector                   | 81-19     | 3 |
| C106A | Near bulkhead connector                 | Not Shown |   |
| C166  |                                         | Not Shown |   |
| C200  | Under RH side of I/P, near blower motor | 81-20     | 5 |

### GROMMETS:

|      |                                     |       |   |
|------|-------------------------------------|-------|---|
| P100 | RH lower cowl in engine compartment | 81-20 | 5 |
|------|-------------------------------------|-------|---|

### GROUND:

|      |                        |       |   |
|------|------------------------|-------|---|
| G106 | Front of engine        | 81-18 | 1 |
| G108 | LH top front of engine | 81-18 | 1 |
| G202 | At DLC connector       | 81-20 | 4 |

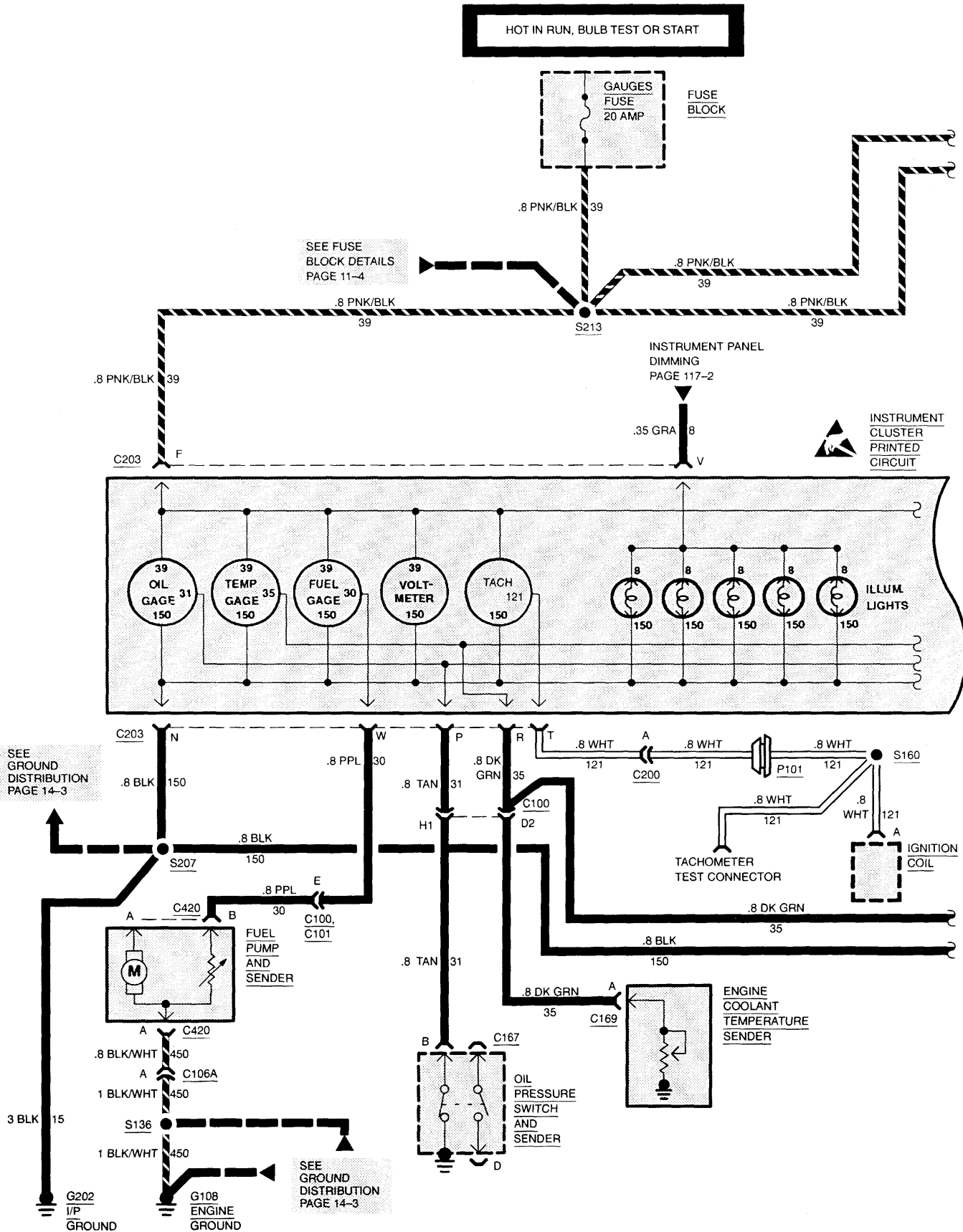
### SPLICES:

|                 |                           |       |   |
|-----------------|---------------------------|-------|---|
| S118 (Diesel)   | Rear of engine            | 81-19 | 1 |
| S160 (Gasoline) | Engine harness, near coil | 81-18 | 1 |
| S207            | Under LH side of I/P      | 81-22 | 7 |
| S213            | Under LH side of I/P      | 81-22 | 7 |

**BLANK**

# 8A-81-4 INSTRUMENT PANEL

## GASOLINE ENGINES

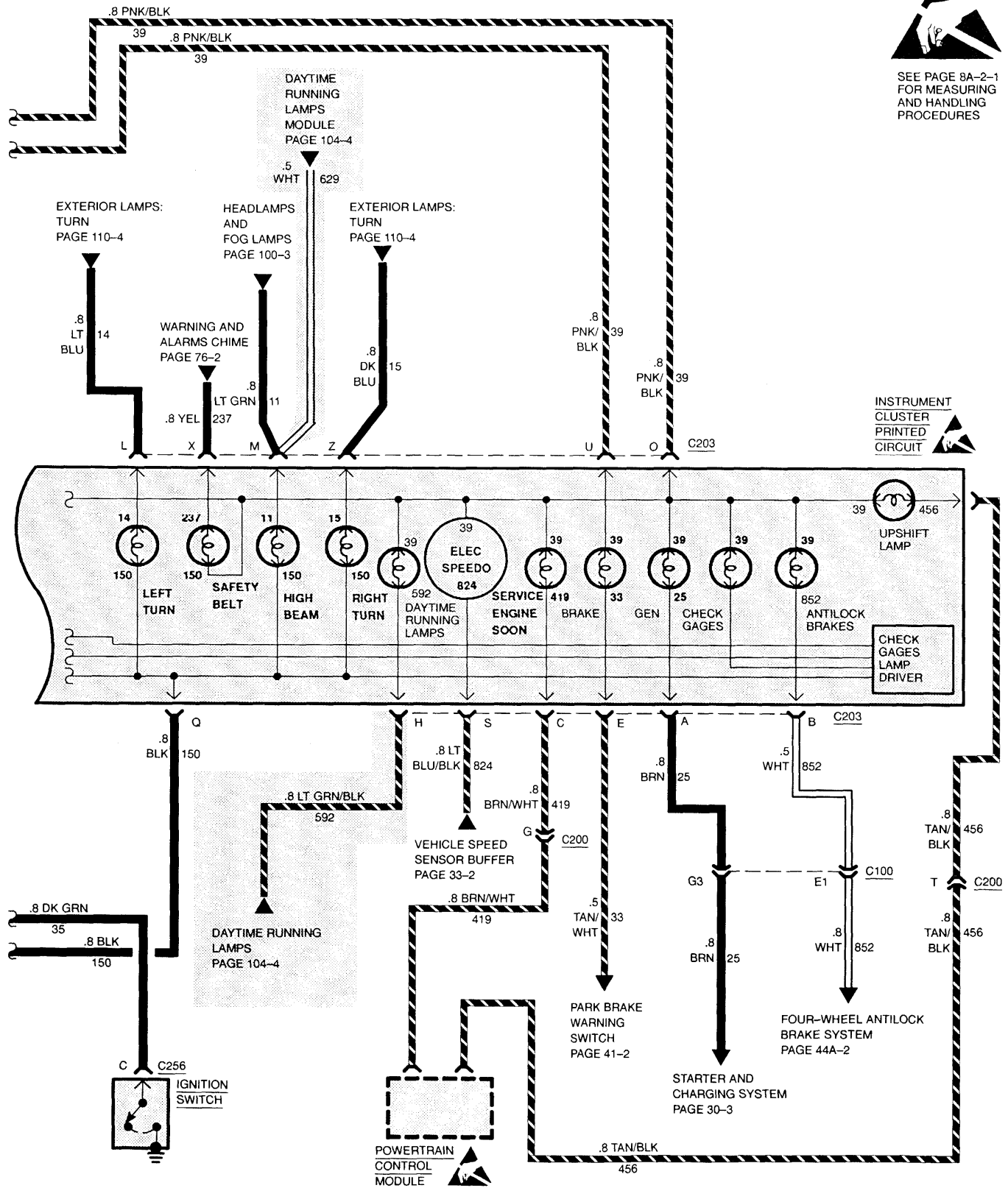


# INSTRUMENT PANEL 8A-81-5

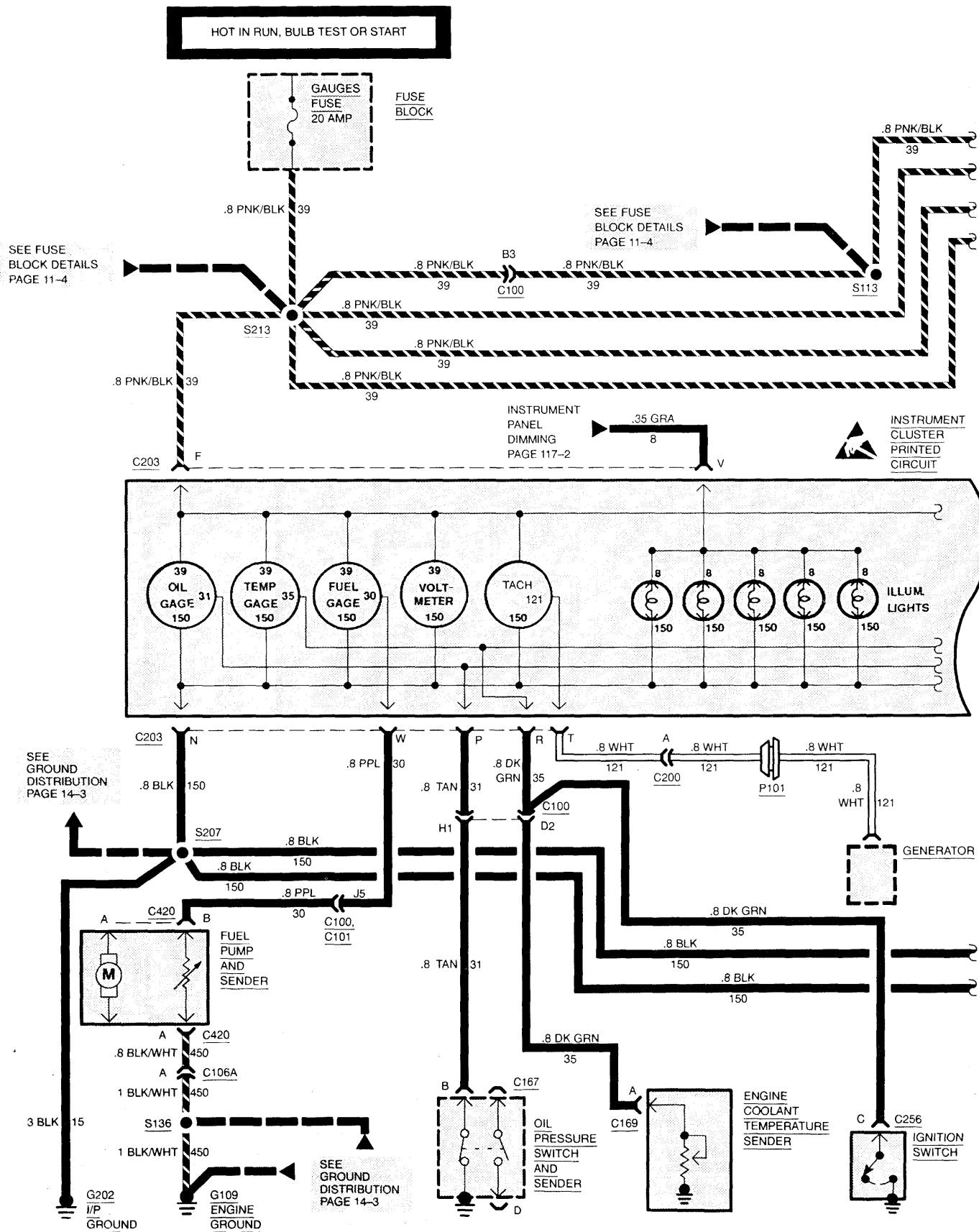
## GASOLINE ENGINES

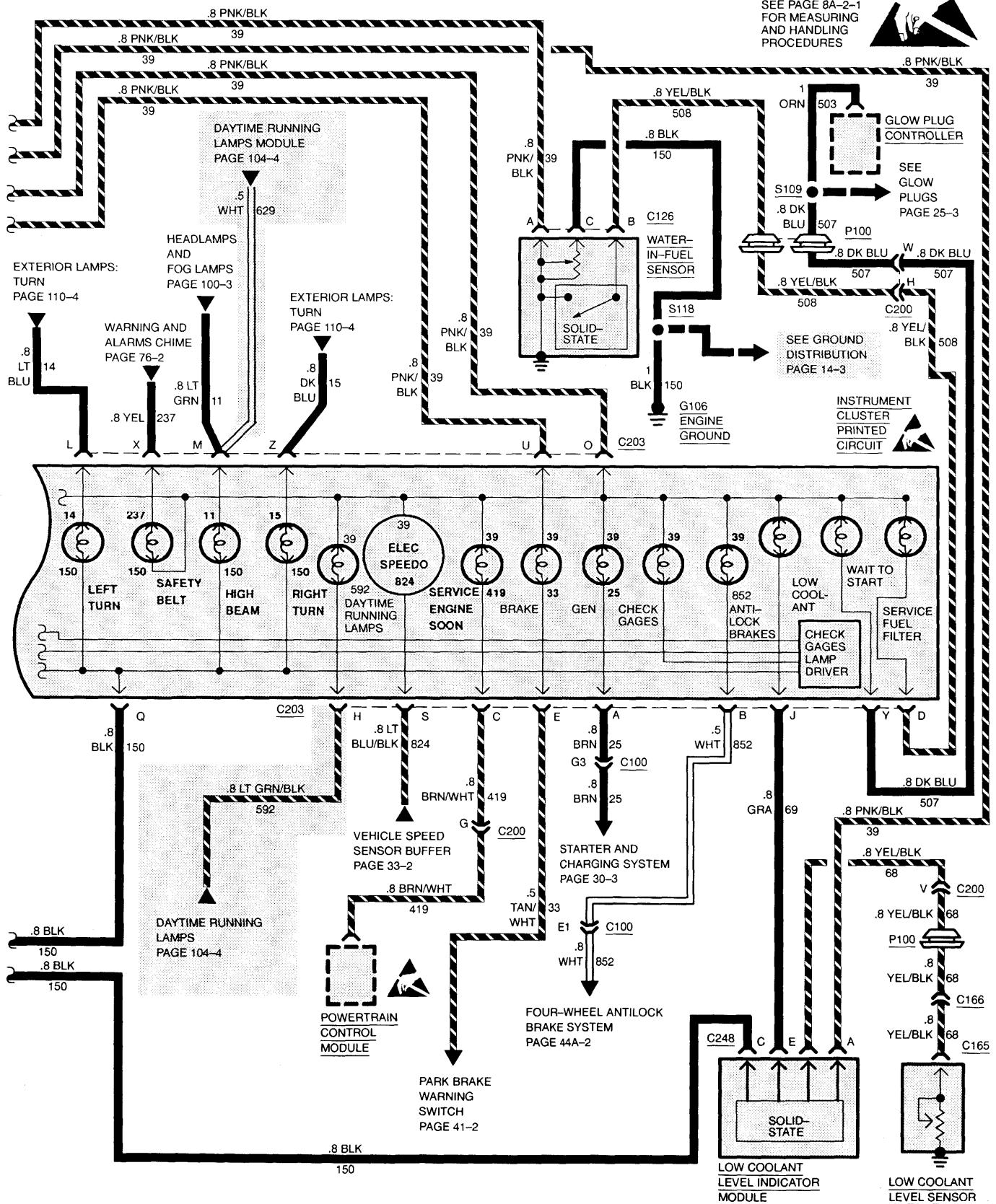


SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



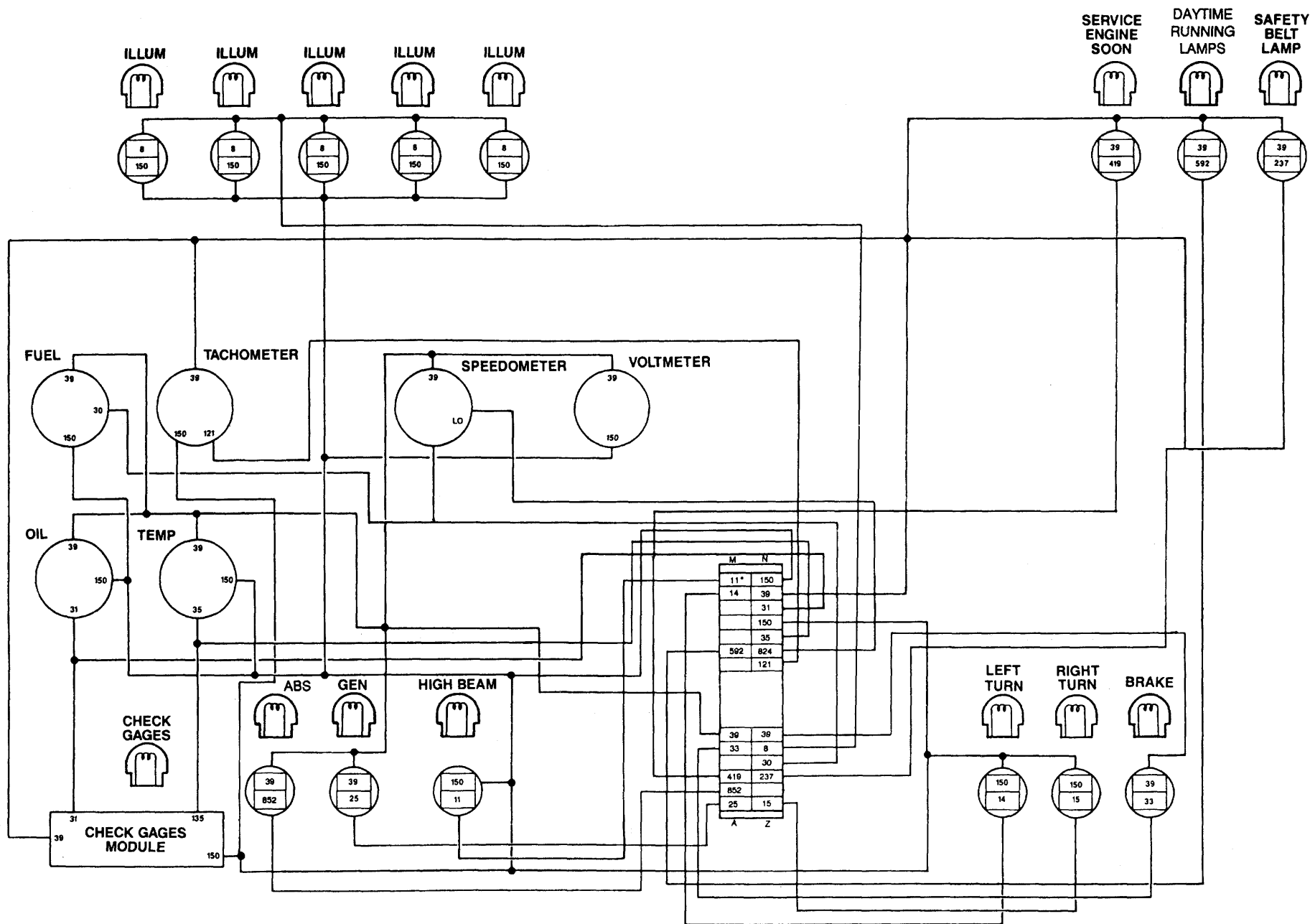
## DIESEL ENGINES

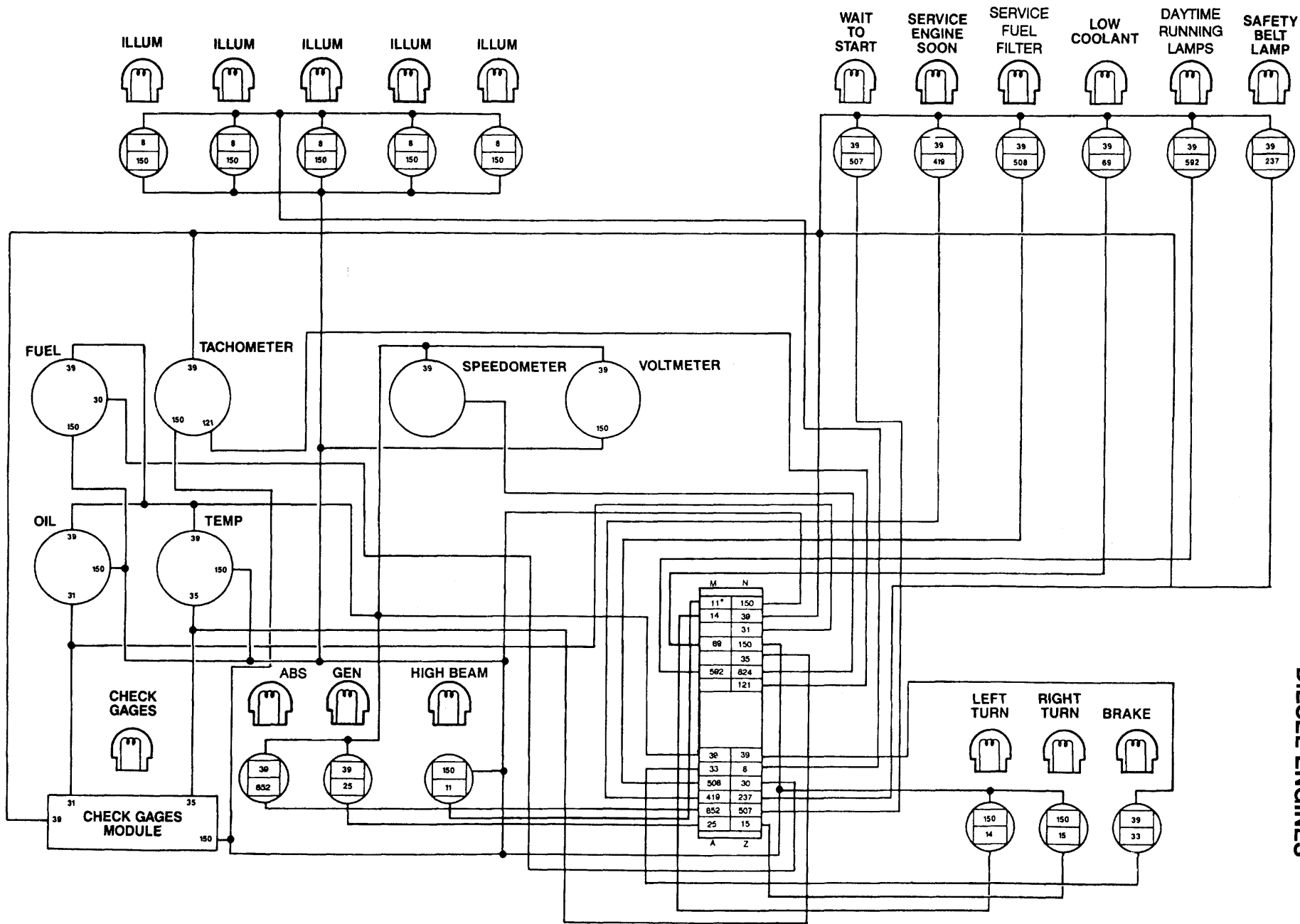






# 8A-81-8 INSTRUMENT PANEL GASOLINE ENGINES





**INSTRUMENT PANEL 8A-81-9**  
**DIESEL ENGINES**

## 8A-81-10 INSTRUMENT PANEL

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### DIAGNOSIS

The following list of symptoms are not covered in this section. The symptoms will be referenced to the appropriate subject located within this manual or will show what manual to use.

#### SYMPTOM

#### FOR DIAGNOSIS

|                                                                                                   |                                                         |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| High Beam Indicator Does Not Operate Properly .....                                               | See Headlamps (Page 100-1)                              |
| Fasten Belts Indicator And Alarm Do Not Operate Properly .....                                    | See Safety Belt Warning Buzzer (Page 76-1)              |
| Brake Indicator Is Always Lit .....                                                               | See Brake Warning System (Page 44-1)                    |
| Brake Indicator Does Not Light When Park Brake Is Applied .....                                   | See Brake Warning System (Page 44-1)                    |
| Malfunction Indicator Is Always Lit .....                                                         | Refer To The 1994 Light Duty Fuel And Emissions Manual. |
| Malfunction Indicator Does Not Light With The Ignition Switch In Run And Engine Not Running ..... | Refer To The 1994 Light Duty Fuel And Emissions Manual. |
| Turn Indicator Does Not Operate Properly .....                                                    | See Front Exterior Lamps (Page 110-1).                  |
| Wait Indicator Does Not Operate Properly .....                                                    | Refer To The 1994 Light Duty Fuel And Emissions Manual. |
| Service Fuel Filter Indicator Does Not Operate Properly .....                                     | See Diesel Engine Fuel Controls (Page 26-1)             |

**DIAGNOSIS — INSTRUMENT PANEL: GAGES AND INDICATORS**

**PRELIMINARY CHECKS:**

1. Check condition of GAGES Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

**FUEL GAGE IS INACCURATE**

| TEST                                                                                                                                                                                                                                           | RESULT                           | ACTION                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel tank sender connector C407. Connect one red lead of tester J33431-B to PNK (30) wire and other to ground. Set resistance dials to 0 ohms and then to 90 ohms. Fuel gage should indicate empty and then slowly move to full. | Gage responds correctly.         | CHECK BLK/WHT (450) wire for high resistance. If wire is good, REPAIR/REPLACE fuel gage sender. |
|                                                                                                                                                                                                                                                | Gage does not respond correctly. | CHECK for high resistance in PNK (30) wire. If wire is good, REPLACE fuel gage.                 |

**FUEL GAGE INDICATES FULL OR BEYOND AT ALL TIMES**

| TEST                                                                                                                                                                      | RESULT                     | ACTION                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel tank sender connector C407 and place ignition switch in RUN. Connect fused jumper from PNK (30) wire at fuel pump and sender connector C407 to ground. | Fuel gage indicates full.  | LOCATE and REPAIR a short in PNK (30) wire between fuel pump and sender connector C407 and connector C102 or connector C102 and I/P cluster connector C203. If no short is found, REPLACE fuel gage. |
|                                                                                                                                                                           | Fuel gage indicates empty. | GO to step 2.                                                                                                                                                                                        |
| 2. Connect fused jumper from PNK (30) wire to BLK/WHT (450) wire at fuel pump and sender connector C407.                                                                  | Fuel gage indicates full.  | LOCATE and REPAIR open in BLK/WHT (450) wire between fuel pump and sender connector C407 and connector C406 or between connector C406 and engine ground G108.                                        |
|                                                                                                                                                                           | Fuel gage indicates empty. | REPAIR/REPLACE fuel gage sender.                                                                                                                                                                     |

## 8A-81-12 INSTRUMENT PANEL

### TEMPERATURE GAGE INDICATES HOT WITH ENGINE COOLANT BELOW OPERATING TEMPERATURE AND IGNITION SWITCH IN RUN

| TEST                                                                                     | RESULT                                   | ACTION                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect engine temperature sender connector C169 and place ignition switch in RUN. | Temperature gage indicates cold.         | REPLACE engine temperature sender.                                                                                                                                                                                                                                        |
|                                                                                          | Temperature gage does not indicate cold. | LOCATE and REPAIR a short in DK GRN (35) wire between engine temperature sender connector C169 and connector C100 or connector C100 and I/P cluster connector C203. If no short is found, PERFORM diagnostic procedures under symptom "Temperature Gage Is Not Accurate." |

### TEMPERATURE GAGE INDICATES COLD ALL THE TIME

| TEST                                                                                                                             | RESULT                                  | ACTION                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect engine temperature sender connector C169. Ground the DK GRN (35) wire at engine temperature sender connector C169. | Temperature gage indicates hot.         | REPAIR/REPLACE engine temperature sender.                                                                                                                                                                   |
|                                                                                                                                  | Temperature gage does not indicate hot. | LOCATE and REPAIR open in DK GRN (35) wire between engine temperature sender connector C169 and connector C100 or connector C100 and I/P cluster connector C203. If wire is good, REPLACE temperature gage. |

### TEMPERATURE GAGE IS NOT ACCURATE

| TEST                                                                                                                                                                                                                                            | RESULT                    | ACTION                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect temperature sender connector C169. Connect red lead from J 33431-B tester to DK GRN (35) wire and other lead to ground. Adjust resistance dials to 1400 ohms and then to 55 ohms. Temperature gage should indicate cold then hot. | Gage indicates correctly. | REPLACE temperature sender.                                                                                                                                                                          |
|                                                                                                                                                                                                                                                 | Gage is not correct.      | LOCATE and REPAIR open in DK GRN (35) wire between temperature sender connector C169 and connector C100 at connector C100 and I/P cluster connector C203. If wire is good, REPLACE temperature gage. |

### CHECK GAGES INDICATOR DOES NOT LIGHT WITH IGNITION SWITCH IN BULB TEST OR START

| TEST                                                                                                                                                                | RESULT                                       | ACTION                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect ignition switch connector C256. Connect fused jumper from DK GRN (35) wire at ignition switch connector C256 to ground. Place ignition switch in RUN. | Temperature or check gages indicator lights. | REPLACE ignition switch.                                                                                                                          |
|                                                                                                                                                                     | Temperature or check gages does not light.   | LOCATE and REPAIR open in DK GRN (35) wire from ignition switch connector C256 to connector C100 or connector C100 to I/P cluster connector C203. |

**OIL PRESSURE GAGE INDICATES LOW PRESSURE WHEN OIL PRESSURE IS GOOD  
(GAGE EQUIPPED) OR OIL PRESSURE INDICATOR IS ALWAYS LIT**

| TEST                                                                                                                     | RESULT                                                                 | ACTION                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel) and place ignition switch in RUN. | Oil pressure gage indicates high pressure or indicator light goes out. | REPLACE oil pressure sender.                                                                                                                                                                                                                                                                      |
|                                                                                                                          | Oil pressure indicates no or low pressure or indicator light stays on. | LOCATE and REPAIR short in TAN (31) wire between fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel) and connector C100 or connector C100 and I/P cluster connector C203. If wire is good, REPLACE oil pressure gage or instrument cluster if equipped with indicator light. |

**OIL PRESSURE GAGE INDICATES HIGH PRESSURE AT ALL TIMES**

| TEST                                                                                                                                                                                                                                                    | RESULT                                                                 | ACTION                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel) and place ignition switch in RUN. Connect fused jumper from TAN (31) wire at fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel) to ground. | Oil pressure gage indicates low pressure or indicator lights.          | REPLACE fuel pump oil pressure switch.                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                         | Oil pressure gage indicates high pressure or indicator does not light. | LOCATE and REPAIR open in TAN (31) wire between fuel pump oil pressure switch connector C167 (Gasoline) C168 (Diesel) and connector C100 or connector C100 and I/P cluster connector C203 and bulb. If wire and bulb are good, REPLACE oil pressure gage or instrument cluster if equipped with indicator light. |

**VOLTMETER IS NOT ACCURATE**

| TEST                                                                                                                | RESULT                                                 | ACTION                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN position. Connect voltmeter between positive and negative terminals of the battery. | Voltage reading is same as vehicle's voltmeter.        | Voltmeter is good.                                                                                                          |
|                                                                                                                     | Voltage reading is different from vehicle's voltmeter. | LOCATE and REPAIR open in PNK/BLK (39) wire and BLK (150) wire at instrument cluster. If wires are good, REPLACE voltmeter. |

## 8A-81-14 INSTRUMENT PANEL

### ENGINE COOLANT LEVEL INDICATOR DOES NOT LIGHT WITH COOLANT LEVEL LOW (DIESEL ONLY)

| TEST                                                                                                                                                                            | RESULT                                         | ACTION                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect engine coolant level sensor connector C165 and place ignition switch in RUN. Observe engine coolant level indicator light.                                        | Engine coolant level indicator lights.         | REPLACE engine coolant level sensor.                                                                                                                                |
|                                                                                                                                                                                 | Engine coolant level indicator does not light. | GO to step 2.                                                                                                                                                       |
| 2. Disconnect engine coolant level indicator module connector C248. Connect voltmeter from PNK/BLK (39) wire at engine coolant level indicator module connector C248 to ground. | Battery voltage.                               | GO to step 3.                                                                                                                                                       |
|                                                                                                                                                                                 | No voltage.                                    | LOCATE and REPAIR open in PNK/BLK (39) wire between fuse block and engine coolant level indicator module connector C248.                                            |
| 3. Connect voltmeter from PNK/BLK (39) wire to BLK (150) wire at engine coolant level indicator module connector C248.                                                          | Battery voltage.                               | GO to step 4.                                                                                                                                                       |
|                                                                                                                                                                                 | No voltage.                                    | LOCATE and REPAIR open in BLK (150) wire between engine coolant level indicator module connector C248 and I/P ground G202.                                          |
| 4. Connect voltmeter from GRA (69) wire at engine coolant level indicator module connector C248 to ground.                                                                      | Battery voltage.                               | GO to step 5.                                                                                                                                                       |
|                                                                                                                                                                                 | No voltage.                                    | LOCATE and REPAIR open or short to ground in GRA (69) wire between engine coolant level indicator module connector C248 and I/P cluster connector C203.             |
| 5. Connect voltmeter from PNK/BLK (39) wire to YEL/BLK (68) at engine coolant level indicator module connector C248.                                                            | Battery voltage.                               | LOCATE and REPAIR short to ground in YEL/BLK (68) wire between engine coolant level indicator module connector C248 and engine coolant level sensor connector C165. |
|                                                                                                                                                                                 | No voltage.                                    | REPAIR engine coolant level indicator module.                                                                                                                       |

### ENGINE COOLANT LEVEL INDICATOR IS LIT WHEN COOLANT LEVEL IS GOOD

| TEST                                                                                                                                                              | RESULT                                    | ACTION                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect fused jumper from engine coolant level sensor connector C165 to ground. Place ignition switch in RUN and observe engine coolant level indicator light. | Engine coolant level indicator goes out.  | REPLACE engine low coolant level sensor.                                                                                                                                                                                                                                                            |
|                                                                                                                                                                   | Engine coolant level indicator stays lit. | LOCATE and REPAIR open in YEL/BLK (68) wire between engine coolant level sensor connector C165 and engine coolant level indicator module connector C248. If wire is good, follow diagnostic procedures listed under symptom "Engine Coolant Level Indicator Does Not Light With Coolant Level Low." |

**FUEL GAGE INDICATES EMPTY WHEN THERE IS FUEL IN THE TANK**

| TEST                                                                                | RESULT                     | ACTION                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel pump and sender connector C407 and place ignition switch in RUN. | Fuel gage indicates full.  | REPAIR/REPLACE fuel gage sender.                                                                                                                                                                       |
|                                                                                     | Fuel gage indicates empty. | LOCATE and REPAIR a short in PNK (30) wire between fuel pump and sender connector C407 and connector C102, or connector C105 and I/P cluster connector C203. If not short is found, REPLACE fuel gage. |

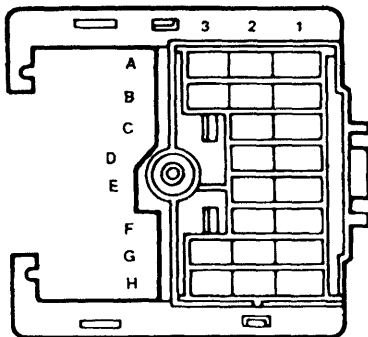
**OIL PRESSURE GAGE IS NOT ACCURATE**

| TEST                                                                                                                                                                                                                                                                                                                                                                                 | RESULT                                         | ACTION                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel). Connect one red lead of J33431B tester to TAN (31) wire at fuel pump oil pressure switch connector C167 (Gasoline) or C168 (Diesel) and other lead to ground. Set resistance dials to 0 ohms and then to 90 ohms. The oil pressure gage should indicate low pressure and then high pressure. | Oil pressure gage indicates correctly.         | REPLACE fuel pump oil pressure switch.                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                      | Oil pressure gage does not indicate correctly. | LOCATE and REPAIR open in TAN (31) wire between fuel pump oil pressure switch connector C167 (Gasoline) C168 (Diesel) and connector C100 or connector C100 and I/P cluster connector C203. If wire is good, REPLACE oil pressure gage. |



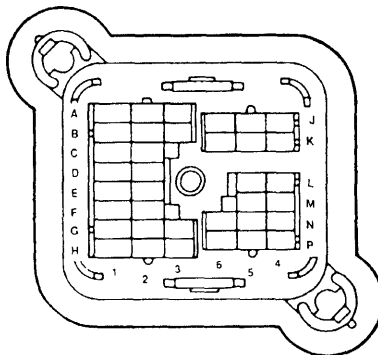
# 8A-81-16 INSTRUMENT PANEL

12020183



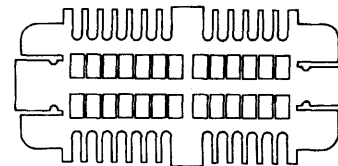
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



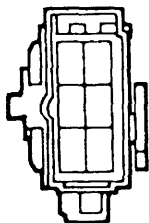
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



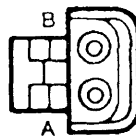
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12020099



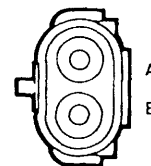
**C101**  
Bulkhead – Rear Lamps

12015792



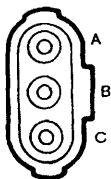
**BLACK**  
Weather Pack  
**C106A**  
Engine to Fuel Pump

12010973



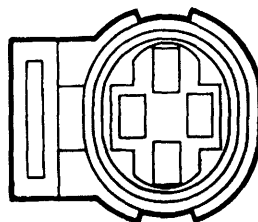
**BLACK**  
Weather Pack  
**C106A**  
Fuel Pump to Engine

12010717



**BLACK**  
Weather Pack  
**C420**  
Fuel Sender Unit

12065401



**GRAY**  
Metri-Pack 150  
**C167**  
Oil Pressure Switch/Sender

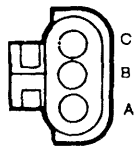
12089499



**C169**  
Engine Coolant Temperature  
Sender

**INSTRUMENT PANEL 8A-81-17**

**12015793**



**BLACK**  
Weather Pack  
**C126**  
Water-In-Fuel Sensor

**06288440**



**BLACK**  
**C165**  
Low Coolant Level Sensor

**12010996**



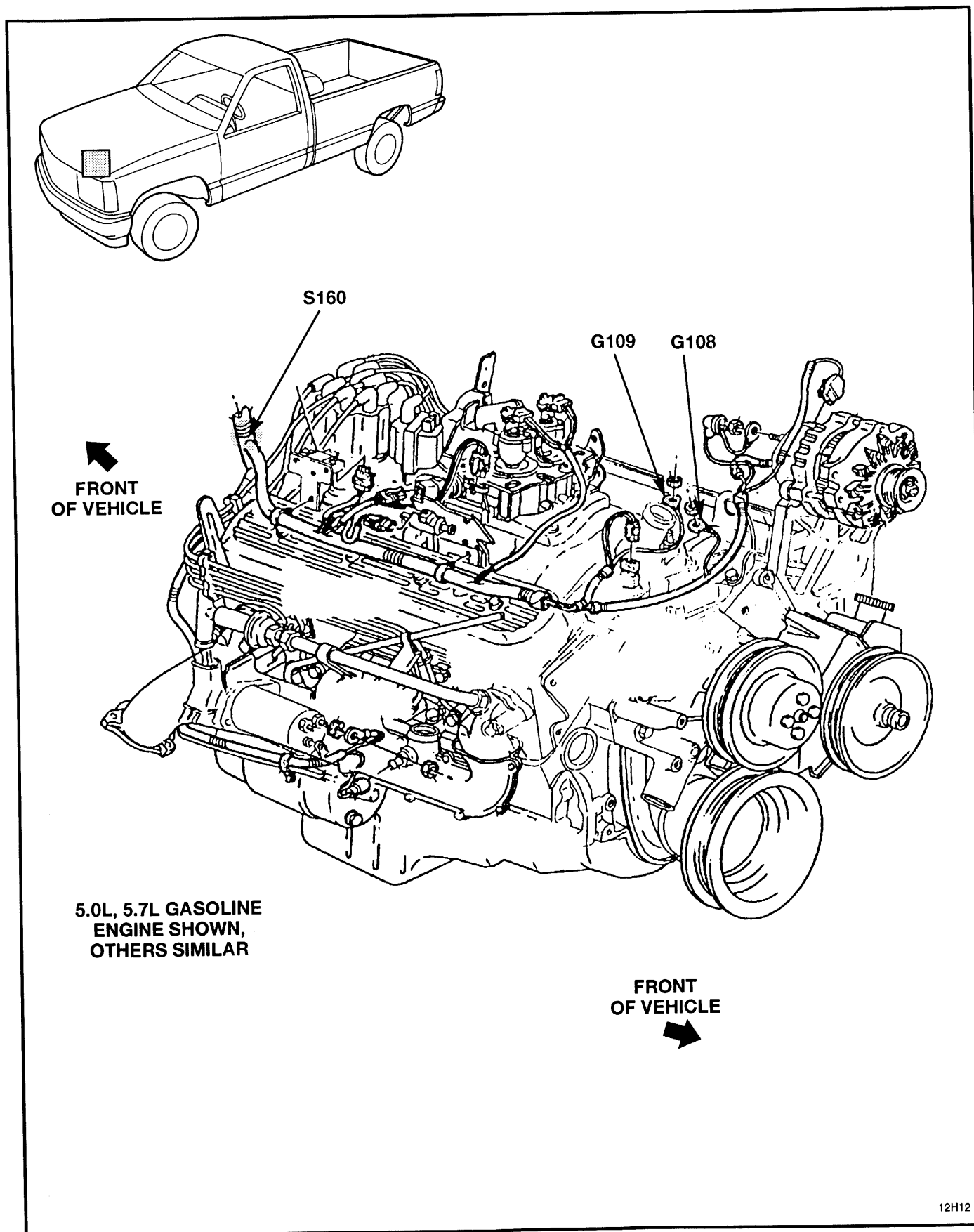
**BLACK**  
Weather Pack  
**C166**  
I/P to Low Coolant Level Sensor

**12015791**



**BLACK**  
Weather Pack  
**C166**  
Low Coolant Level Sensor to I/P

## 8A-81-18 INSTRUMENT PANEL



12H12

Figure 1 — LH Side of Engine, 5.0L (305 CID), 5.7L (350 CID) Engine — Gasoline

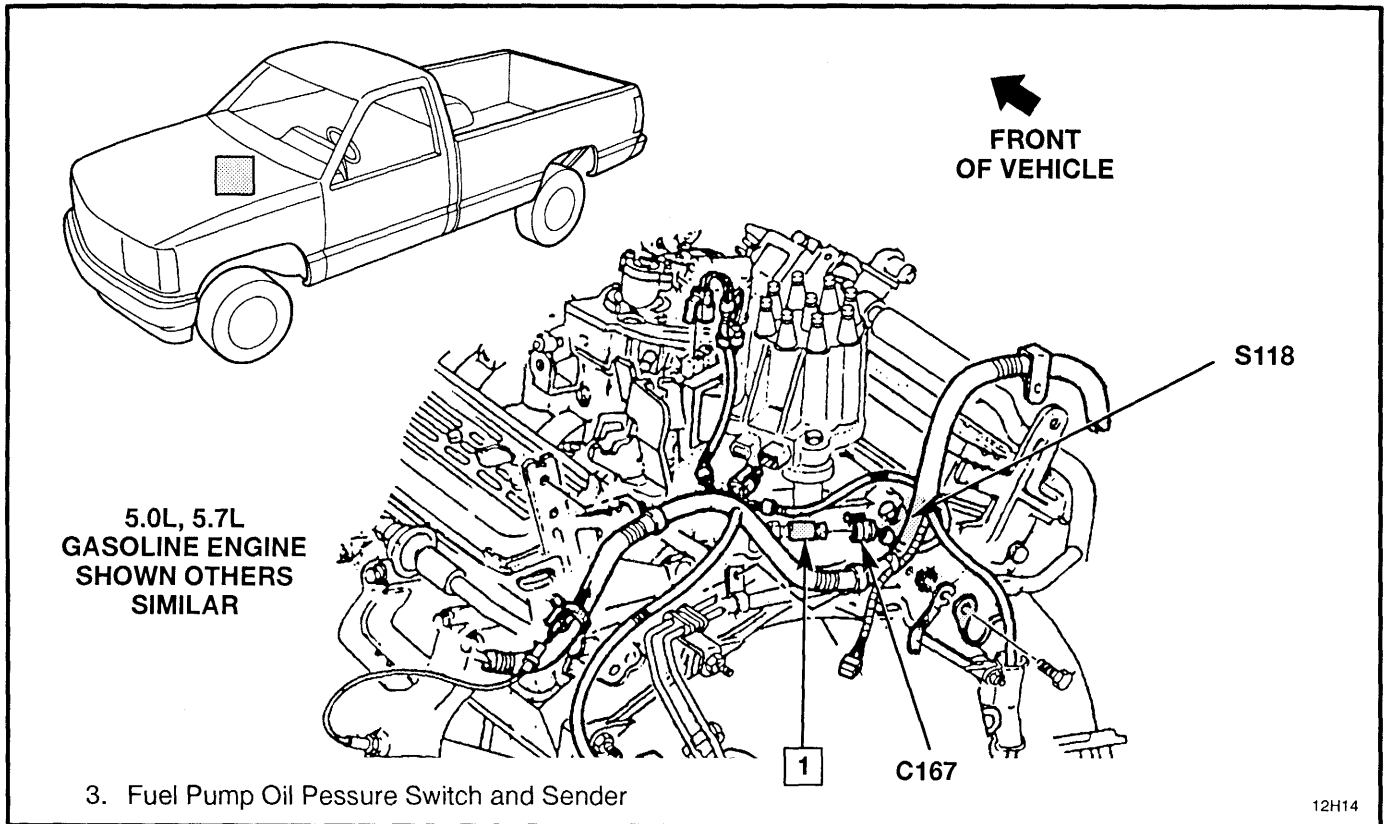


Figure 2 — Engine Wiring Rear, 5.0L (305 CID) and 5.7L (350 CID) — Gasoline Engines

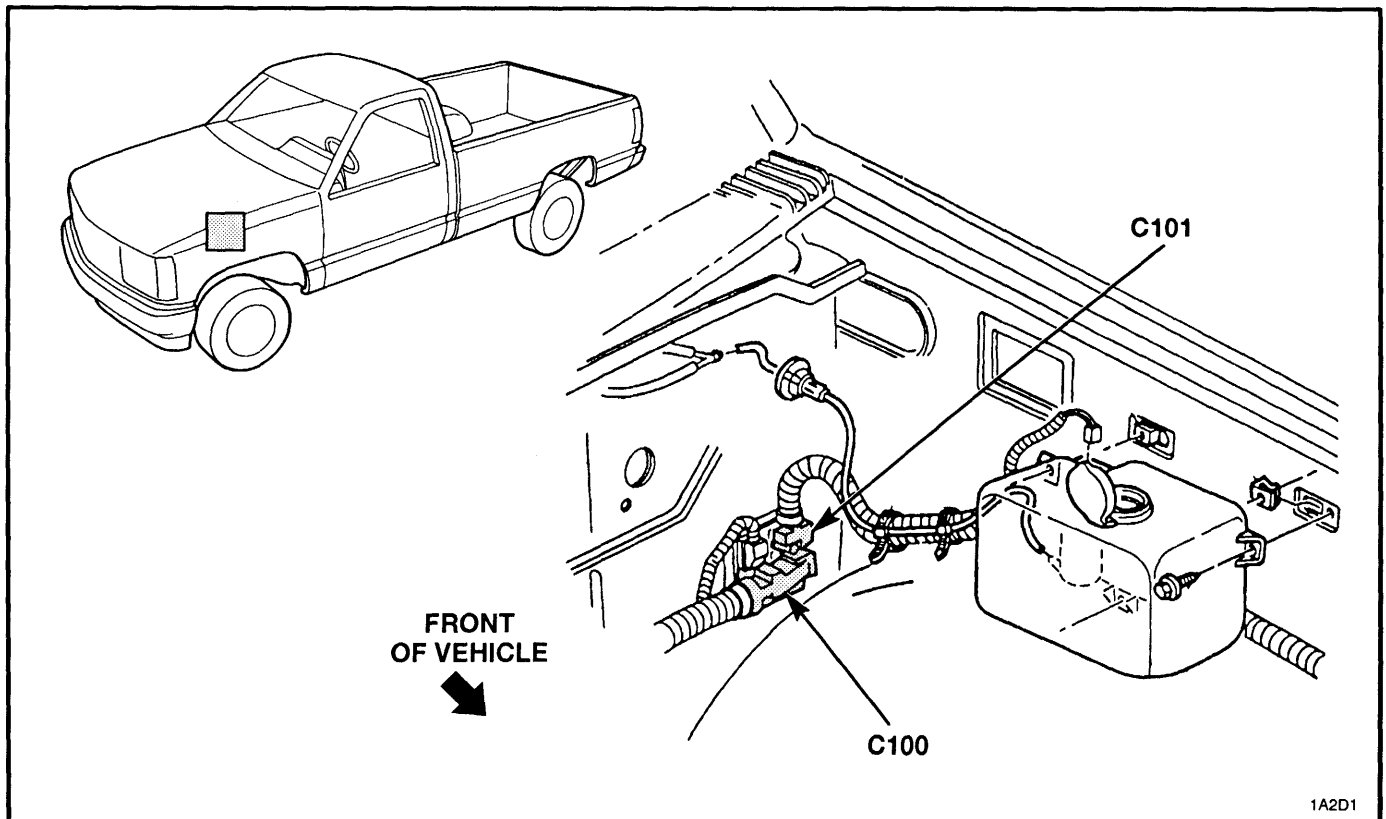


Figure 3 — LH Front Fender Wiring

## 8A-81-20 INSTRUMENT PANEL

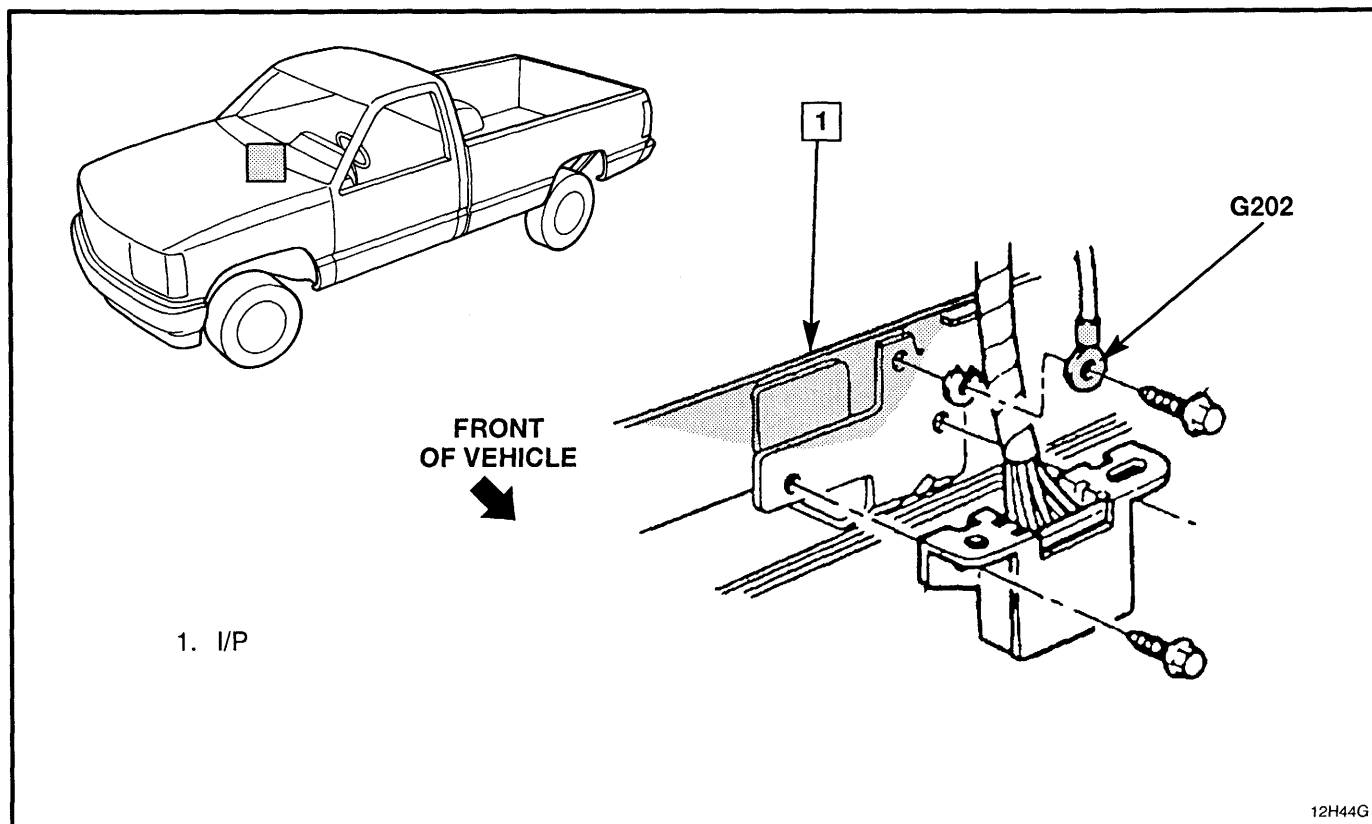


Figure 4 — I/P Ground Wiring

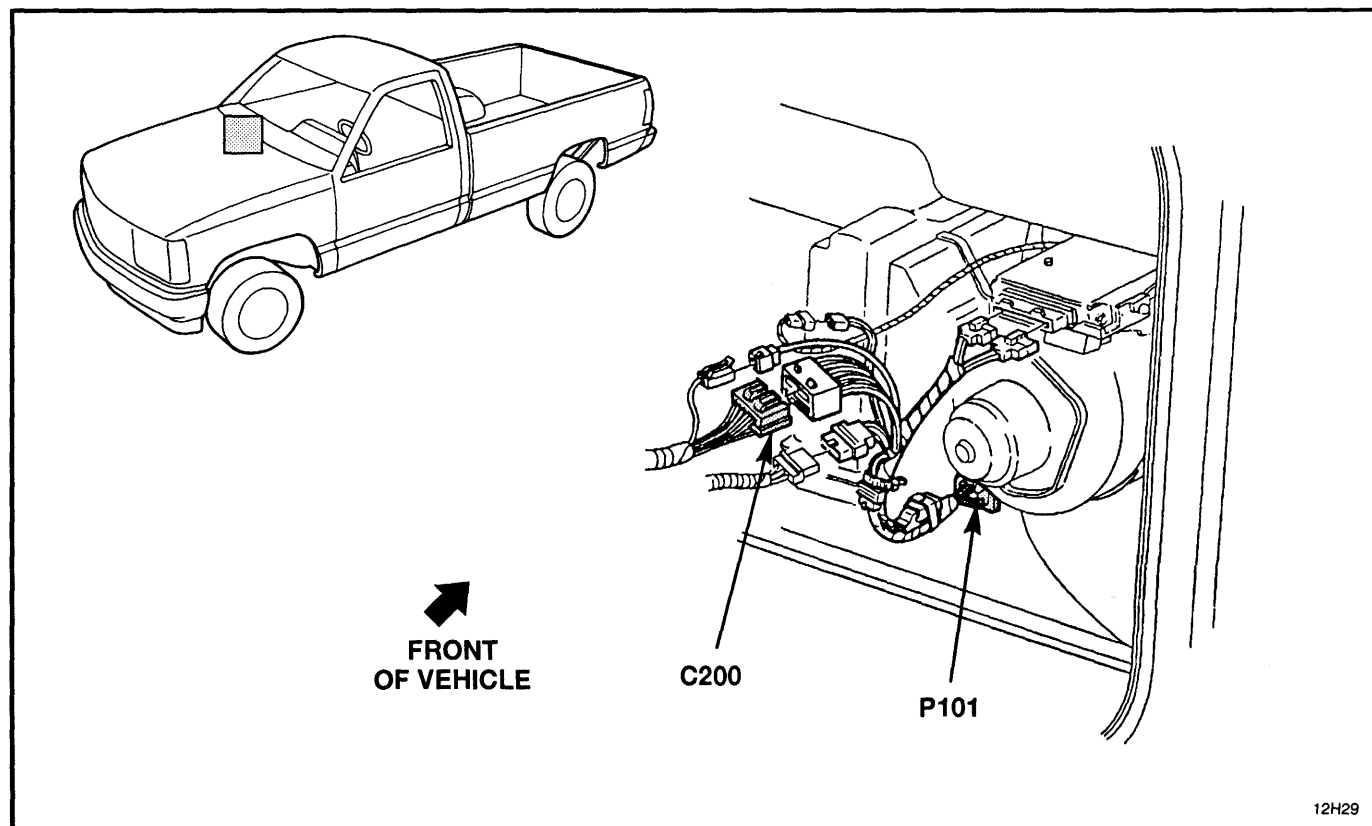
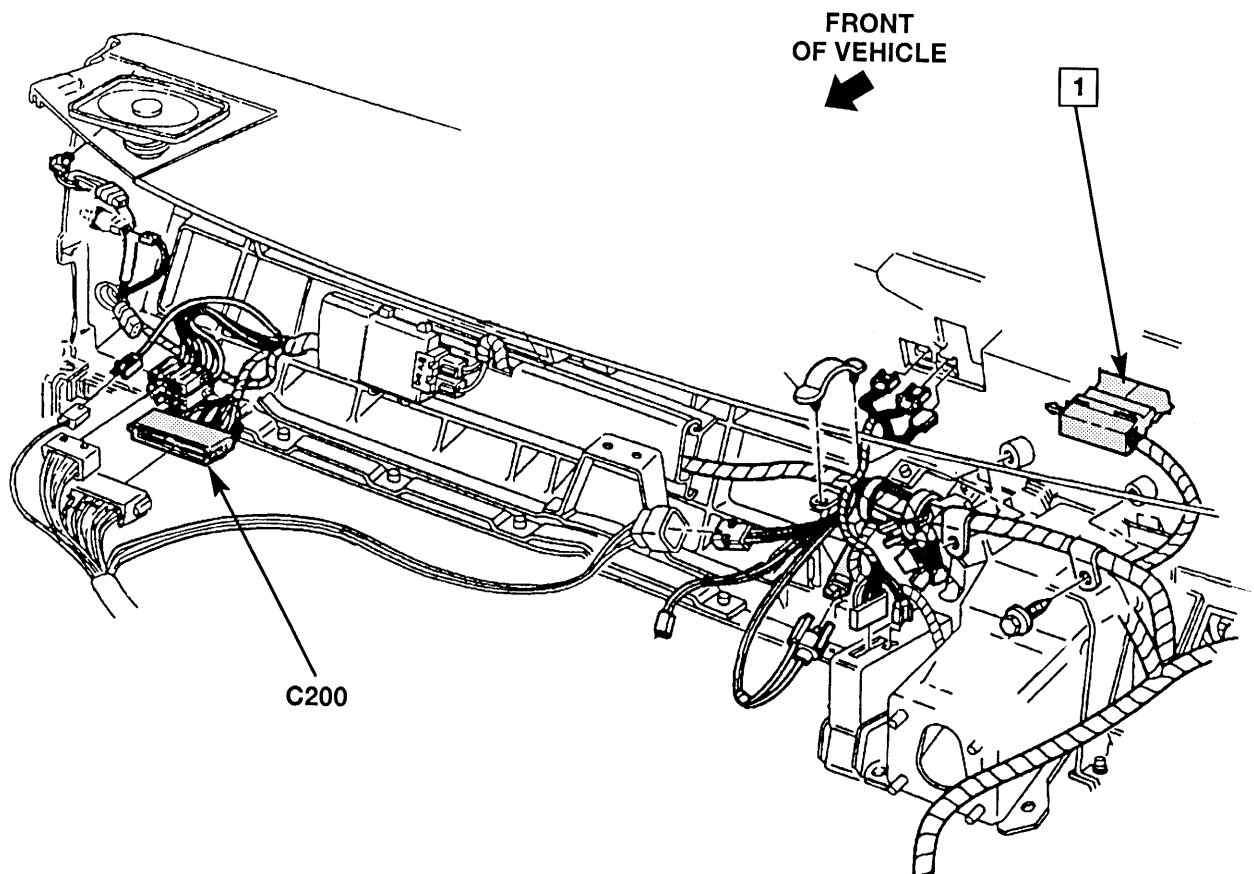
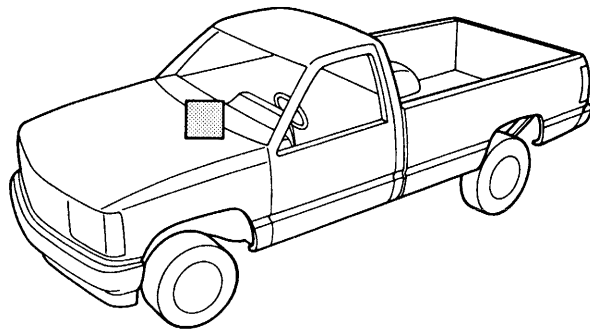


Figure 5 — Behind RH Side of I/P



1. Instrument Cluster

Figure 6 — Instrument Panel Wiring, RH Side

## 8A-81-22 INSTRUMENT PANEL

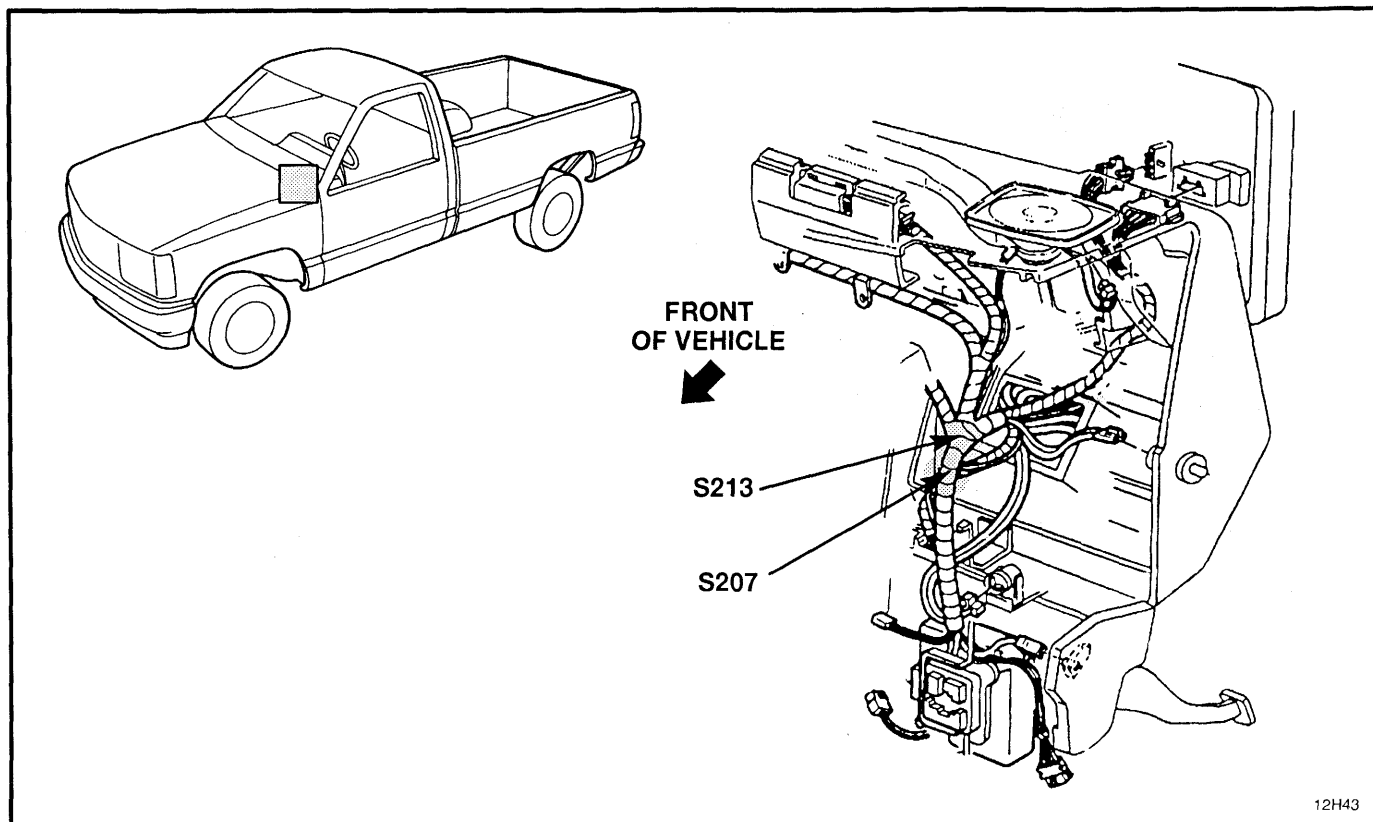


Figure 7 — Instrument Panel LH Side

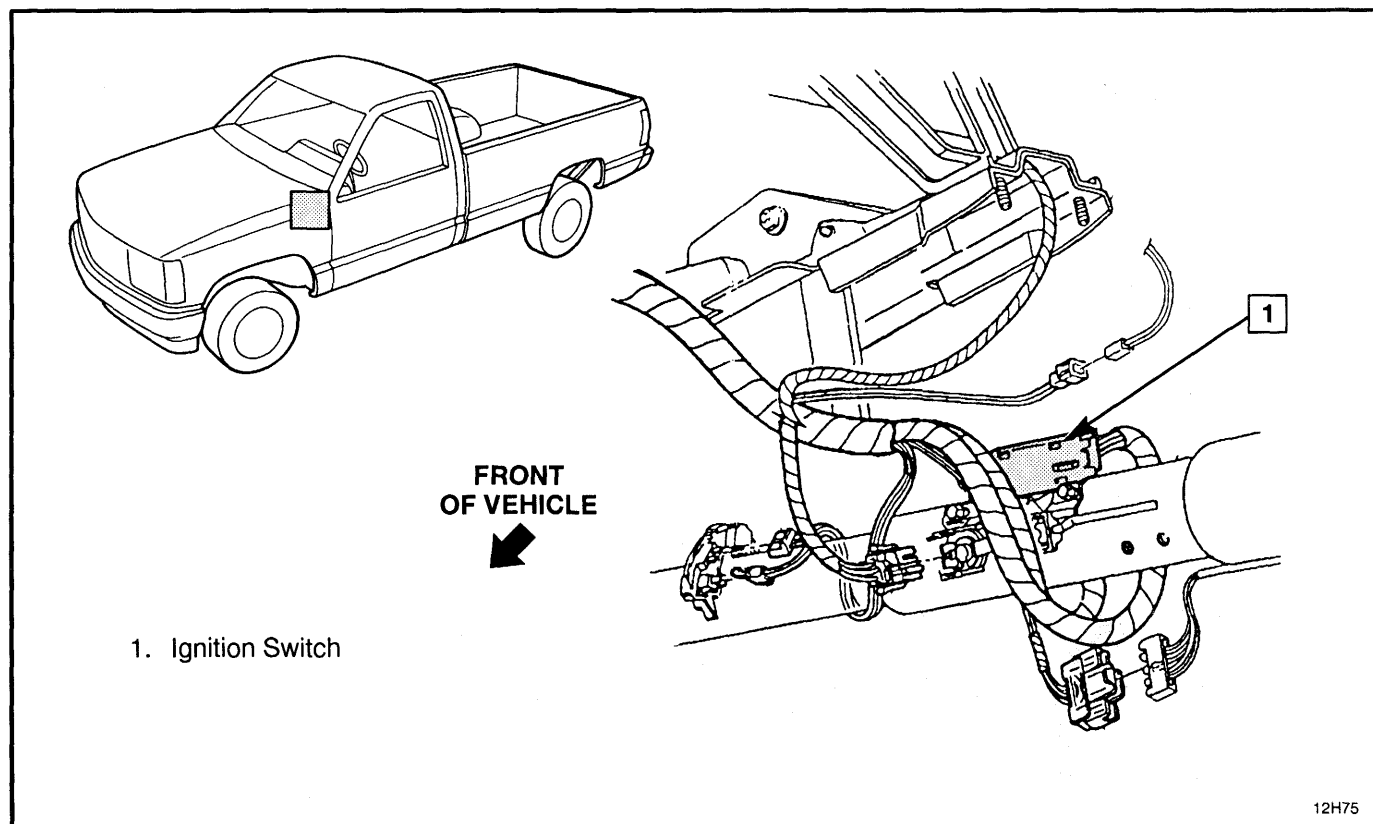


Figure 8 — Steering Column Wiring, RH Side

## CIRCUIT OPERATION

### WIPERS (CONVENTIONAL)

When the Wiper/Washer Switch is in LO, battery voltage is supplied through the GRA (91) wire directly to the low speed brushes of the Wiper Motor. The Wiper Motor runs at low speed.

When the Wiper/Washer Switch is in HI, battery voltage is supplied through the PPL (92) wire to the high speed brushes of the Wiper Motor. The motor operates at higher speed.

The Park Switch is open only when the wiper blades are in the PARK position. In all other positions, the Park Switch is closed. When the Wiper/Washer Switch is moved to OFF, battery voltage at the WHT (93) wire is supplied through the Park Switch, the Wiper/Washer Switch and the GRA (91) wire to the low speed brushes of the Wiper Motor. The Wiper Motor continues to run at low speed until the wiper blades reach the PARK position. At that time the Park Switch opens and stops the Wiper Motor.

The Wiper Motor is protected by a circuit breaker which opens if the current through the Motor rises to a high level. This may happen if the wiper blades are blocked by ice or snow. The circuit breaker resets automatically after it cools off.

### WASHER (CONVENTIONAL WIPER)

The Washer Motor is engaged whenever the Washer Switch is pressed and runs as long as the Washer Switch is closed. Battery voltage is supplied through the Washer Switch and the PNK (94) wire to the Washer Motor. The other terminal of the motor is grounded through the BLK (150) wire.

### WIPERS (PULSE)

In addition to the features of a conventional (non-pulse) Wiper System (MIST, LO and HI speeds), the pulse-type Wiper/Washer System includes an operating mode in which the wipers make single strokes with an adjustable time interval between strokes. The time interval is controlled by a Solid-State Pulse/Speed/Wash Control in the Wiper Motor Module. The duration of the relay interval is determined by the Pulse Delay Resistance in the Wiper/Washer Switch.

### LOW SPEED

In the LO position, the Wiper/Washer Switch supplies voltage to the GRA (91) wire and the Pulse/Speed/Wash Control. The Pulse/Speed/Wash Control provides ground to the Park/Run Relay which is energized and supplies voltage to the brushes of the Wiper Motor. The wipers run at low speed until they are turned off.

### HIGH SPEED

With the Wiper/Washer Switch in the HI position, battery voltage is supplied from the PPL (92) wire directly to a second armature terminal of the Wiper Motor. The wipers run at high speed. When the Wiper/Washer Switch is turned to OFF, the wipers complete the last sweep at low speed and park.

### PARK

When the wipers are turned off, the Wiper Motor runs at low speed until the wiper blades reach the PARK position. At that time the Park/Run Relay opens and shunts the Wiper Motor to stop it immediately. The wiper blades remain in the PARK position.

### MIST

When the control is moved to MIST and released, the wipers make one sweep at low speed and return to PARK. The circuit operation is the same as low speed.

### PULSE

With the Wiper/Washer Switch in PULSE (Delay), voltage is applied to the GRA (91) wire, the Wiper Motor Module and the Solid-State Control Board. Voltage is supplied to the Park/Run Relay coil which is momentarily grounded by the Pulse/Speed/Wash Control circuit and the relay closes. Battery voltage is supplied through the closed contacts of the relay to run the Wiper Motor. The relay remains energized as long as the contacts of the Park/Run Switch remain closed. When the wiper blades have reached PARK, the Park/Run Switch opens, de-energizing the Park/Run Relay. The wiper blades remain in PARK until the Control Board grounds the Park/Relay coil to start another sweep. The delay time between sweeps is controlled by the pulse delay resistors. The delay can be adjusted from 0 to 43 seconds.



## 8A-91-2 FRONT WIPER/WASHER

### WASHER (PULSE WIPER)

When the Washer Switch is depressed, voltage is supplied to the Solid-State Control Board. The Control Board supplies battery voltage to the Washer Motor through the ORN (98) and PNK (94) wire. It also starts the wiper cycle through the low speed brushes of the Wiper Motor. The washer continues to run as long as the switch is held down. The Solid-State Control Board keeps the

wipers on for approximately six seconds after the washer goes off. If the washer is switched on during the PULSE operation, the wipers run in low speed for six seconds. The wash cycle is completed before the wipers return to the delayed pulse operation.

The Wiper Motor is equipped with a circuit breaker which protects the motor when the wipers are blocked. The resulting high current will open the circuit breaker which will reset upon cooling.

### COMPONENT LOCATION

#### Page — Figure

|                                          |                                                               |           |   |
|------------------------------------------|---------------------------------------------------------------|-----------|---|
| Fuse Block .....                         | Lower LH side of I/P .....                                    | 91-12     | 6 |
| Windshield Washer Pump .....             | At washer reservoir .....                                     | 91-10     | 4 |
| Windshield Wiper Motor Module ....       | Center rear engine compartment, at cowl .....                 | Not Shown |   |
| Windshield Wiper and Washer Switch ..... | Part of multi-function switch, LH upper steering column ..... | 91-11     | 5 |

### CONNECTORS:

|            |                                               |       |   |
|------------|-----------------------------------------------|-------|---|
| C100 ..... | At bulkhead connector .....                   | 91-10 | 4 |
| C102 ..... | At bulkhead connector .....                   | 91-10 | 4 |
| C202 ..... | Under RH side of I/P, near blower motor ..... | 91-8  | 2 |
| C266 ..... | At steering column, under cowl .....          | 91-11 | 5 |

### GROMMETS:

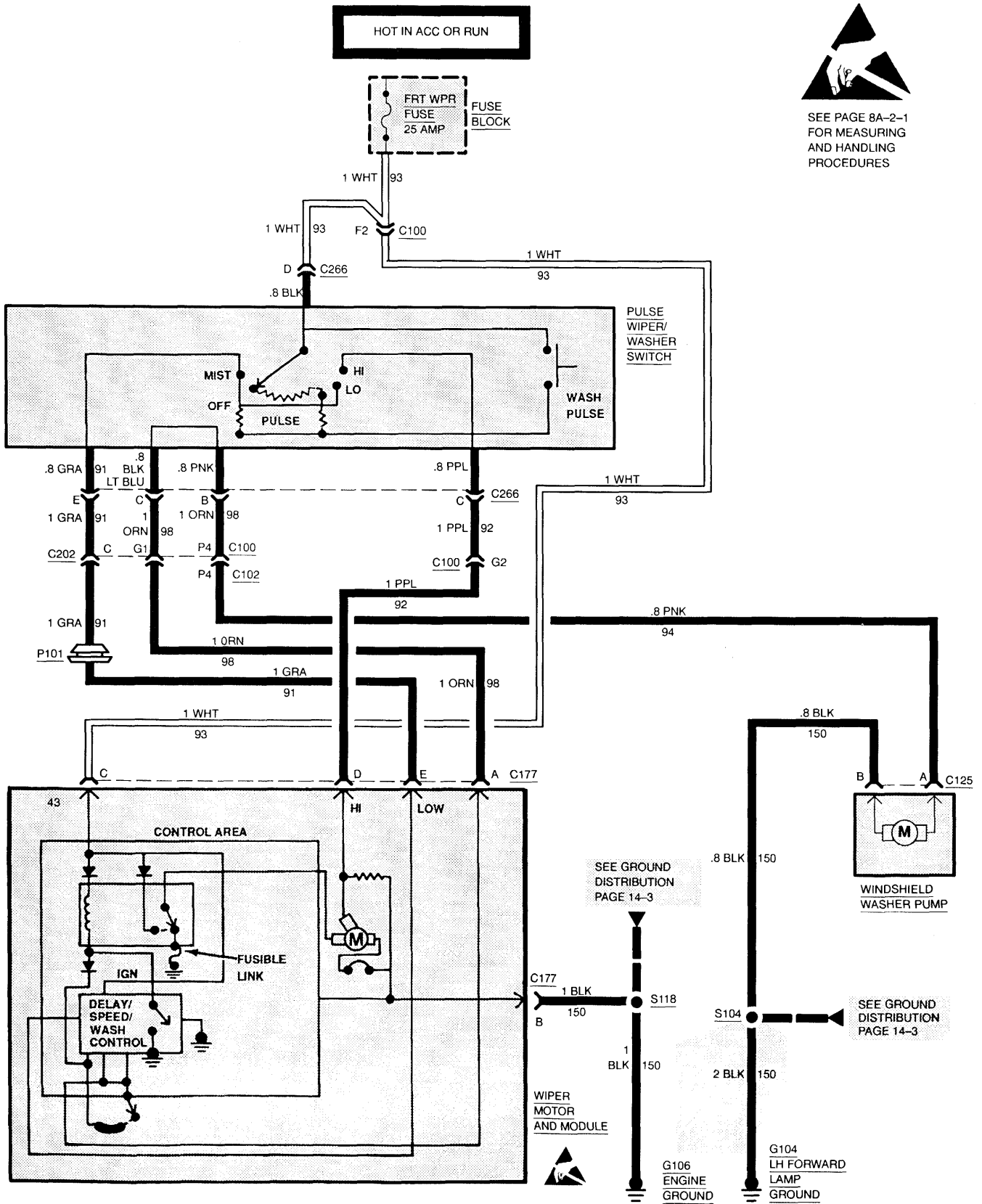
|             |                                          |      |   |
|-------------|------------------------------------------|------|---|
| GT101 ..... | RH lower cowl (engine compartment) ..... | 91-8 | 2 |
|-------------|------------------------------------------|------|---|

### GROUNDINGS:

|            |                                           |      |   |
|------------|-------------------------------------------|------|---|
| G104 ..... | On sheet metal, above LH headlamp .....   | 91-8 | 1 |
| G106 ..... | Rear center cowl, near in-line fuse ..... | 91-9 | 3 |

### SPLICES:

|            |                                                           |      |   |
|------------|-----------------------------------------------------------|------|---|
| S104 ..... | LH side, near headlamp .....                              | 91-8 | 1 |
| S118 ..... | Engine harness, near cowl LH rear engine compartment .... | 91-9 | 3 |



## 8A-91-4 FRONT WIPER/WASHER

### DIAGNOSIS — WIPER/WASHER

#### PRELIMINARY CHECKS:

1. Check condition of FRT WIPER Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

#### WIPERS DO NOT OPERATE IN ANY MODE

| TEST                                                                                                                                          | RESULT                    | ACTION                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------|
| 1. Disconnect wiper switch connector C266. Connect test lamp from WHT (93) wire at wiper switch connector C266 to ground.                     | Test lamp lights.         | GO to step 2.                                                                           |
|                                                                                                                                               | Test lamp does not light. | LOCATE and REPAIR open in WHT (93) wire from wiper switch connector C266 to fuse block. |
| 2. Connect wiper switch connector C266. Position switch in LO. Connect test lamp from GRA (91) wire at wiper switch connector C266 to ground. | Test lamp lights.         | LOCATE and REPAIR open in wiper wires from wiper switch to wiper motor module.          |
|                                                                                                                                               | Test lamp does not light. | REPLACE wiper switch.                                                                   |

#### WIPERS OPERATE AT LOW SPEED ONLY (HIGH SPEED INOPERATIVE)

| TEST                                                                                                                                                                                          | RESULT                    | ACTION                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------|
| 1. Disconnect wiper motor module connector C177. Place ignition switch in ACC and wiper switch in HI position. Connect test lamp from PPL (92) wire at wiper module connector C177 to ground. | Test lamp lights.         | REPLACE wiper motor module.                                                                                    |
|                                                                                                                                                                                               | Test lamp does not light. | GO to step 2.                                                                                                  |
| 2. Connect test lamp from PPL (92) wiper switch connector C266 to ground.                                                                                                                     | Test lamp lights.         | LOCATE and REPAIR open in PPL (92) wire from wiper switch connector C266 to wiper motor module connector C177. |
|                                                                                                                                                                                               | Test lamp does not light. | REPLACE wiper switch.                                                                                          |

#### WIPERS OPERATE AT HIGH SPEED ONLY (LOW SPEED INOPERATIVE)

| TEST                                                                                                                                                                                                | RESULT                    | ACTION                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------|
| 1. Disconnect wiper motor module connector C177. Place ignition switch in ACC and wiper switch in LO position. Connect test lamp from GRA (91) wire at wiper motor module connector C177 to ground. | Test lamp lights.         | REPLACE wiper motor module.                                                                                    |
|                                                                                                                                                                                                     | Test lamp does not light. | GO to step 2.                                                                                                  |
| 2. Connect test lamp from GRA (91) wire at wiper switch connector C266 to ground.                                                                                                                   | Test lamp lights.         | LOCATE and REPAIR open in GRA (91) wire from wiper switch connector C266 to wiper motor module connector C177. |
|                                                                                                                                                                                                     | Test lamp does not light. | REPLACE wiper switch.                                                                                          |

## FRONT WIPER/WASHER 8A-91-5

### NO DELAY IN THE PULSE (DELAY) MODE

| TEST                                                                                                                                                                  | RESULT                                                  | ACTION                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect wiper switch connector C266. Place wiper switch to LO position. Connect ohmmeter from GRA (91) wire terminal to WHT (93) wire terminal at wiper switch. | A reading of approximately 680 ohms.                    | GO to step 2.                                                                                                                                                  |
|                                                                                                                                                                       | A reading of less than or greater than 680 ohms.        | REPLACE wiper switch.                                                                                                                                          |
| 2. Move wiper switch through delay range to maximum delay position.                                                                                                   | Readings increase in steps to approximately 450 k ohms. | LOCATE and REPAIR open in GRA (91) wire or WHT (93) wire from wiper switch connector C266 to wiper motor module C177. If wires are good, REPLACE wiper switch. |
|                                                                                                                                                                       | Readings are incorrect.                                 | REPLACE wiper switch.                                                                                                                                          |

### WIPERS WILL NOT SHUT OFF

| TEST                                                                                                                                                                                                | RESULT                               | ACTION                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------|
| 1. Disconnect wiper motor module connector C177. Place ignition switch in ACC and wiper switch to LO position. Connect test lamp from GRA (91) wire at wiper motor module connector C177 to ground. | Test lamp lights.                    | GO to step 2.                                                                                                  |
|                                                                                                                                                                                                     | Test lamp does not light.            | LOCATE and REPAIR open in GRA (91) wire from wiper motor module connector C177 to wiper switch connector C266. |
| 2. Move wiper switch to HI position. Connect test lamp from PPL (92) wire at wiper motor module connector C177 to ground.                                                                           | Test lamp lights.                    | GO to step 3.                                                                                                  |
|                                                                                                                                                                                                     | Test lamp does not light.            | LOCATE and REPAIR open in PPL (92) wire from wiper motor module connector C177 to wiper switch connector C266. |
| 3. Connect test lamp from WHT (93) wire at wiper motor module connector C177 to ground.                                                                                                             | Test lamp lights (w/pulse wipers).   | REPLACE wiper motor module.                                                                                    |
|                                                                                                                                                                                                     | Test lamp lights (w/o pulse wipers). | GO to step 4.                                                                                                  |
|                                                                                                                                                                                                     | Test lamp does not light.            | LOCATE and REPAIR open in WHT (93) wire from wiper motor module connector C177 to ground G106.                 |
| 4. Turn ignition and wiper switches to OFF. Disconnect battery. Connect ohmmeter between ORN (98) and GRA (91) wires at wiper motor module connector C177.                                          | A reading of 0 ohms.                 | REPLACE wiper motor module.                                                                                    |
|                                                                                                                                                                                                     | A reading of greater than 0 ohms.    | LOCATE and REPAIR open in ORN (98) wire from wiper motor module connector C177 to wiper switch connector C266. |

## 8A-91-6 FRONT WIPER/WASHER

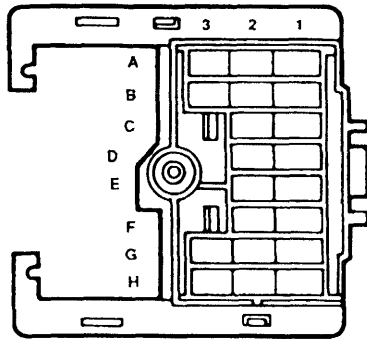
### WASHER WILL NOT OPERATE (W/O PULSE WIPERS)

| TEST                                                                                                                                                               | RESULT                    | ACTION                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------|
| 1. Disconnect washer pump motor connector C176. Place ignition switch to WASH. Connect test lamp from PNK (94) wire at washer pump motor connector C176 to ground. | Test lamp lights.         | GO to step 2.                                                                                                 |
|                                                                                                                                                                    | Test lamp does not light. | GO to step 3.                                                                                                 |
| 2. Connect test lamp from PNK (94) wire to BLK (150) wire at washer pump motor connector C176.                                                                     | Test lamp lights.         | REPLACE washer pump motor.                                                                                    |
|                                                                                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from washer pump motor connector C176 to ground terminal G104.       |
| 3. Connect test lamp from PNK (94) wire at wiper switch connector C266.                                                                                            | Test lamp lights.         | LOCATE and REPAIR open in PNK (94) wire from wiper switch connector C266 to washer pump motor connector C176. |
|                                                                                                                                                                    | Test lamp does not light. | REPLACE wiper switch.                                                                                         |

### WASHER WILL NOT OPERATE (W/PULSE WIPERS)

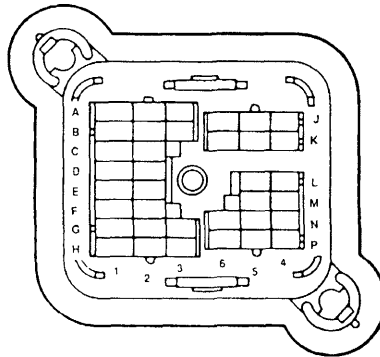
| TEST                                                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect washer pump motor connector C176. Place ignition switch to ACC and wiper switch to WASH. Connect test lamp from PNK (94) wire at washer pump motor connector C176 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                         |
|                                                                                                                                                                                            | Test lamp does not light. | GO to step 3.                                                                                                                                         |
| 2. Connect test lamp from PNK (94) wire to BLK (150) wire at washer pump motor connector C176.                                                                                             | Test lamp lights.         | REPLACE washer pump motor.                                                                                                                            |
|                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from washer pump motor connector C176 to ground terminal G104.                                               |
| 3. Connect test lamp from GRA (91) wire at wiper motor module connector C177 to ground.                                                                                                    | Test lamp lights.         | GO to step 4.                                                                                                                                         |
|                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in GRA (91) wire from wiper motor module connector C177 to wiper switch connector C266. If wire is good, REPLACE wiper switch. |
| 4. Connect test lamp from ORN (98) wire at wiper motor module connector C177 to ground.                                                                                                    | Test lamp lights.         | LOCATE and REPAIR open in ORN (98) wire from wiper motor module connector C177 to wiper switch connector C266. If wire is good, REPLACE wiper switch. |
|                                                                                                                                                                                            | Test lamp does not light. | REPLACE wiper motor module.                                                                                                                           |

**12020183**



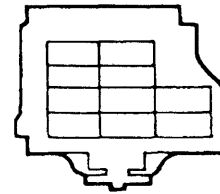
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

**12020184**



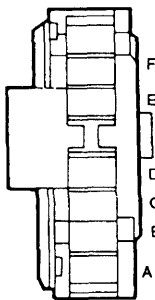
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

**12020100**



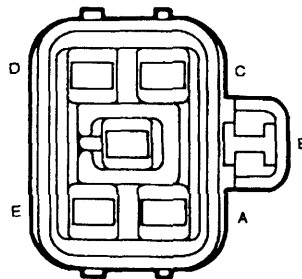
**C102**  
Bulkhead to Forward Lamps

**12020491**



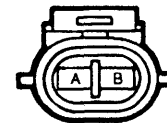
**BLACK**  
Pac/on  
**C266**  
Wiper/Washer Switch

**12052813**



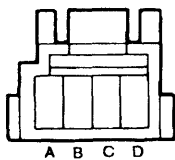
**BLACK**  
Metri-Pack 280  
**C177**  
Wiper Motor Module

**12052641**



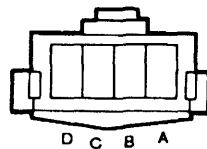
**BLACK**  
Metri-Pack 150  
**C125**  
Washer Pump

**12015664**



**BLACK**  
Metri-Pack 630  
**C202**  
In-Line Engine to I/P

**12052623**



**BLACK**  
Metri-Pack 630  
**C202**  
In-Line I/P to Engine

## 8A-91-8 FRONT WIPER/WASHER

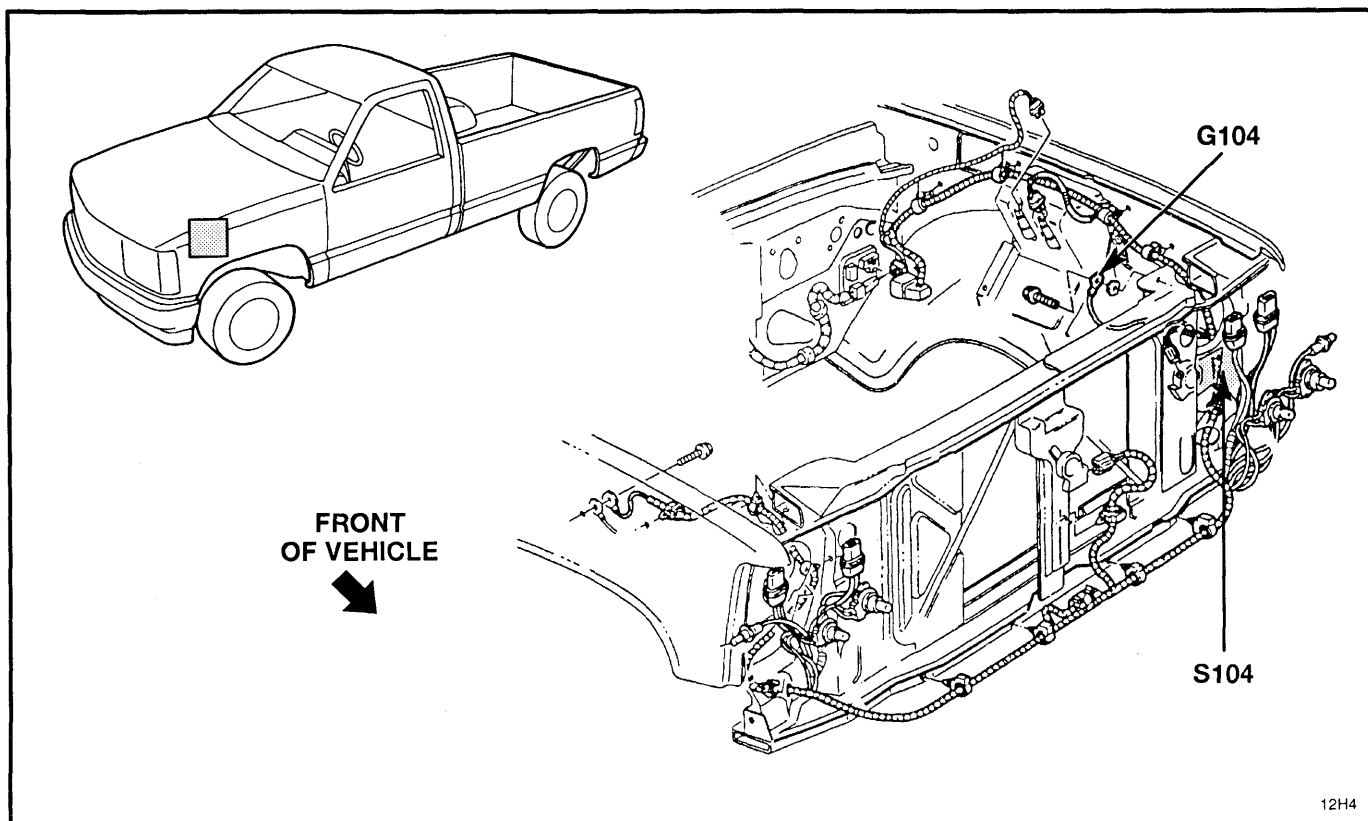


Figure 1 — Forward Lamp Harness

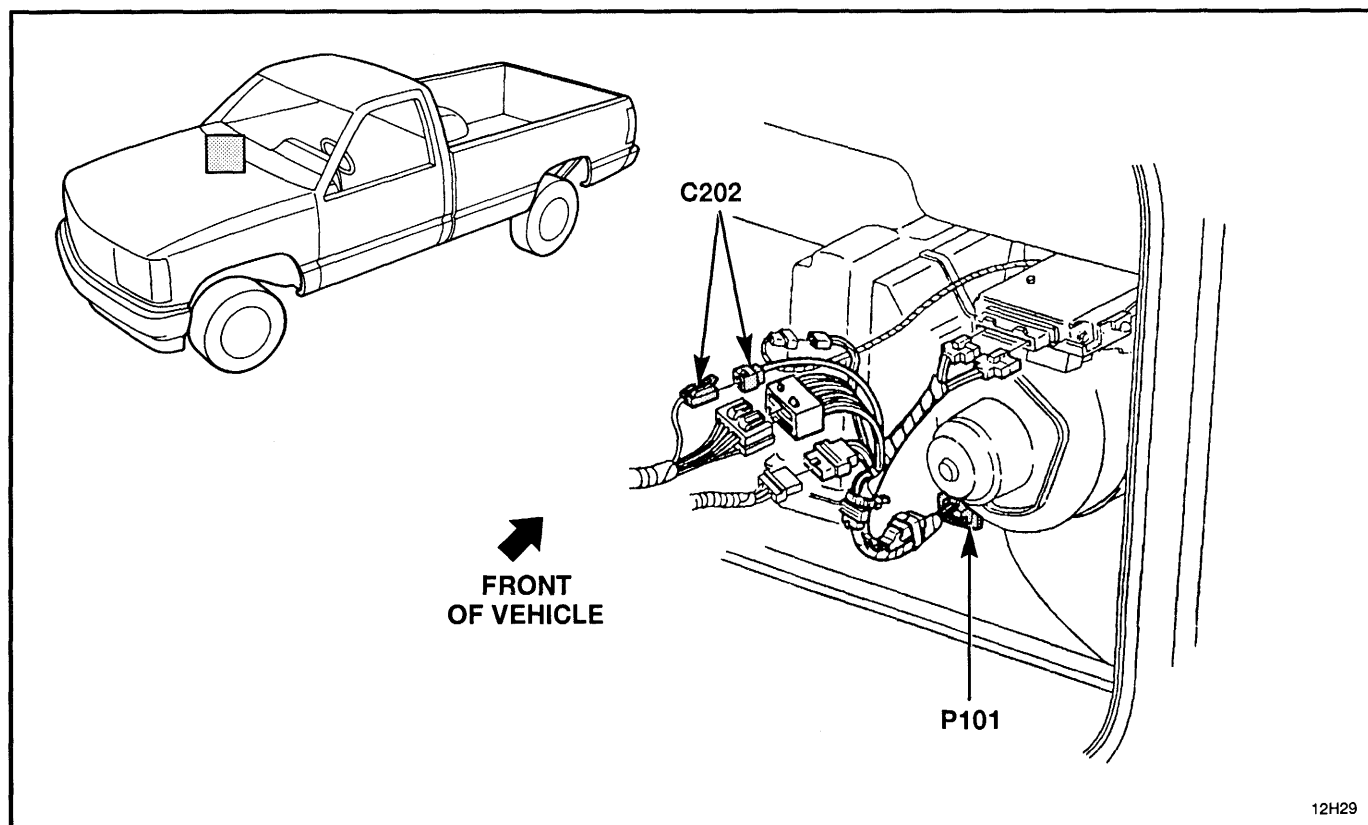


Figure 2 — Behind RH Side of I/P

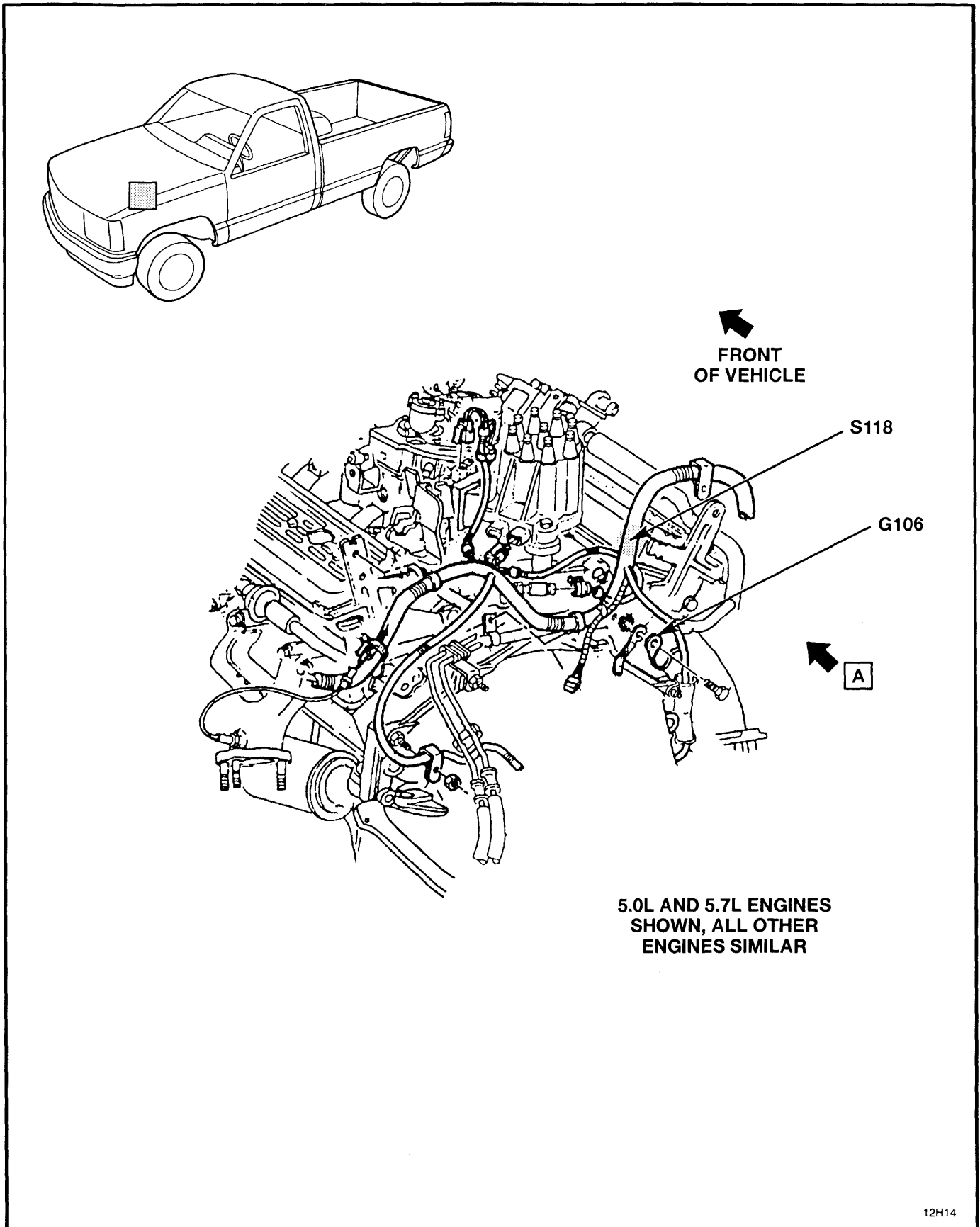


Figure 3 — LH Side of Engine — 5.0L (305 CID), 5.7L (350 CID) Gasoline Engine



## 8A-91-10 FRONT WIPER/WASHER

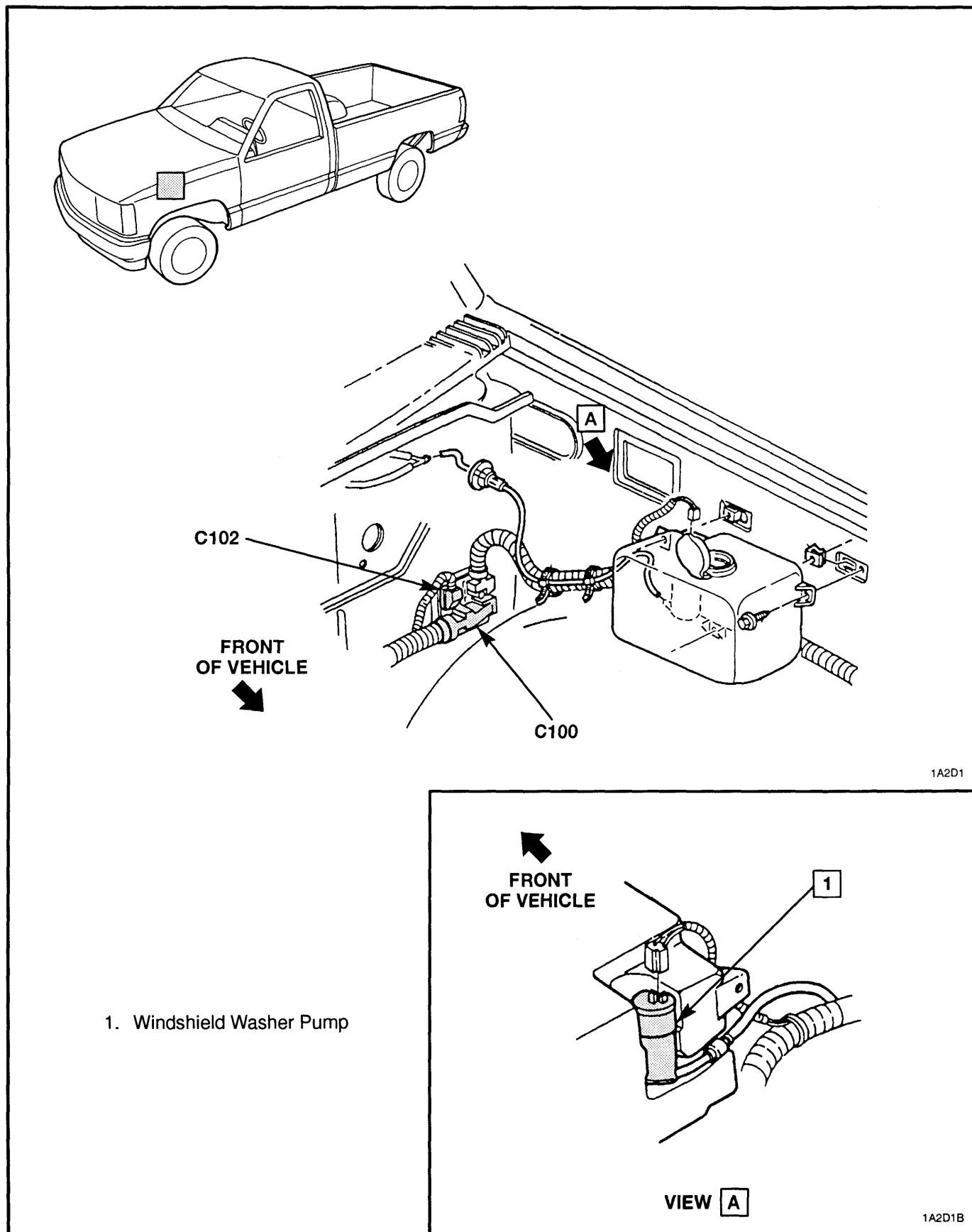
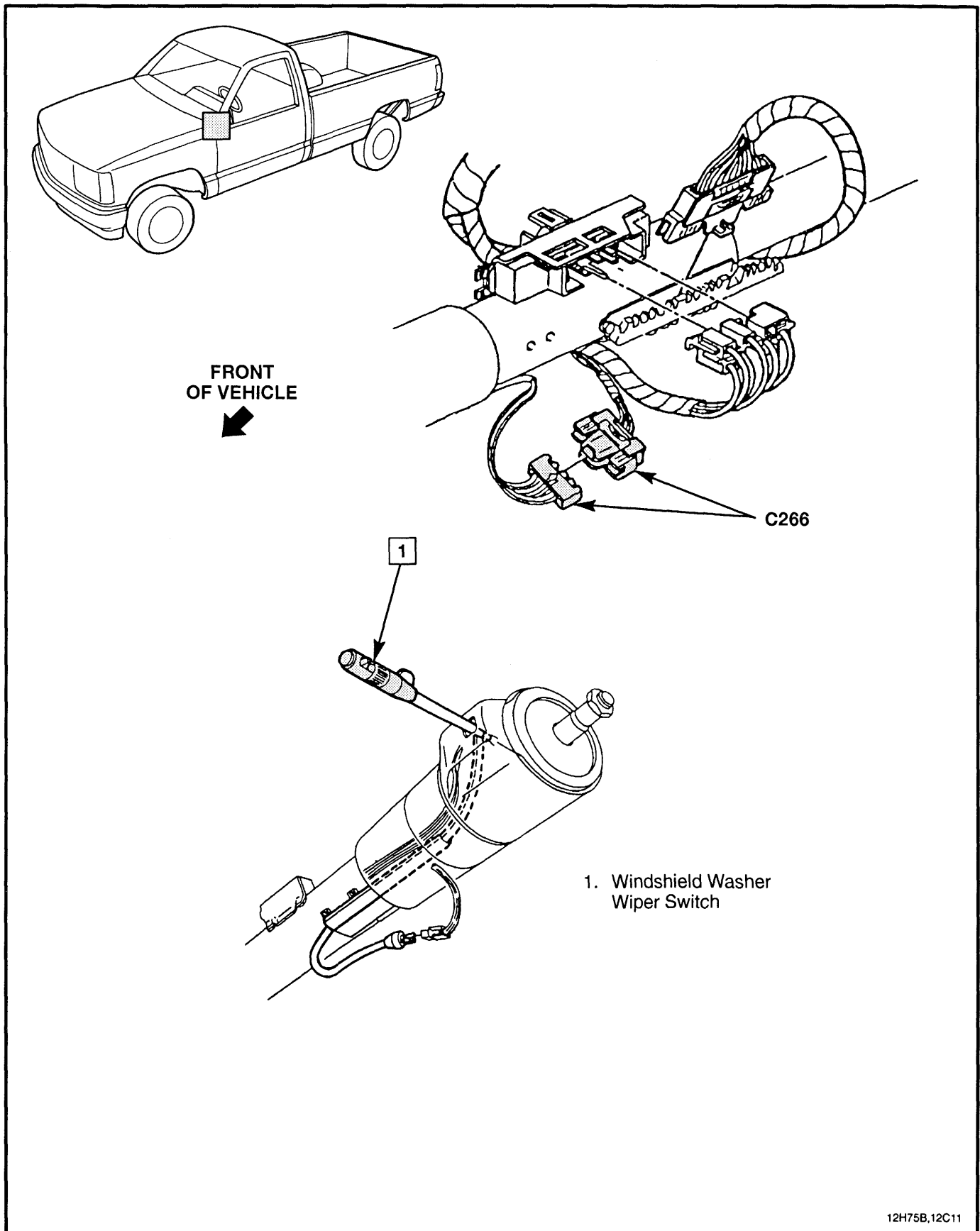


Figure 4 — Windshield Washer Reservoir and Pump, Except Suburban and Utility



12H75B, 12C11

Figure 5 — Steering Column Wiring, RH Side

## 8A-91-12 FRONT WIPER/WASHER

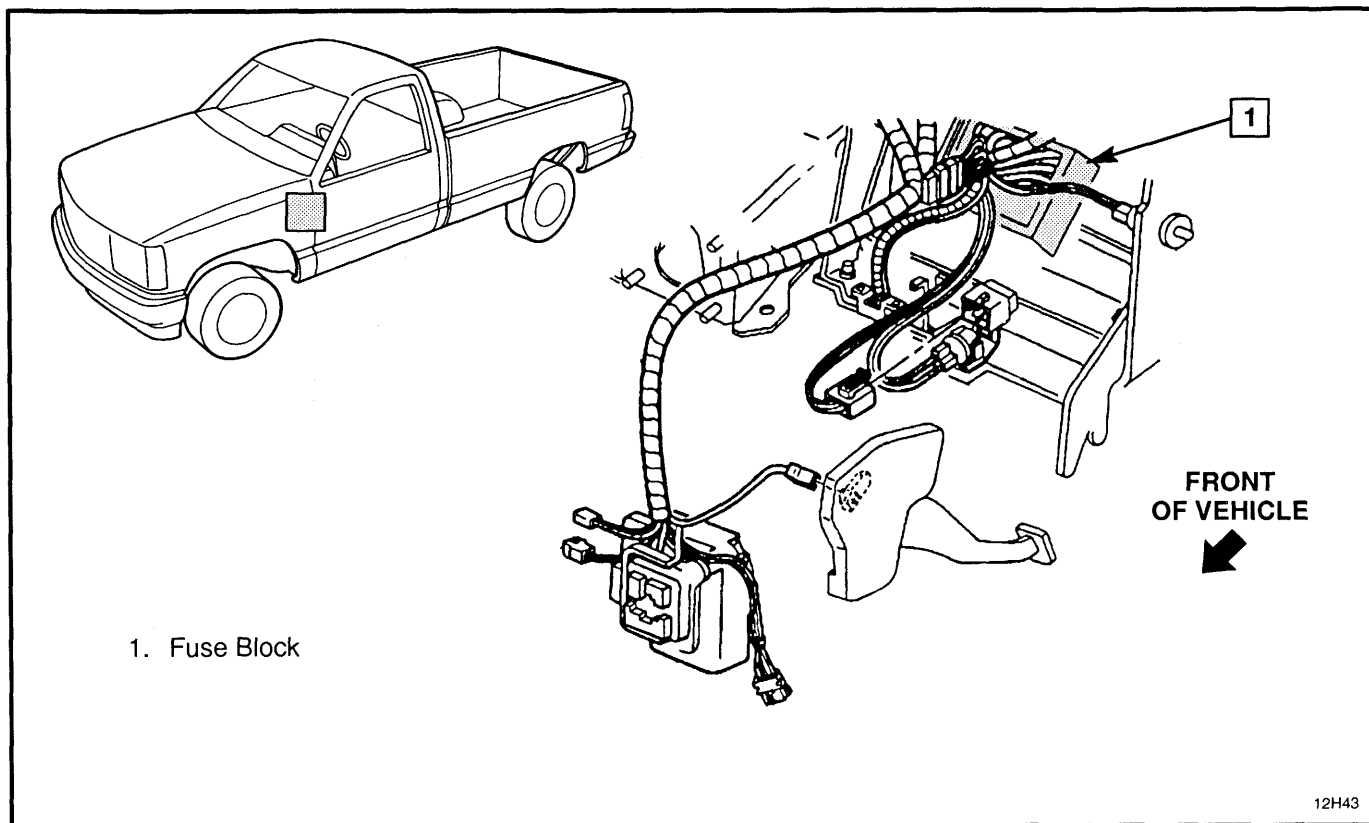


Figure 6 — LH Side of Instrument Panel

## CIRCUIT OPERATION

### PULSE REAR WIPER/WASHER

Voltage to the Rear Wiper/Washer is supplied through the ACC-IGN circuit breaker and WHT (393) wire with the Ignition Switch in ACC or RUN.

### WIPERS

In addition to the features of a conventional (non-pulse) Wiper System (MIST, LO and HI speeds), the Rear Pulse Wiper/Washer System includes an operating mode in which the wipers make single strokes with an adjustable time interval between strokes. The time interval is controlled by a Solid-State Pulse/Speed/Wash Control in the Wiper Motor Module. The duration of the relay interval is determined by the Pulse Delay Resistance in the Wiper/Washer Switch.

In the LO position, the Wiper/Washer Switch supplies voltage to the GRA (391) wire and the Pulse/Speed/Wash Control. The Pulse/Speed/Wash Control provides ground to the Park/Run Relay which is energized and supplies voltage to the brushes of the Wiper Motor. The wipers run at low speed until they are turned off.

With the Wiper/Washer Switch in the HI position, battery voltage is supplied from the DK GRN (392) wire directly to a second armature terminal of the Wiper Motor. The wipers run at high speed. When the Wiper/Washer Switch is turned to OFF, the wipers complete the last sweep at low speed and park.

When the wipers are turned off, the Wiper Motor runs at low speed until the wiper blades reach the PARK position. At that time the Park/Run Relay opens and shunts the Wiper Motor to stop it immediately. The wiper blades remain in the PARK position.

When the control is moved to MIST and released, the wipers make one sweep at low speed and return to PARK. The circuit operation is the same as low speed.

With the Wiper/Washer Switch in PULSE, voltage is supplied to the GRA (391) wire, the Wiper Motor Module and the Solid-State Control Board. Voltage is supplied to the Park/Run Relay coil which is momentarily grounded by the Pulse/Speed/Wash Control circuit and the relay closes. Battery voltage is supplied by the LT BLU (97) wire through the closed contacts of the Relay to run the Wiper Motor at LO speed. The relay remains energized as long as the contacts of the Park/Run Switch remain closed. When the wiper blades have reached PARK, the Park/Run Switch opens, de-energizing the Park/Run Relay. The wiper blades remain in PARK until the Control Board grounds the Park/Relay coil to start another sweep. The delay time between sweeps is controlled by the pulse delay resistors. The delay can be adjusted from 0 to 43 seconds.

### WASHER

When the Washer Switch is depressed, voltage is supplied to the Solid-State Control Board in the Wiper Control Module. The Wiper Switch supplies battery voltage to the Washer Motor through the DK GRN (392) wire. It also starts the wiper cycle through the low speed brushes of the Wiper Motor. The washer continues to run as long as the switch is held down. The Solid-State Control Board keeps the wipers on for approximately six seconds after the washer goes off. If the washer is switched on during the PULSE operation, the wipers run in low speed for six seconds. When the wash cycle is completed the Wipers return to the pulse operation.

The Wiper Motor is equipped with a circuit breaker which protects the motor when the wipers are blocked. The resulting high current will open the circuit breaker which will reset upon cooling.

### COMPONENT LOCATION

|                                 |                                    | Page — Figure |   |
|---------------------------------|------------------------------------|---------------|---|
| Convenience Center .....        | Under LH side of I/P .....         | 92-10         | 4 |
| Fuse Block .....                | Under LH side of I/P .....         | 92-9          | 3 |
| Rear Window Washer Pump .....   | At washer reservoir .....          | 92-8          | 1 |
| Rear Window Wiper/Washer Module | On lower rear liftgate glass ..... | 92-11         | 5 |
| Rear Window Wiper/Washer Switch | Center of I/P .....                | 92-10         | 4 |

### CONNECTORS:

|            |                                                      |           |   |
|------------|------------------------------------------------------|-----------|---|
| C260 ..... | Under LH end of I/P .....                            | 92-10     | 4 |
| C273 ..... | Behind LH side of I/P, near convenience center ..... | Not Shown |   |
| C406 ..... | RH upper rear body .....                             | 92-11     | 5 |
| C900 ..... | At rear window wiper module .....                    | 92-11     | 5 |

## 8A-92-2 REAR WIPER/WASHER

## COMPONENT LOCATION

Page — Figure

## GROMMETS:

|      |                         |       |   |
|------|-------------------------|-------|---|
| P120 | At lower LH cowl        | 92-10 | 4 |
| P405 | At endgate window frame | 92-11 | 5 |

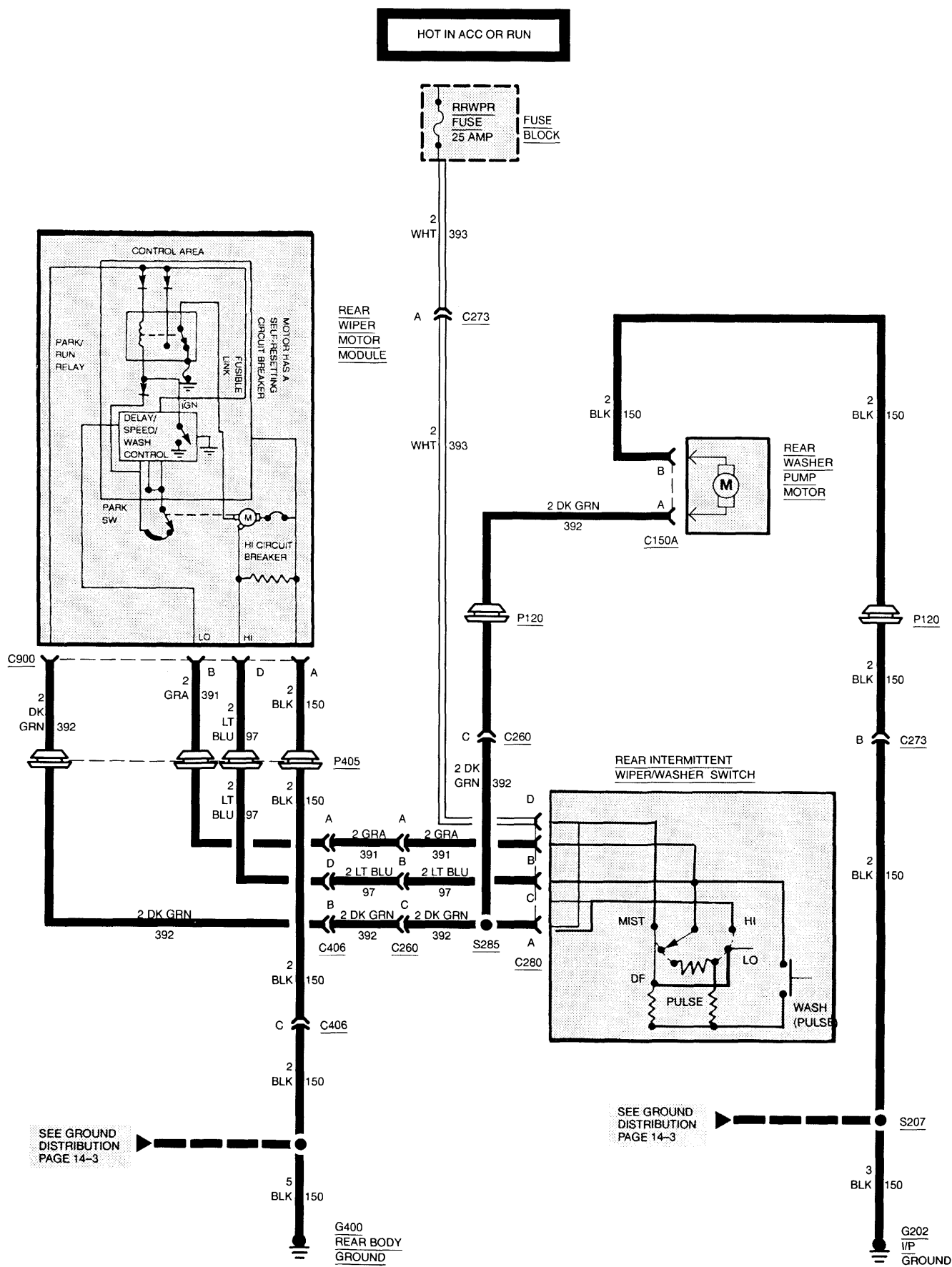
**GRUNDS:**

|      |                  |           |   |
|------|------------------|-----------|---|
| G202 | At DLC connector | 92-8      | 2 |
| G400 | At RH D-pillar   | Not Shown |   |

## SPLICES:

|      |                                                                      |       |   |
|------|----------------------------------------------------------------------|-------|---|
| S207 | Under LH side of I/P                                                 | 92-9  | 3 |
| S285 | Rear window wiper switch harness, near body wiring harness connector | 92-10 | 4 |
| S402 | Above rear liftgate glass opening                                    | 92-12 | 6 |

REAR WIPER/WASHER 8A-92-3



## DIAGNOSIS — REAR WIPER/WASHER

### PRELIMINARY CHECKS:

1. Check to see if RR WPR Fuse is blown. If fuse is blown, locate and repair source of overload. Replace fuse.
2. If fuse is not blown, proceed with the following diagnostic procedures.

#### REAR WIPER DOES NOT OPERATE IN ANY MODE

| TEST                                                                                                                                                                                                           | RESULT                                         | ACTION                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Turn ignition switch to ACC or RUN. Connect test lamp from WHT (393) wire at rear wiper switch connector C280 to ground.                                                                                    | Test lamp lights.                              | GO to step 2.                                                                                                                                                                                    |
|                                                                                                                                                                                                                | Test lamp does not light.                      | LOCATE and REPAIR open in WHT (393) wire between rear wiper switch connector C280 and convenience center connector C273, or from convenience center connector C273 to fuse block.                |
| 2. Connect test lamp from GRA (391) wire at rear wiper switch connector C280 to ground. Move rear wiper switch to LO position. Repeat at LT BLU (97) wire with wiper switch in HI.                             | Test lamp lights at both wires.                | GO to step 3.                                                                                                                                                                                    |
|                                                                                                                                                                                                                | Test lamp does not light at one or both wires. | REPLACE rear wiper switch.                                                                                                                                                                       |
| 3. Disconnect rear wiper/washer module connector C900. Connect test lamp from GRA (391) wire at connector C900 to ground. Move rear wiper switch to LO position. Repeat at LT BLU (97) wire with switch in HI. | Test lamp lights at both wires.                | GO to step 4.                                                                                                                                                                                    |
|                                                                                                                                                                                                                | Test lamp does not light at one or both wires. | LOCATE and REPAIR open in GRA (391) or LT BLU (97) wire between rear wiper/washer module connector C900 and connector C406, from C406 to C260, or from C260 to rear wiper switch connector C280. |
| 4. Connect test lamp from GRA (391) or LT BLU (97) wire to BLK (150) wire at rear wiper/washer module connector C900. Move rear wiper switch to LO.                                                            | Test lamp lights.                              | REPAIR rear wiper/washer module. Refer to Section 8E in the 1994 C/K Service Manual.                                                                                                             |
|                                                                                                                                                                                                                | Test lamp does not light.                      | LOCATE and REPAIR open in BLK (150) wire between rear wiper/washer module connector C900 and connector C406, from C406 to splice S402, or from S402 to ground G400.                              |

**REAR WIPER/WASHER 8A-92-5****REAR WIPER OPERATES AT LOW SPEED ONLY (HIGH SPEED INOPERATIVE)**

| TEST                                                                                                                                                                                        | RESULT                    | ACTION                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from DK GRN (392) wire at rear wiper switch connector C280 to ground. Move switch to HI position.                                                                      | Test lamp lights.         | GO to step 2.                                                                                                                                                                                 |
|                                                                                                                                                                                             | Test lamp does not light. | REPLACE rear wiper switch.                                                                                                                                                                    |
| 2. Disconnect rear wiper/washer module connector C900. Connect test lamp from LT BLU (97) wire at rear wiper/washer module connector C900 to ground. Move rear wiper switch to HI position. | Test lamp lights.         | REPAIR rear wiper/washer module.                                                                                                                                                              |
|                                                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in LT BLU (97) wire between rear wiper/washer module connector C900 and connector C406, from C406 to connector C260, or from C260 to rear wiper switch connector C280. |

**REAR WIPER OPERATES AT HIGH SPEED ONLY (LOW SPEED INOPERATIVE)**

| TEST                                                                                                                                                                                      | RESULT                    | ACTION                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from GRA (391) wire at rear wiper switch connector C280 to ground. Move switch to LO position.                                                                       | Test lamp lights.         | GO to step 2.                                                                                                                                                                               |
|                                                                                                                                                                                           | Test lamp does not light. | REPLACE rear wiper switch.                                                                                                                                                                  |
| 2. Disconnect rear wiper/washer module connector C900. Connect test lamp from GRA (391) wire at rear wiper/washer module connector C900 to ground. Move rear wiper switch to LO position. | Test lamp lights.         | REPAIR rear wiper/washer module.                                                                                                                                                            |
|                                                                                                                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in GRA (391) wire between rear wiper/washer module connector C900 and connector C406, from C406 to connector C260, or from C260 to rear wiper switch connector C280. |

**REAR WIPER WILL NOT SHUT OFF OR PARK**

| TEST                                                                                                                                                            | RESULT                    | ACTION                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Turn ignition switch to ACC or RUN and rear wiper switch to OFF. Connect test lamp from GRA (391) wire at rear wiper/washer module connector C900 to ground. | Test lamp lights.         | REPLACE rear wiper switch.                                                                                                                                          |
|                                                                                                                                                                 | Test lamp does not light. | GO to step 2.                                                                                                                                                       |
| 2. Connect self-powered test lamp from ground to BLK (150) wire at rear wiper/washer module connector C900.                                                     | Test lamp lights.         | REPAIR rear wiper/washer module. Refer to Section 8E in the 1994 C/K Service Manual.                                                                                |
|                                                                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear wiper/washer module connector C900 and connector C406, from C406 to splice S402, or from S402 to ground G400. |



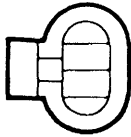
## 8A-92-6 REAR WIPER/WASHER

### REAR WASHER WILL NOT OPERATE

| TEST                                                                                                                                                         | RESULT                    | ACTION                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch to ACC or RUN and rear washer switch to ON. Connect test lamp from DK GRN (392) wire at rear wiper switch connector C280 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                   |
|                                                                                                                                                              | Test lamp does not light. | REPLACE rear washer switch.                                                                                                                                                     |
| 2. Disconnect rear washer pump connector C150A. Connect test lamp from DK GRN (392) at rear washer pump connector C150A to ground.                           | Test lamp lights.         | GO to step 3.                                                                                                                                                                   |
|                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in DK GRN (392) wire between rear washer pump connector C150A and splice S285 or from S285 to rear washer switch connector C280.                         |
| 3. Connect test lamp from DK GRN (392) wire to BLK (150) wire at rear washer pump connector C150A.                                                           | Test lamp lights.         | REPLACE rear washer pump.                                                                                                                                                       |
|                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between rear washer pump connector C150A and convenience center connector C270, from C270 to splice S207, or from S207 to ground G102. |

# REAR WIPER/WASHER 8A-92-7

12020599



**BLACK**  
Metri-Pack 280  
**C150A**  
Rear Washer Pump Motor

12034344



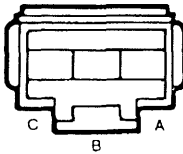
**BLACK**  
Metri-Pack 280  
**C273**  
In-Line I/P to Wiper Switch

12034343



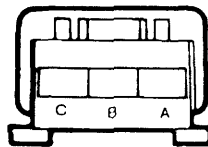
**BLACK**  
Metri-Pack  
**C273**  
In-Line Wiper Switch to I/P

12020398



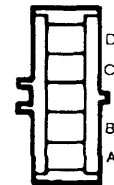
**BLACK**  
Metri-Pack 180  
**C260**  
In-Line Wiper Extension to Switch

12020397



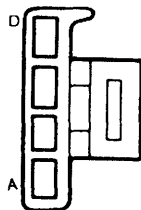
**BLACK**  
Metri-Pack 280  
**C260**  
In-Line Wiper Switch to Extension

08905220



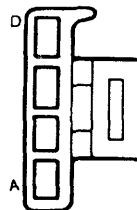
**BLACK**  
Pac/on  
**C406**  
In-Line Rear Wiper to Extension Harness

12052856



**C280**  
Rear Wiper Switch

12052856



**C900**  
Rear Wiper Module

## 8A-92-8 REAR WIPER/WASHER

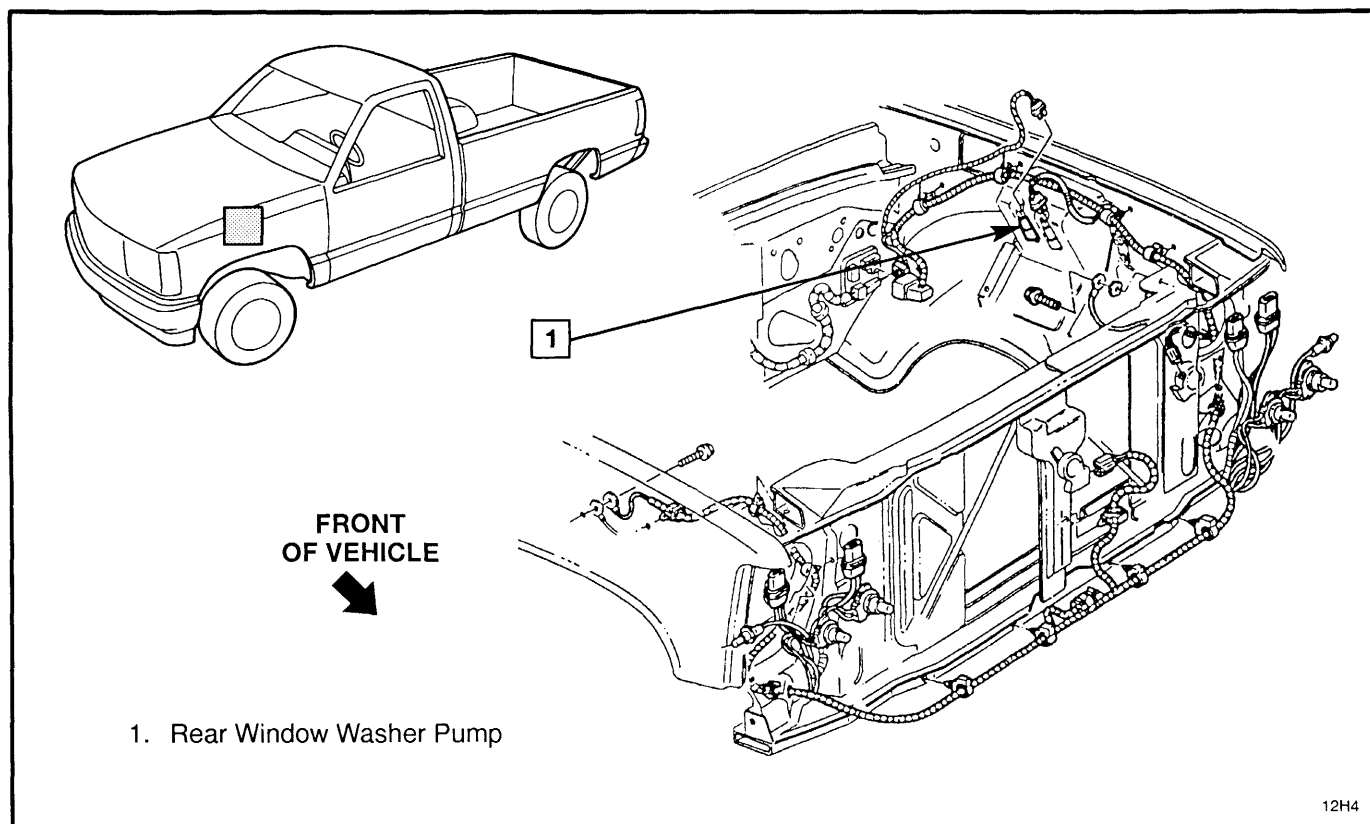


Figure 1 — Rear Window Washer Pump

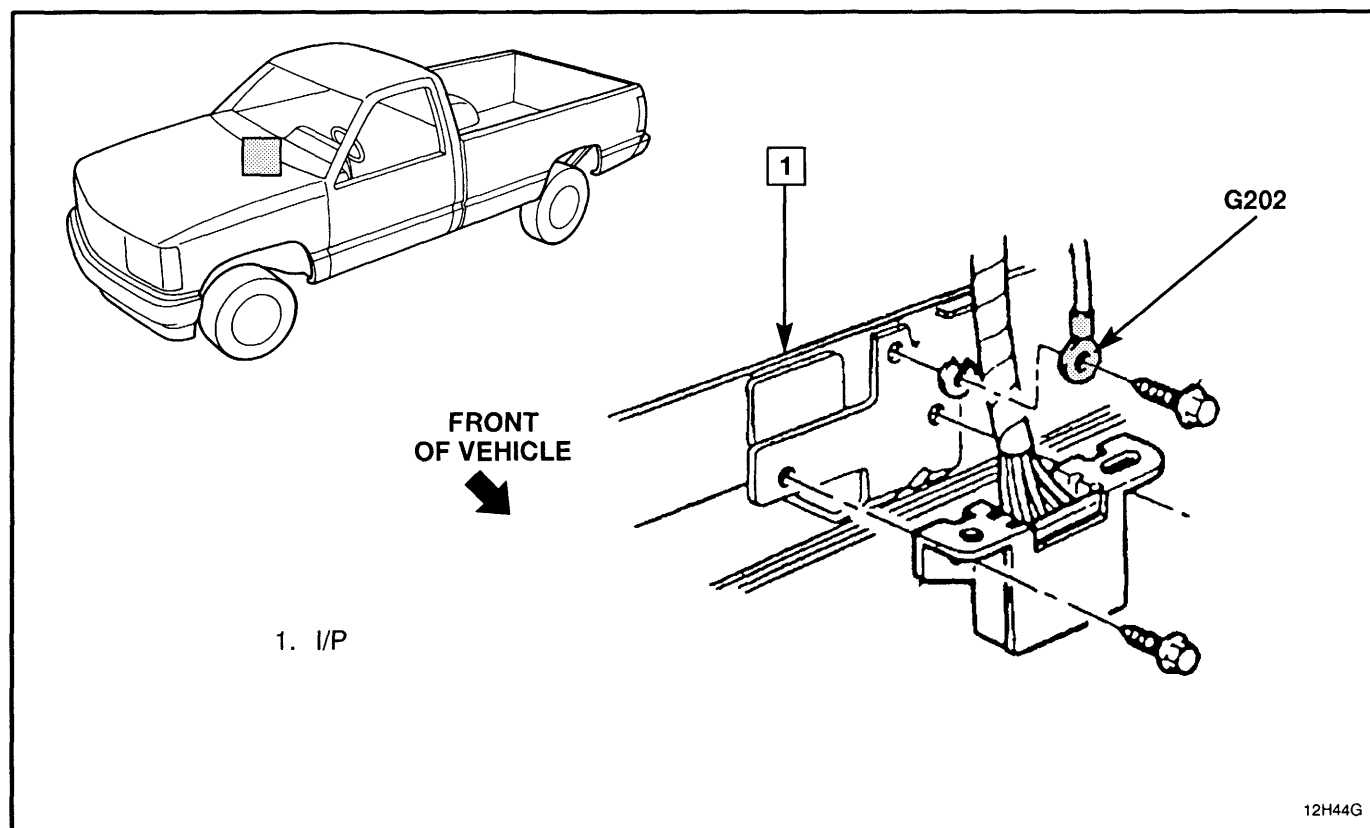


Figure 2 — I/P Ground

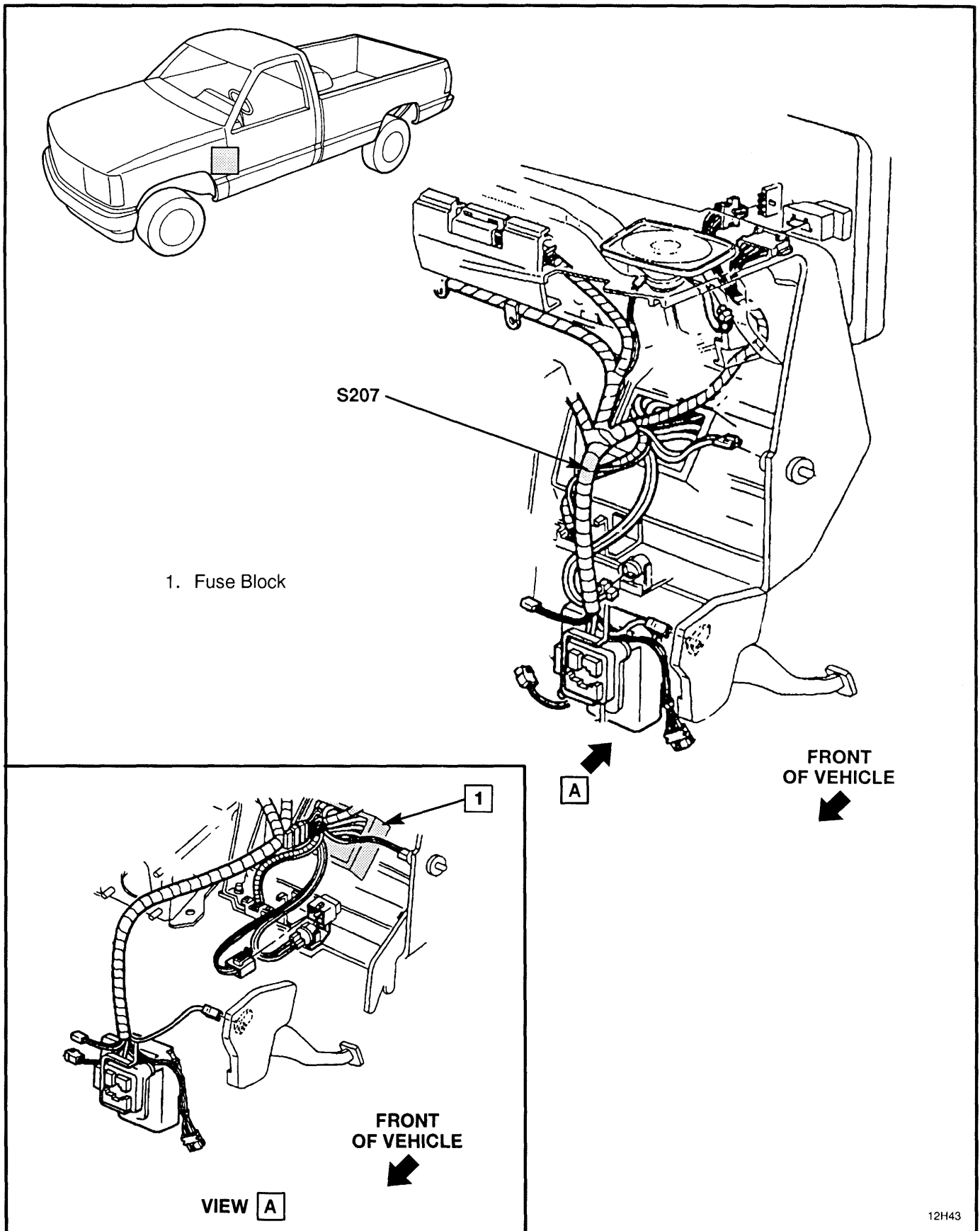


Figure 3 — LH Side of Instrument Panel

## 8A-92-10 REAR WIPER/WASHER

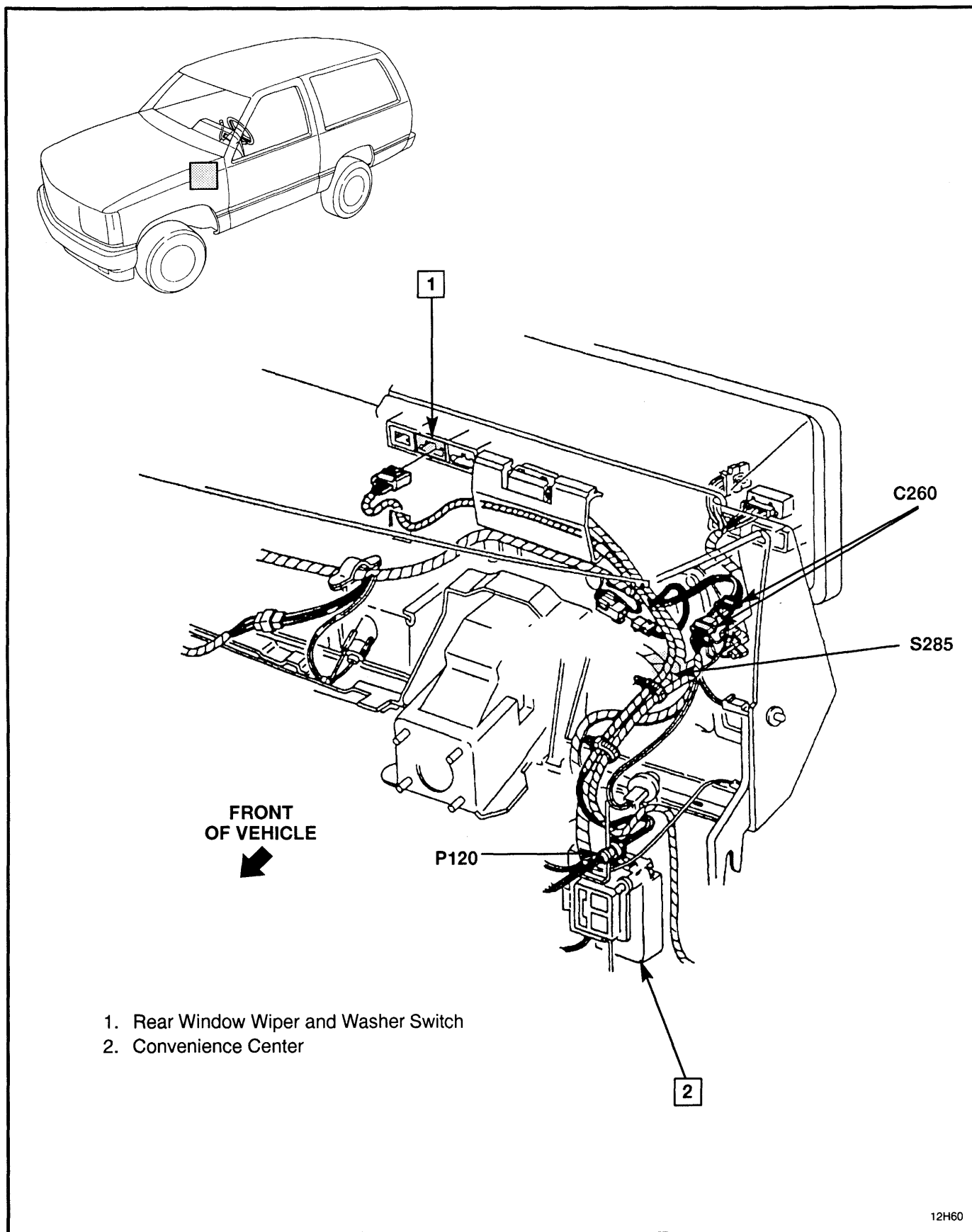


Figure 4 — Rear Window Wiper and Washer Front Wiring – Utility and Suburban

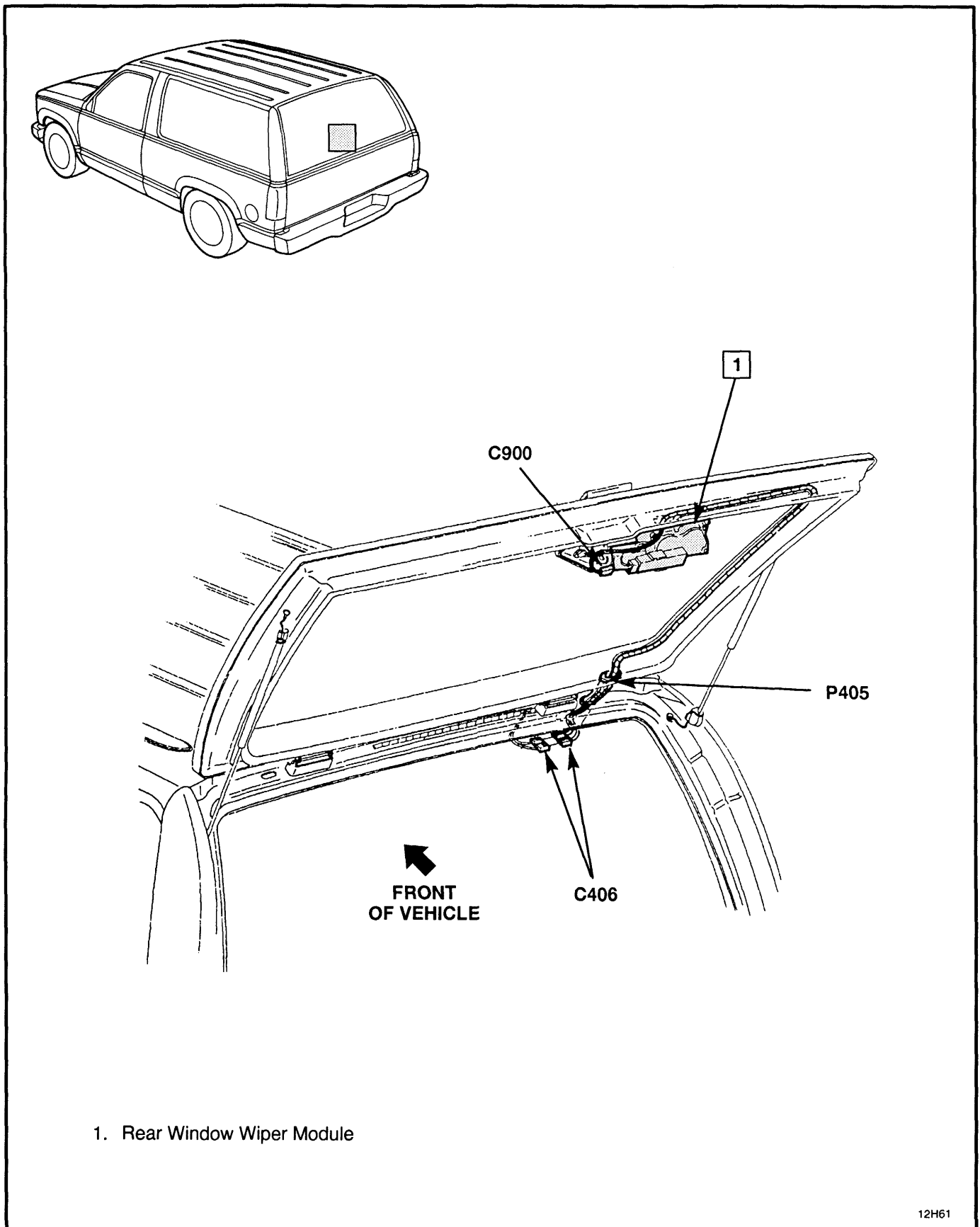


Figure 5 — Rear Window Wiper and Washer Rear Wiring – Utility and Suburban

## 8A-92-12 REAR WIPER/WASHER

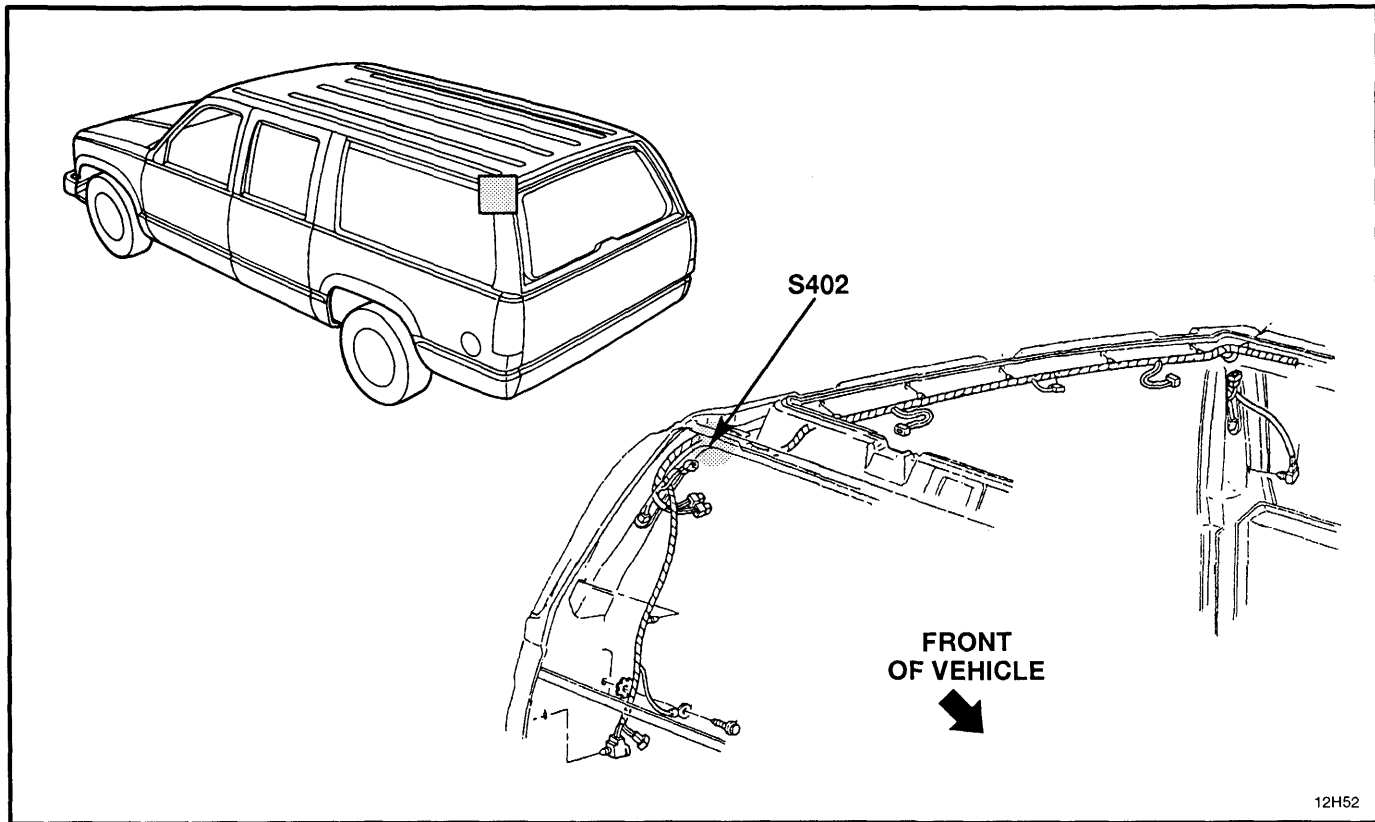


Figure 6 — Body Wiring, Rear — Suburban

## CIRCUIT OPERATION

### HEADLAMPS

Voltage is supplied to the Light Switch at all times. The Light Switch includes a Self-Resetting Circuit Breaker. The Circuit Breaker opens when the Headlight circuit draws too much current. When the Circuit Breaker opens, it interrupts the current flow. With no current flow, the Circuit Breaker cools off and resets automatically. When the Light Switch is in HEAD, the Headlamp Dimmer Switch directs voltage to either the Low Beams or High Beams. The High Beam Indicator also receives voltage along with the High Beams.

### FOG LAMPS

Voltage is supplied to the Fog Lamp Relay at all times through the ORN/BLK (60) wire and the ACC-BATT circuit

breaker. When the Fog Lamp switch is ON, voltage is supplied to the coil of the Fog Lamp Relay through the BRN (9) wire. Ground for the coil is provided through the YEL (317) wire, the Logic Circuit of the Fog Lamp Switch, the BLK (150) wire to the Convenience Center and Ground G202. With the relay energized, voltage is provided to the Fog Lamps through the PPL (34) wire. The Fog Lamp Indicator is illuminated by the Logic Circuit located in the Fog Lamp Switch.

If the headlamps are on HIGH BEAM, voltage is supplied to LT GRN (11) wire to the Logic Circuit of the Fog Lamp Switch. This interrupts the voltage for the Fog Lamps and de-energizes the circuit.

### COMPONENT LOCATION

### Page — Figure

|                                  |                                        |           |   |
|----------------------------------|----------------------------------------|-----------|---|
| Convenience Center .....         | Under LH side of I/P .....             | 100-13    | 3 |
| Fog Lamp, LH .....               | Lower ends of front bumper .....       | 100-16    | 7 |
| Fog Lamp, RH .....               | Lower ends of front bumper .....       | 100-16    | 7 |
| Fog Lamp Relay .....             | Under LH end of I/P .....              | 100-13    | 3 |
| Fog Lamp Switch .....            | RH side of instrument cluster .....    | 100-13    | 3 |
| Headlamp Dimmer Switch .....     | Lower LH side of steering column ..... | 100-17    | 8 |
| Headlamp, LH High/Low Beam ..... | LH front of vehicle .....              | Not Shown |   |
| Headlamp, RH High/Low Beam ..... | RH front of vehicle .....              | Not Shown |   |
| Headlamp, LH High Beam .....     | LH front of vehicle .....              | Not Shown |   |
| Headlamp, RH High Beam .....     | RH front of vehicle .....              | Not Shown |   |
| Headlamp, LH Low Beam .....      | LH front of vehicle .....              | Not Shown |   |
| Headlamp, RH Low Beam .....      | RH front of vehicle .....              | Not Shown |   |
| Instrument Cluster .....         | LH side of I/P .....                   | 100-17    | 9 |
| Light Switch .....               | Upper LH side of I/P .....             | 100-16    | 6 |

### CONNECTORS:

|            |                                              |        |   |
|------------|----------------------------------------------|--------|---|
| C100 ..... | At bulkhead connector .....                  | 100-12 | 1 |
| C102 ..... | At bulkhead connector .....                  | 100-12 | 1 |
| C183 ..... | LH rear engine compartment, near GT103 ..... | 100-13 | 3 |

### GROMMETS:

|            |                                                                   |        |   |
|------------|-------------------------------------------------------------------|--------|---|
| P103 ..... | LH rear engine compartment at cowl, near bulkhead connector ..... | 100-13 | 3 |
|------------|-------------------------------------------------------------------|--------|---|

### GROUND:

|            |                                         |        |   |
|------------|-----------------------------------------|--------|---|
| G104 ..... | On sheet metal, above LH headlamp ..... | 100-14 | 4 |
| G105 ..... | RH inner fender, near battery .....     | 100-14 | 4 |
| G202 ..... | At DLC connector .....                  | 100-12 | 2 |



## 8A-100-2 HEADLAMPS AND FOG LAMPS

---

### COMPONENT LOCATION

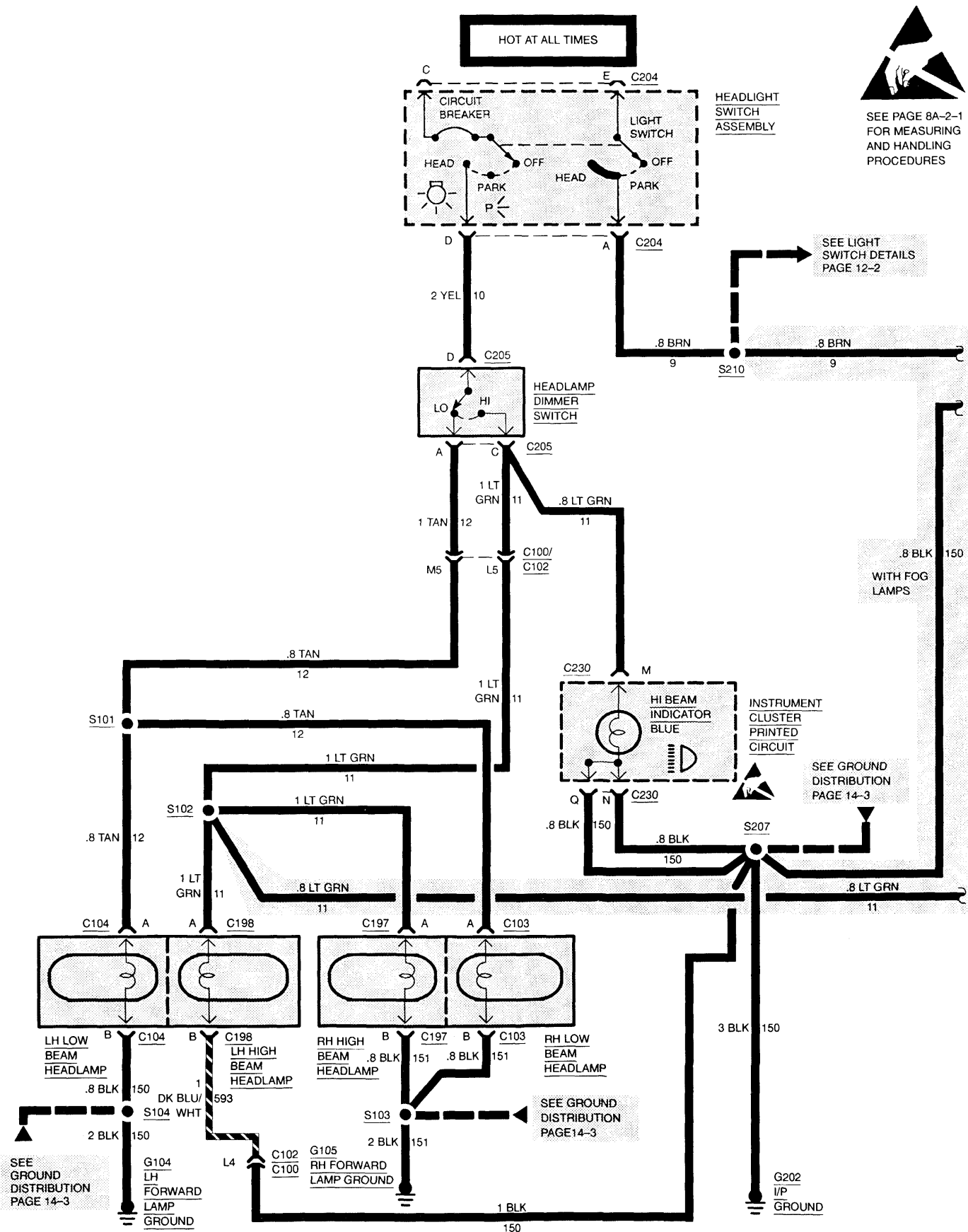
Page — Figure

#### SPLICES:

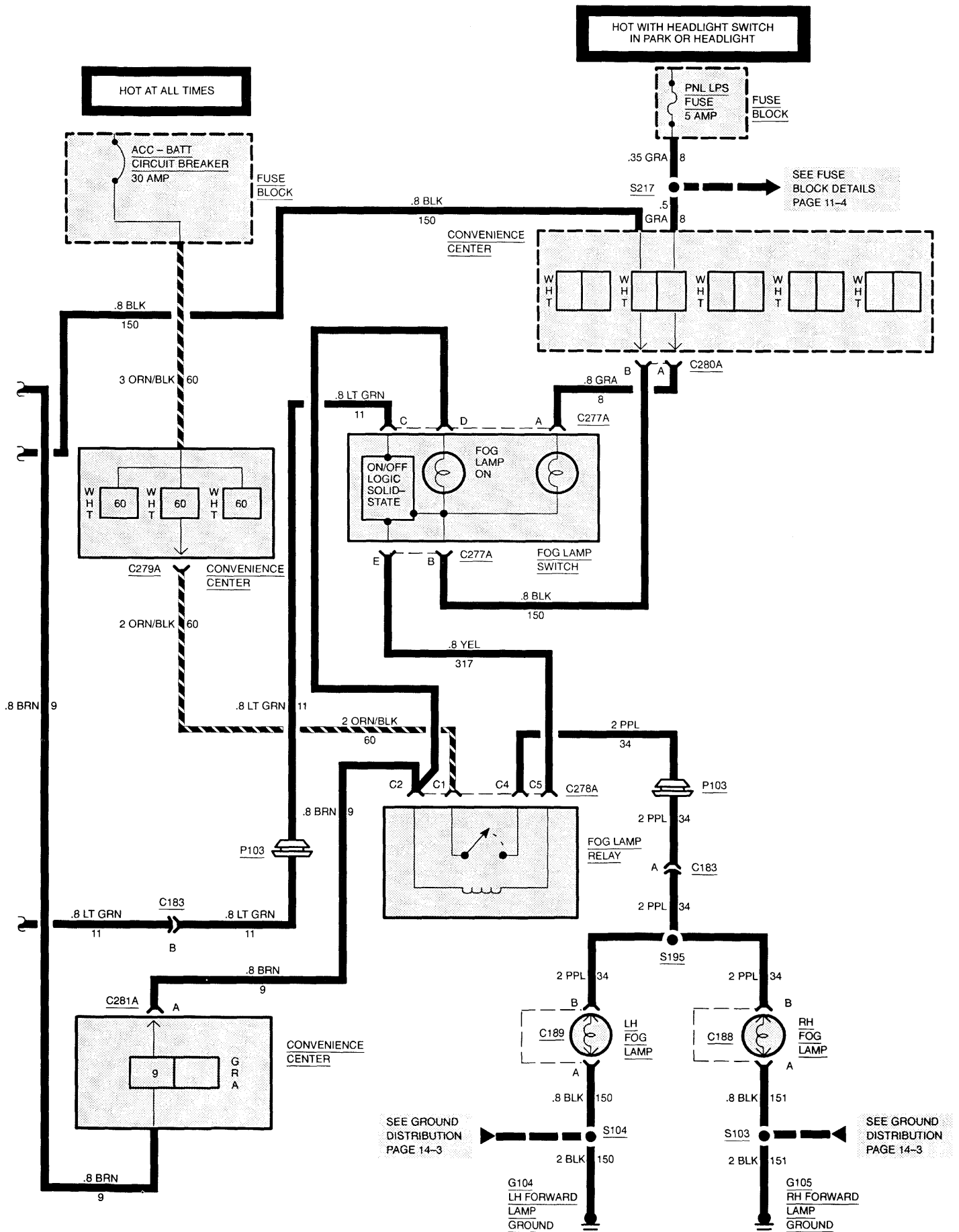
|      |                                    |        |   |
|------|------------------------------------|--------|---|
| S101 | ..... LH side, near headlamp ..... | 100-14 | 4 |
| S102 | ..... LH side, near headlamp ..... | 100-14 | 4 |
| S103 | ..... RH side, near headlamp ..... | 100-14 | 4 |
| S104 | ..... LH side, near headlamp ..... | 100-15 | 5 |
| S195 | ..... LH side, near headlamp ..... | 100-15 | 5 |
| S207 | ..... Under LH side of I/P .....   | 100-16 | 6 |
| S210 | ..... Under LH side of I/P .....   | 100-16 | 6 |
| S217 | ..... Under LH side of I/P .....   | 100-16 | 6 |

[illegible]

# 8A-100-4 HEADLAMPS AND FOG LAMPS



# HEADLAMPS AND FOG LAMPS 8A-100-5



## 8A-100-6 HEADLAMPS AND FOG LAMPS

### DIAGNOSIS — HEADLAMPS AND FOG LAMPS

#### PRELIMINARY CHECKS:

1. Check condition of ACC-BATT circuit breaker. If breaker will not reset, locate and repair source of overload.

#### HEADLAMPS DO NOT ILLUMINATE HIGH OR LOW BEAMS — BOTH SIDES

| TEST                                                                                                                                                        | RESULT                    | ACTION                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from RED (2) wire at light switch connector C204 to ground.                                                                            | Test lamp lights.         | GO to step 3.                                                                                                          |
|                                                                                                                                                             | Test lamp does not light. | GO to step 2.                                                                                                          |
| 2. Connect test lamp from RED (2) wire at connector C202 to ground.                                                                                         | Test lamp lights.         | LOCATE and REPAIR open in RED (2) wire between connector C202 and light switch connector C204.                         |
|                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire or BLK (2) fusible link between connector C202 and Battery Junction Block.      |
| 3. Place the light switch in ON and the headlamp dimmer switch in HIGH BEAM. Connect test lamp from YEL (10) wire at light switch connector C204 to ground. | Test lamp lights.         | GO to step 4.                                                                                                          |
|                                                                                                                                                             | Test lamp does not light. | REPLACE light switch.                                                                                                  |
| 4. Connect test lamp from YEL (10) wire at headlamp dimmer connector C205 to ground.                                                                        | Test lamp lights.         | REPLACE headlamp dimmer switch.                                                                                        |
|                                                                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in YEL (10) wire between light switch connector C204 and headlamp dimmer switch connector C205. |

#### LOW BEAM LAMP(S) DO NOT OPERATE (SINGLE HEADLAMPS)

| TEST                                                                                                                                                                   | RESULT                    | ACTION                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place light switch in ON and headlamp dimmer switch in LOW BEAM position. Connect test lamp from TAN (12) wire at inoperative lamp(s) to ground.                    | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                        | Test lamp does not light. | GO to step 3.                                                                                                                                                                                                                                                                                  |
| 2. Connect test lamp from TAN (12) wire to BLK (151) wire at RH headlamp connectors C103 or from TAN (12) wire to DK BLU/WHT (593) wire at LH headlamp connector C104. | Test lamp lights.         | REPLACE headlamp(s).                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire from RH headlamp connector C103 to ground G105 or LOCATE and REPAIR open in DK BLU/WHT (593) wire from LH headlamp connector C104, to bulkhead connector C102/C100 or BLK (150) wire from C100 to splice S207 or from splice S207 to I/P ground G202. |

## HEADLAMPS AND FOG LAMPS 8A-100-7

### LOW BEAM LAMP(S) DO NOT OPERATE (SINGLE HEADLAMPS) (CONTINUED)

| TEST                                                                                        | RESULT                    | ACTION                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3. Connect test lamp from TAN (12) wire at headlamp dimmer switch connector C205 to ground. | Test lamp lights.         | LOCATE and REPAIR open in BLK (151) wire from RH headlamp connector C103 to ground G105 or LOCATE and REPAIR open in DK BLU/WHT (593) wire from LH headlamp connector C104 to bulkhead connector C102/C100 or BLK (150) wire from C100 to splice S207 or from splice S207 to I/P ground G202. |
|                                                                                             | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                                                                                                                                                                                               |

### HIGH BEAM LAMP(S) DO NOT OPERATE (SINGLE HEADLAMPS)

| TEST                                                                                                                                                       | RESULT                    | ACTION                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1. Place headlamp switch in ON and headlamp dimmer switch in HIGH BEAM position. Connect test lamp from LT GRN (11) wire at inoperative lamp(s) to ground. | Test lamp lights.         | GO to step 2.                                                                                                                  |
|                                                                                                                                                            | Test lamp does not light. | GO to step 3.                                                                                                                  |
| 2. Connect a test lamp from LT GRN (11) wire to DK BLU/WHT (593) LH or BLK (151) RH wire(s) at light connectors C103 RH or C104 LH.                        | Test lamp lights.         | REPLACE headlamp(s).                                                                                                           |
|                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire at headlamp connector C103 to ground connection G105 or from C104 to I/P ground G202. |
| 3. Connect test lamp from LT GRN (11) wire at headlamp dimmer switch connector C205 to ground.                                                             | Test lamp lights.         | LOCATE and REPAIR open in LT GRN (11) wire from headlamp connector(s) C103 or C104 to headlamp dimmer switch connector C205.   |
|                                                                                                                                                            | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                                |

### FOG LAMPS DO NOT OPERATE

| TEST                                                                                                                      | RESULT                    | ACTION                                                                          |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------|
| 1. Place fog lamp switch in ON and light switch in OFF. Connect test lamp from PPL (34) wire at connector C183 to ground. | Test lamp lights.         | LOCATE and REPAIR open in PPL (34) wire between connector C183 and splice S111. |
|                                                                                                                           | Test lamp does not light. | GO to step 2.                                                                   |
| 2. Connect test lamp from PPL (34) wire at fog lamp relay connector C278A to ground.                                      | Test lamp lights.         | LOCATE and REPAIR open in PPL (34) wire from fog lamp relay to fog lamps.       |
|                                                                                                                           | Test lamp does not light. | GO to step 3.                                                                   |
| 3. Connect test lamp from ORN/BLK (60) wire at fog lamp relay connector C278A to ground.                                  | Test lamp lights.         | GO to step 5.                                                                   |
|                                                                                                                           | Test lamp does not light. | GO to step 4.                                                                   |

## 8A-100-8 HEADLAMPS AND FOG LAMPS

### FOG LAMPS DO NOT OPERATE (CONTINUED)

| TEST                                                                                                        | RESULT                    | ACTION                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 4. Connect test lamp from ORN/BLK (60) wire at convenience center tap connector C279A to ground.            | Test lamp lights.         | LOCATE and REPAIR open in ORN/BLK (60) wire from fog lamp relay connector C278A to convenience center tap connector C279A.   |
|                                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in ORN/BLK (60) wire between convenience center and fuse block.                                       |
| 5. Connect test lamp from BRN (9) wire at fog lamp relay connector C278A to ground.                         | Test lamp lights.         | GO to step 8.                                                                                                                |
|                                                                                                             | Test lamp does not light. | GO to step 6.                                                                                                                |
| 6. Connect test lamp from BRN (9) wire at convenience center tap connector C281A to ground.                 | Test lamp lights.         | LOCATE and REPAIR open in BRN (9) wire between convenience center tap connector C281A and fog lamp relay connector C278A.    |
|                                                                                                             | Test lamp does not light. | GO to step 7.                                                                                                                |
| 7. Place light switch in PARK. Observe taillamps.                                                           | Taillamps are ON.         | LOCATE and REPAIR open in BRN (9) wire between convenience center and splice S210.                                           |
|                                                                                                             | Taillamps are OFF.        | LOCATE and REPAIR open in BRN (9) wire between light switch connector C204 and splice S210.                                  |
| 8. Connect self-powered test lamp from YEL (317) wire at fog lamp relay connector C278A to ground.          | Test lamp lights.         | REPLACE fog lamp relay.                                                                                                      |
|                                                                                                             | Test lamp does not light. | GO to step 9.                                                                                                                |
| 9. Connect self-powered test lamp from YEL (317) wire at fog lamp switch connector C277A to ground.         | Test lamp lights.         | LOCATE and REPAIR open in YEL (317) wire between fog lamp switch connector C277A and fog lamp relay connector C278A.         |
|                                                                                                             | Test lamp does not light. | GO to step 10.                                                                                                               |
| 10. Connect self-powered test lamp from BLK (150) wire at fog lamp switch connector C277A to ground.        | Test lamp lights.         | REPLACE fog lamp switch.                                                                                                     |
|                                                                                                             | Test lamp does not light. | GO to step 11.                                                                                                               |
| 11. Connect self-powered test lamp from BLK (150) wire at convenience center tap connector C280A to ground. | Test lamp lights.         | LOCATE and REPAIR open in BLK (150) wire between convenience center tap connector C280A and fog lamp switch connector C722A. |
|                                                                                                             | Test lamp does not light. | GO to step 12.                                                                                                               |
| 12. Turn on radio.                                                                                          | Radio operates.           | LOCATE and REPAIR open in BLK (150) wire between convenience center and splice S207.                                         |
|                                                                                                             | Radio does not operate.   | LOCATE and REPAIR open in BLK (150) wire between splice S207 and ground G202.                                                |

## HEADLAMPS AND FOG LAMPS 8A-100-9

### LOW BEAM LAMP(S) DO NOT OPERATE (QUAD HEADLAMPS)

| TEST                                                                                                                                                | RESULT                    | ACTION                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place light switch in ON and headlamp dimmer switch in LOW BEAM position. Connect test lamp from TAN (12) wire at inoperative lamp(s) to ground. | Test lamp lights.         | GO to step 2.                                                                                                                        |
|                                                                                                                                                     | Test lamp does not light. | GO to step 3.                                                                                                                        |
| 2. Connect test lamp from TAN (12) wire to BLK (150 or 151) wire(s) at headlamp connectors C103 RH or C104 LH to ground.                            | Test lamp lights.         | REPLACE headlamp(s).                                                                                                                 |
|                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (150 or 151) wire(s) from RH headlamp connector(s) C103 RH or C104 LH to ground(s) G104 LH or G105 RH. |
| 3. Connect test lamp from TAN (12) wire at headlamp dimmer switch connector C205 to ground                                                          | Test lamp lights.         | LOCATE and REPAIR open in TAN (12) wire from headlamp dimmer switch connector C205 to headlamp connector(s) C103 or C104.            |
|                                                                                                                                                     | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                                      |

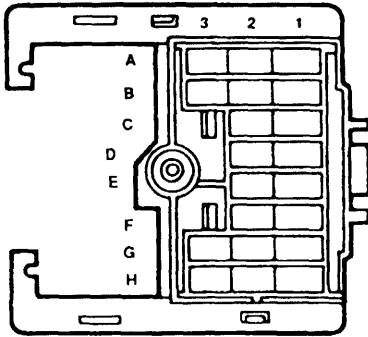
### HIGH BEAM LAMP(S) DO NOT OPERATE (QUAD HEADLAMPS)

| TEST                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place headlamp switch in ON and headlamp dimmer switch in HIGH BEAM position. Connect test lamp from LT GRN (11) wire at inoperative lamp(s) to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                               |
|                                                                                                                                                            | Test lamp does not light. | GO to step 3.                                                                                                                                                               |
| 2. Connect a test lamp from LT GRN (11) wire to DK BLU/WHT (593) LH or BLK (151) RH wire(s) at light connectors C197 RH or C198 LH.                        | Test lamp lights.         | REPLACE headlamp(s).                                                                                                                                                        |
|                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire at headlamp connection C197 to ground connection G105 or from DK BLU/WHT (593) wire at headlamp connector C198 to I/P ground G202. |
| 3. Connect test lamp from LT GRN (11) wire at headlamp dimmer switch connector C205 to ground.                                                             | Test lamp lights.         | LOCATE and REPAIR open in LT GRN (11) wire from headlamp connector(s) C103 or C104 to headlamp dimmer switch connector C205.                                                |
|                                                                                                                                                            | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                                                                             |



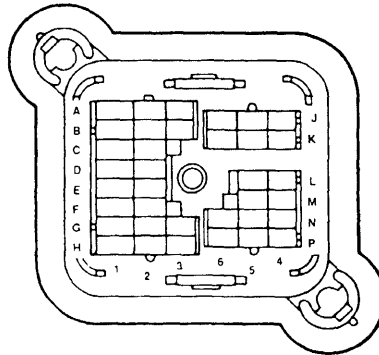
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12020183



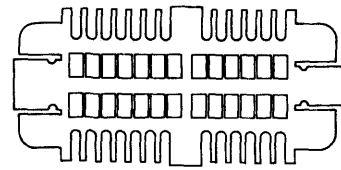
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



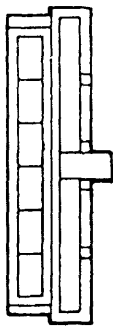
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Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



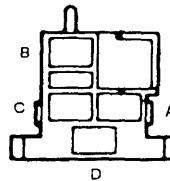
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12034061



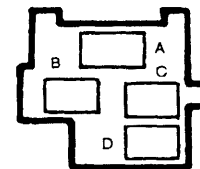
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

08917693



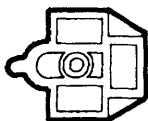
**BLACK**  
56 Series  
**C203**  
Headlamp Dimmer Switch

06294641



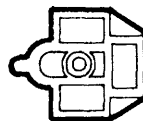
**BLACK**  
56 Series  
**C256**  
Ignition Switch

06288471



**NATURAL**  
56 Series  
**C103**  
RH High-Low Beam Headlamp

06288471



**NATURAL**  
56 Series  
**C104**  
LH High-Low Beam Headlamp

12059181



**MED. GRAY**  
Metri-Pack 280  
**C103**  
RH Low Beam Headlamp

# HEADLAMPS AND FOG LAMPS 8A-100-11

12059181



**MED. GRAY**  
Metri-Pack 280  
**C104**  
LH Low Beam Headlamp

12059183



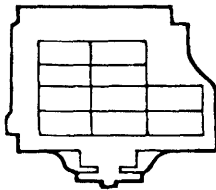
**BLACK**  
Metri-Pack 280  
**C197**  
RH High Beam Headlamp

12059183



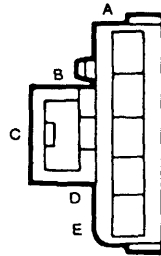
**BLACK**  
Metri-Pack 280  
**C198**  
LH High Beam Headlamp

12020100



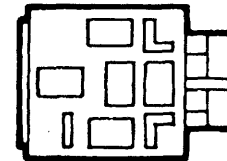
**C102**  
Bulkhead - Forward Lamps

12059296



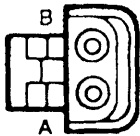
**C277A**  
Fog Lamp Switch

12034003



**BLACK**  
Metri-Pack 630  
**C278A**  
Fog Lamp Relay

12015792



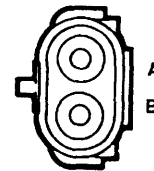
**BLACK**  
Weather Pack  
**C188**  
RH Fog Lamp

12015792



**BLACK**  
Weather Pack  
**C189**  
LH Fog Lamp

12034074



**C183**  
In-Line to Fog Lamps

## 8A-100-12 HEADLAMPS AND FOG LAMPS

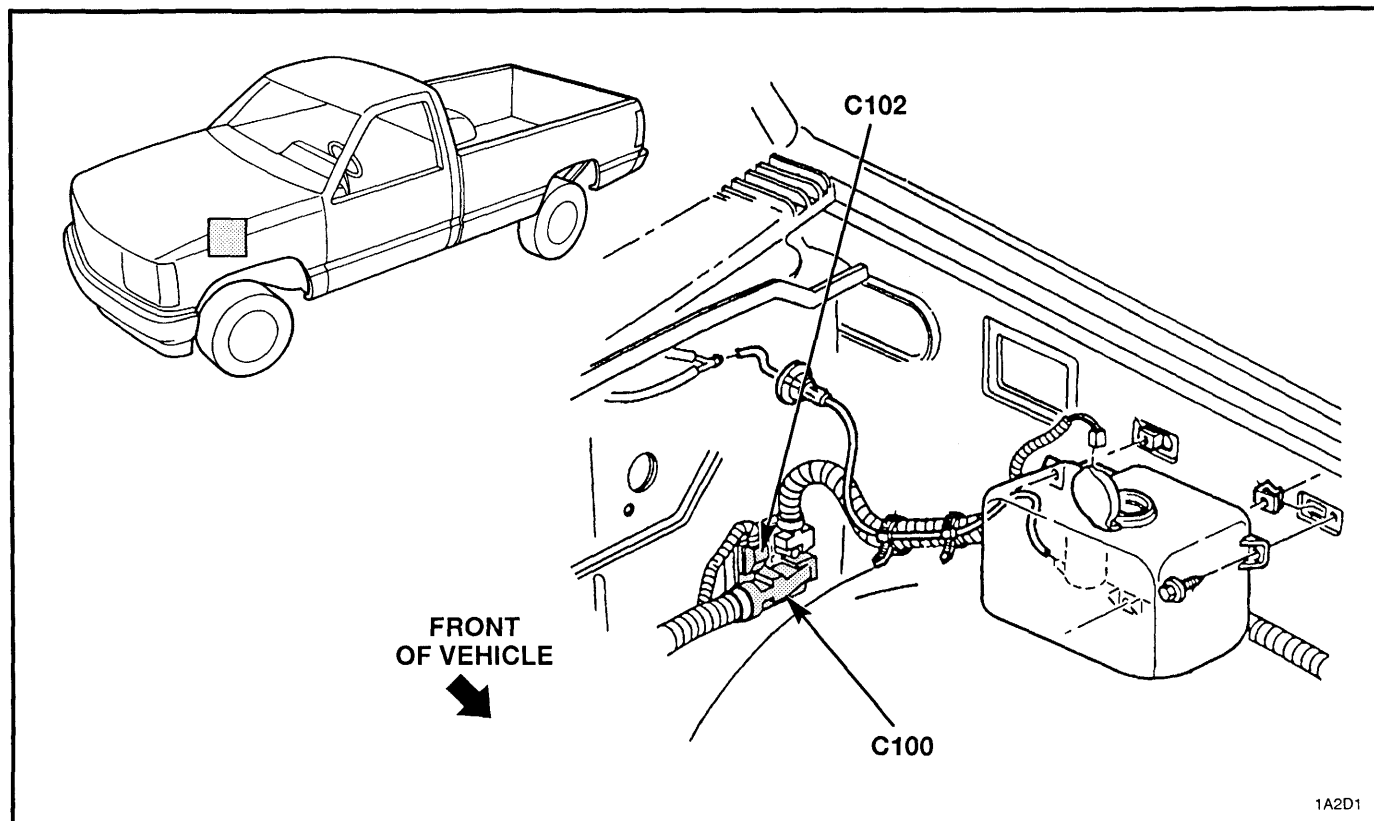


Figure 1 — Cowl Wiring — Except Suburban and Utility

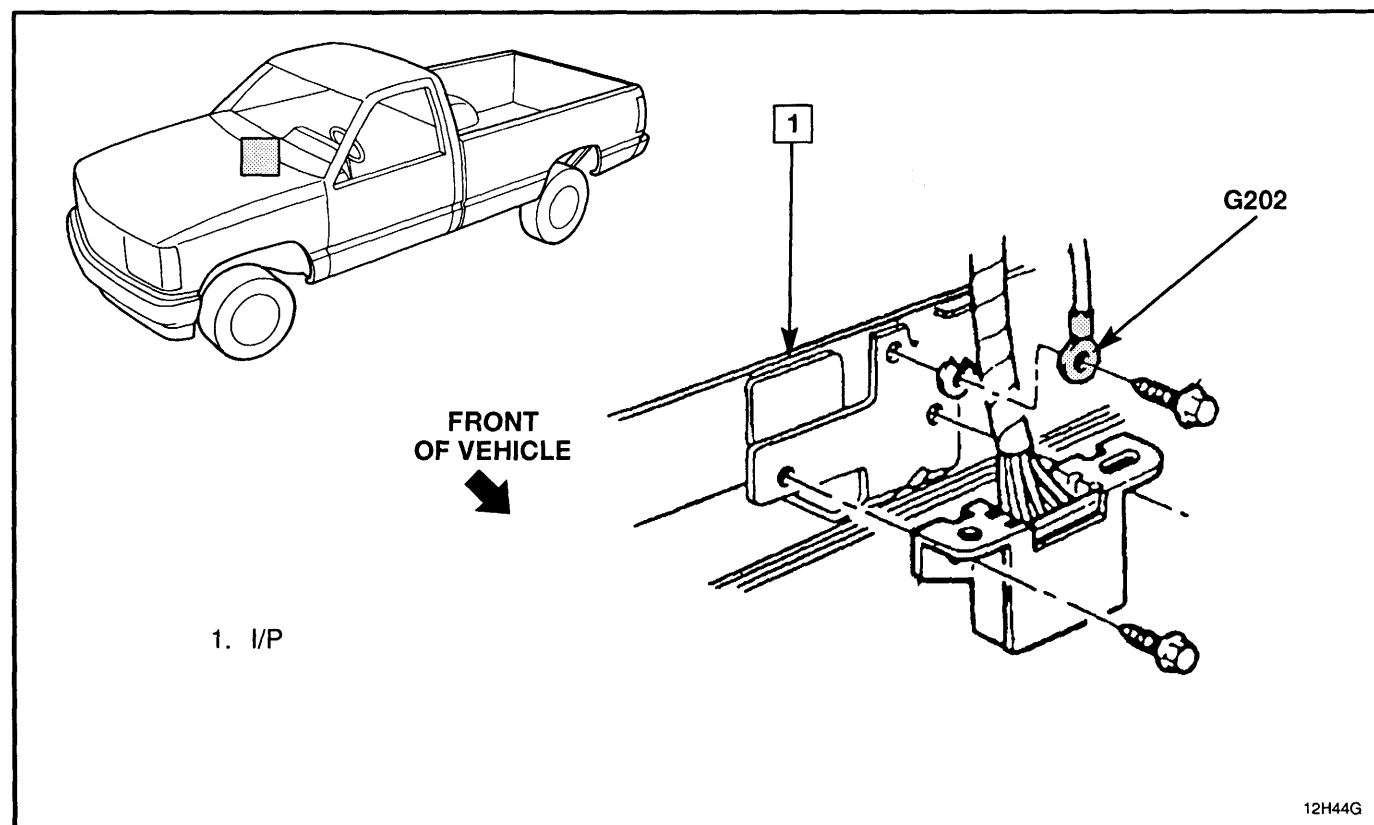
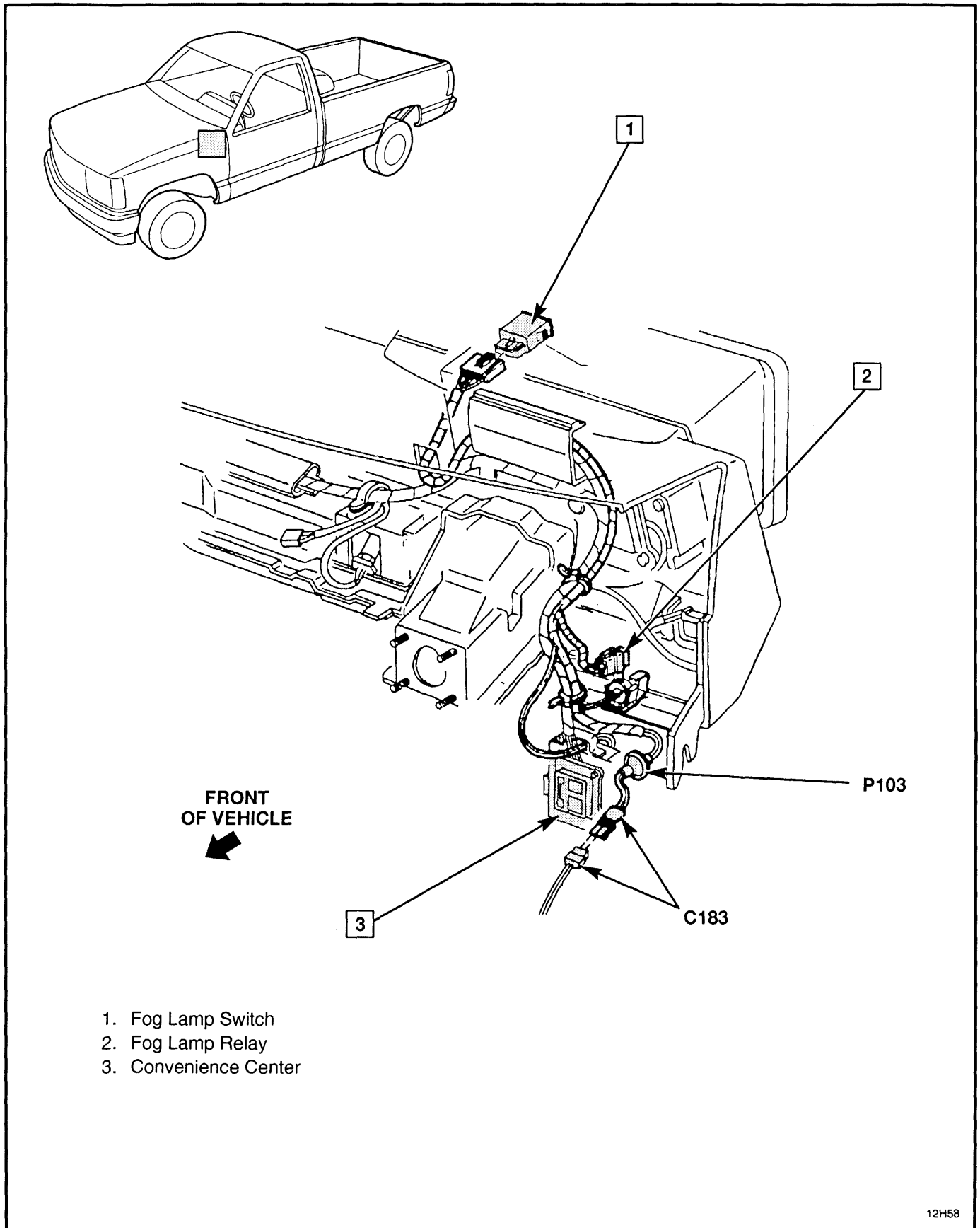


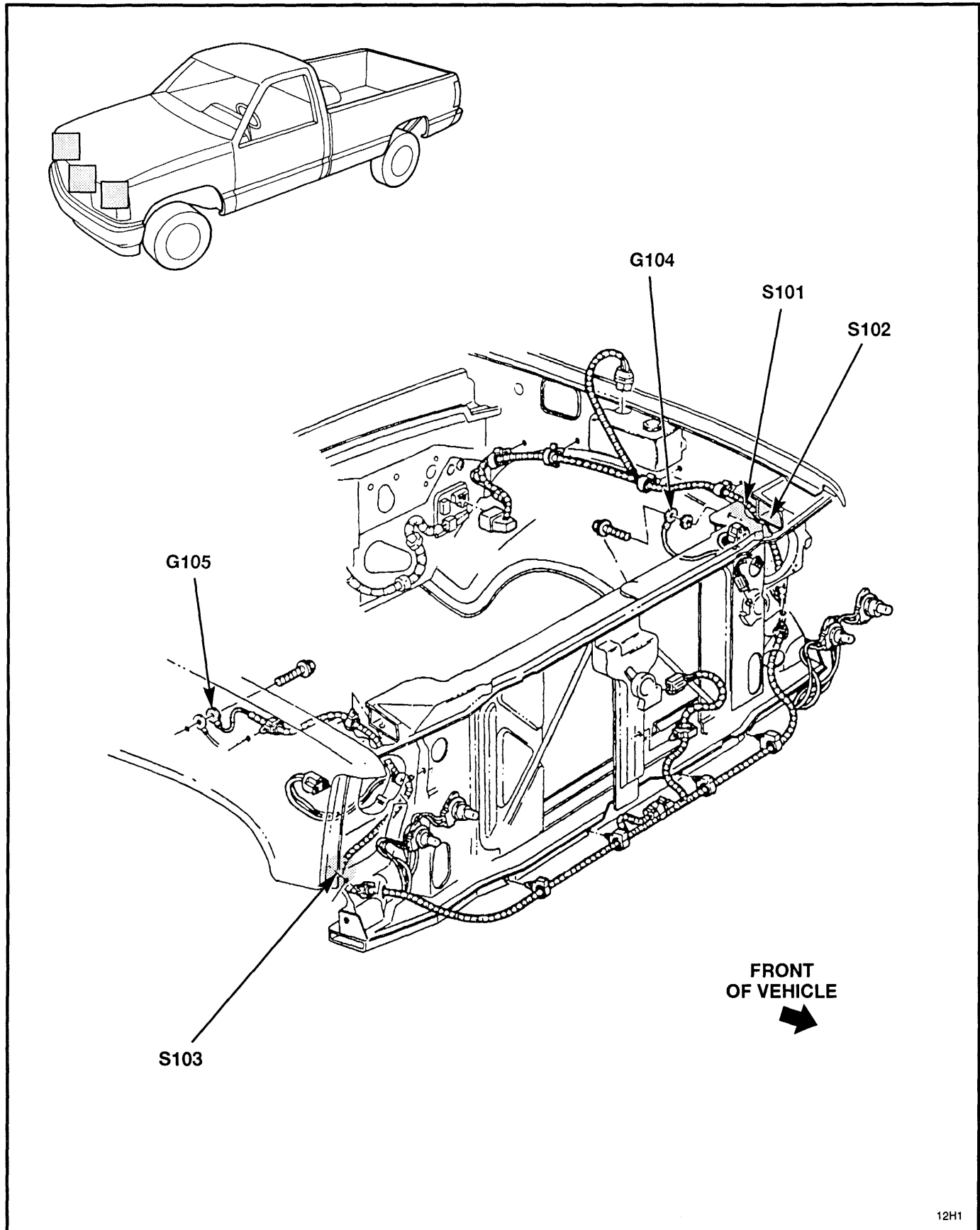
Figure 2 — I/P Ground

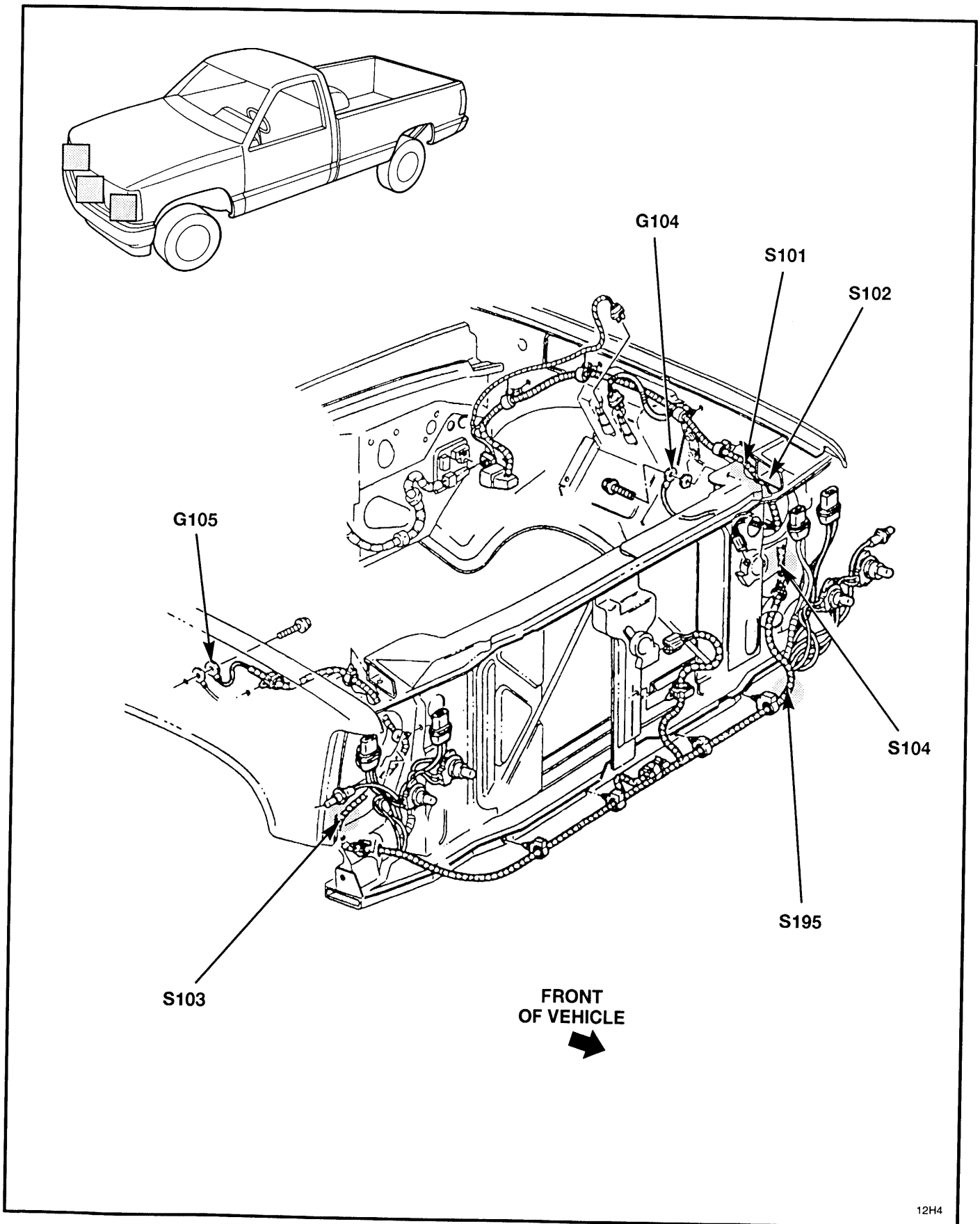


1. Fog Lamp Switch
2. Fog Lamp Relay
3. Convenience Center

Figure 3 — Fog Lamp Wiring

## 8A-100-14 HEADLAMPS AND FOG LAMPS





## 8A-100-16 HEADLAMPS AND FOG LAMPS

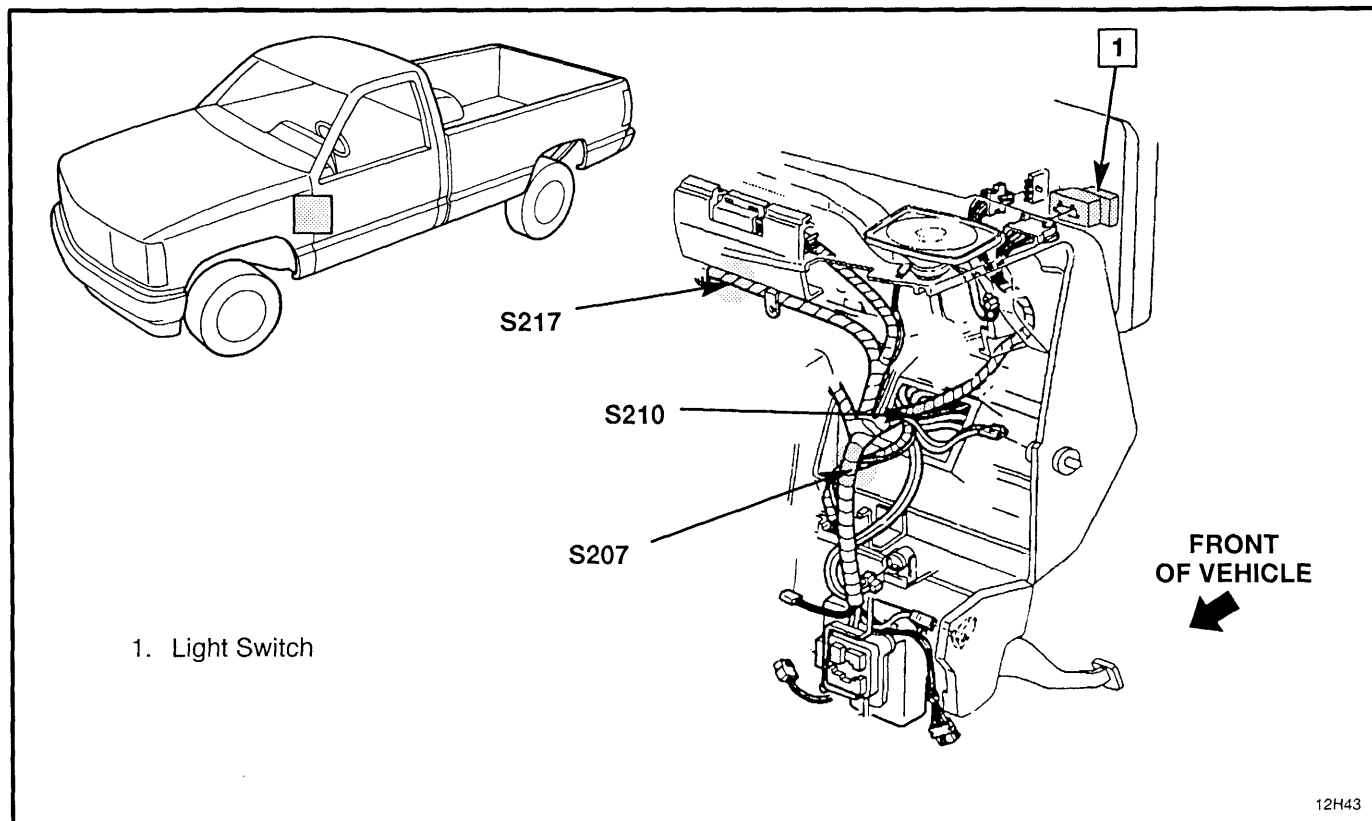


Figure 6 — LH Side of Instrument Panel

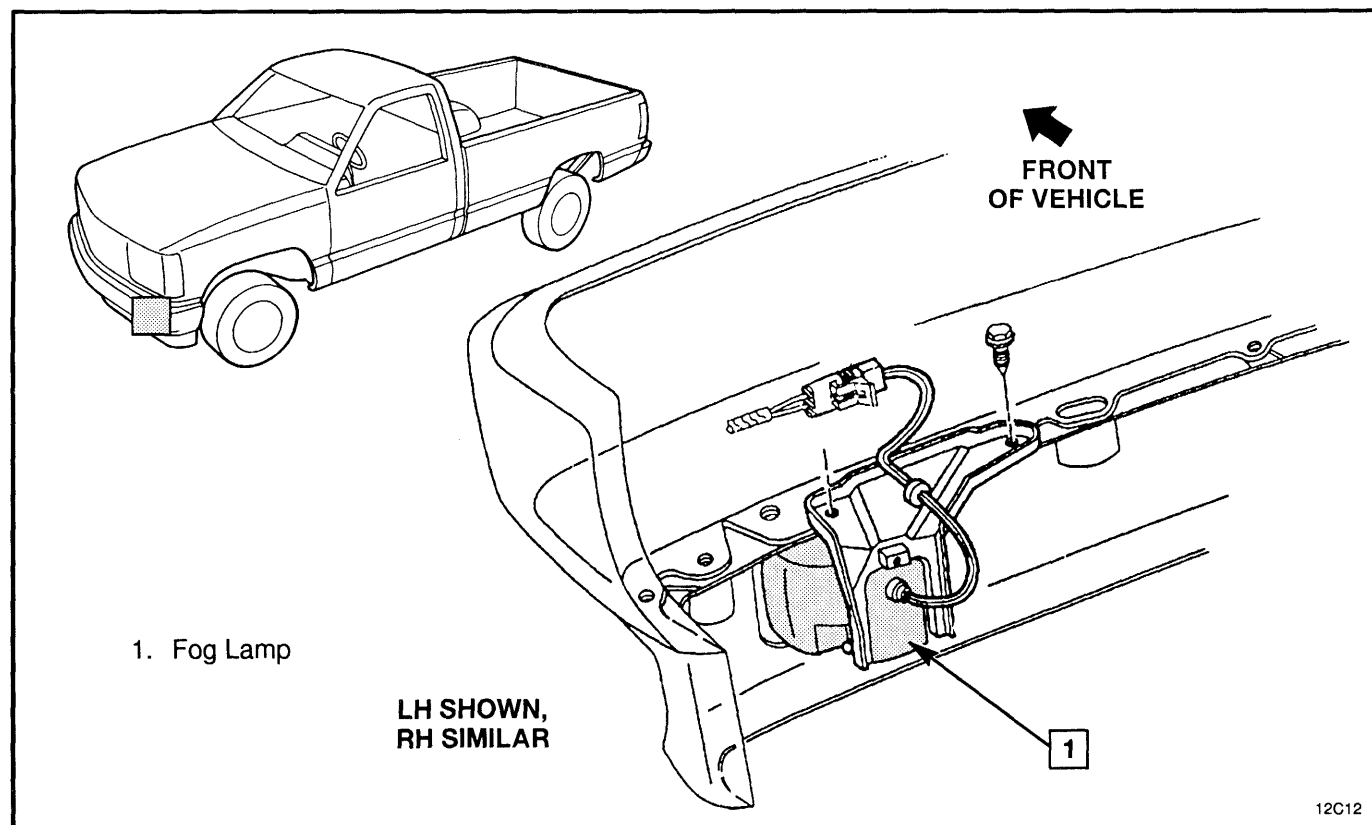


Figure 7 — Fog Lamp

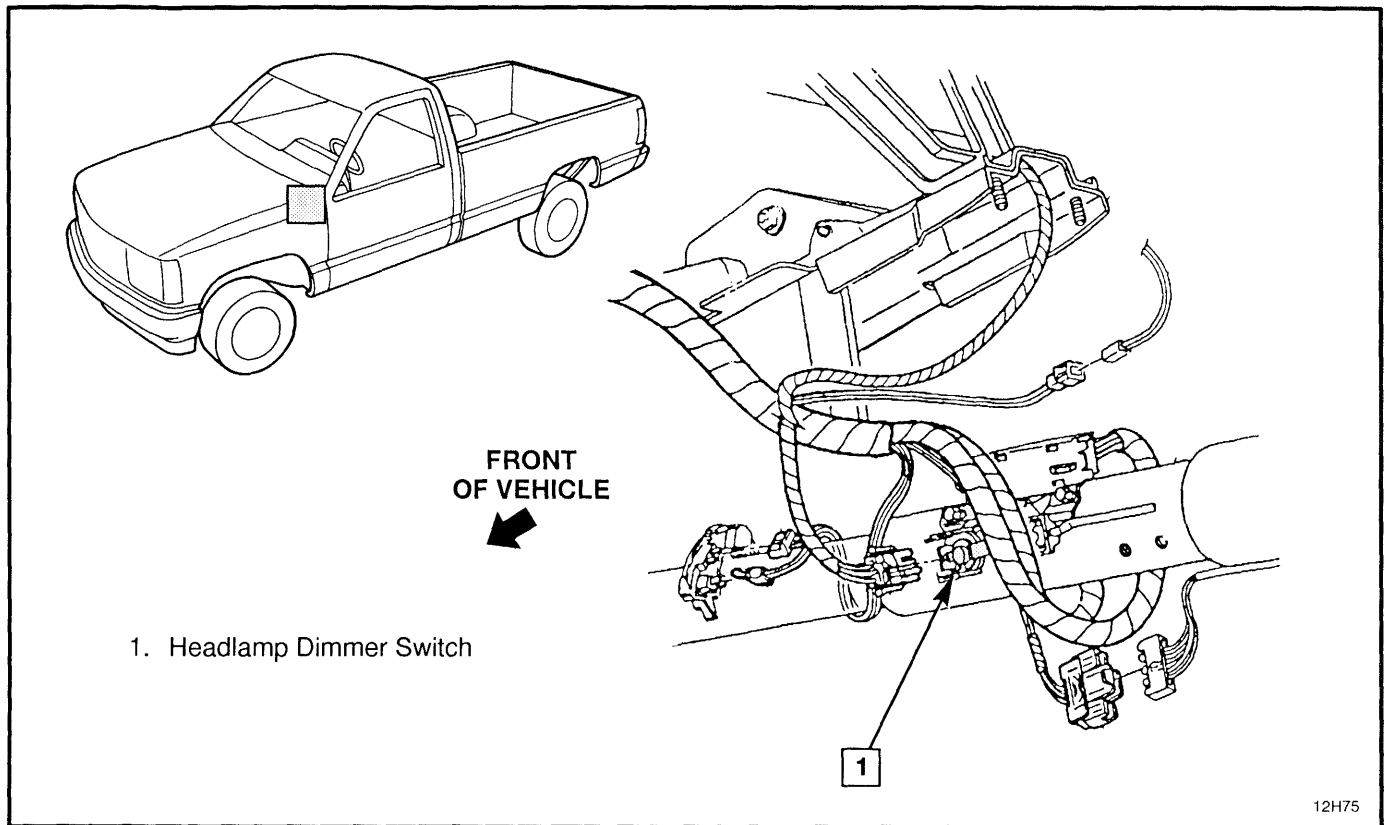


Figure 8 — Steering Column Wiring, LH Side

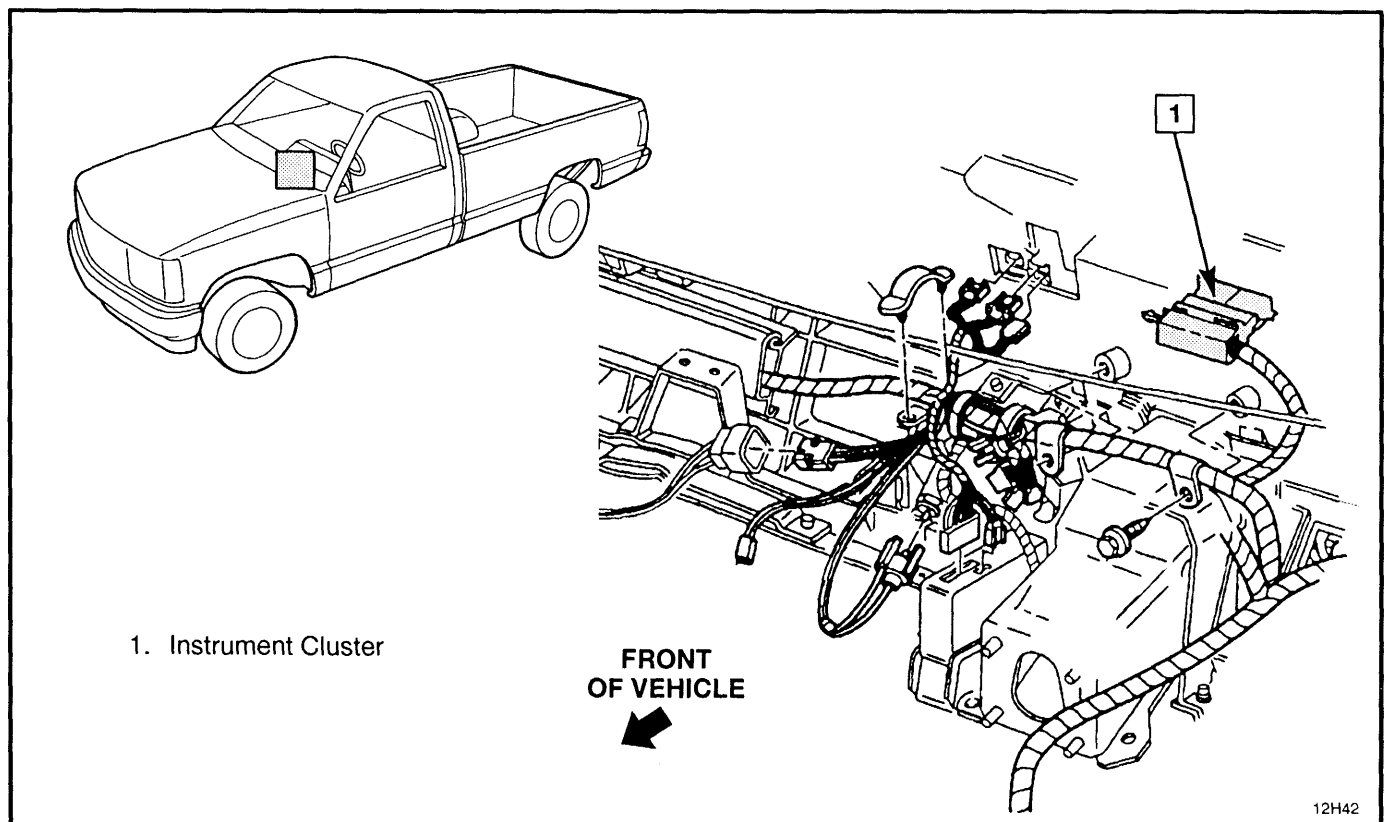


Figure 9 — Instrument Panel Wiring, RH Side



**BLANK**

## CIRCUIT OPERATION

### HEADLAMPS

Voltage is supplied to the Light Switch at all times. The light Switch includes a Self-Resetting Circuit Breaker. The Circuit Breaker opens when the Headlight circuit draws too much current. When the Circuit Breaker opens, it interrupts the current flow. With no current flow, the Circuit Breaker cools off and resets automatically. When the Light Switch is in HEAD, the Headlamp Dimmer Switch directs voltage to either the Low Beams or High Beams. The High Beam Indicator also receives voltage along with the High Beams.

### DAYTIME RUNNING LAMPS (CANADIAN ONLY)

Voltage is supplied to the Daytime Running Lamp (DRL) Relay Switch at all times through the RED (340) wire from the DRL Fuse and when the Ignition Switch is in RUN through the PNK/BLK (39) wire from the GAGES Fuse.

The DRL Relay Switch provides voltage to the LH High Beam through the DK BLU/WHT (593) wire and this wire also becomes the ground wire when the Headlamps are operating normally.

Voltage is supplied to the DRL Module when the Ignition Switch is in RUN through the BRN (50) wire from the AC/HTR Fuse. When the Ignition Switch is placed in RUN, the voltage from the DRL Relay Switch is provided a ground path through the LT GRN wire through the DRL Module. This enables the DRL Relay Switch to provide voltage to the High Beam Lamps from the DRL Relay Switch and places the High Beam Lamps in series.

The DRL Module will not enable the DRL Relay Switch if the Light Switch is in the ON position or the Park Brake Switch is ON.

The High Beam Indicator also receives voltage from the DRL Module when the Headlamp Dimmer Switch is in the High position.

## COMPONENT LOCATION

## Page — Figure

|                            |                                            |           |   |
|----------------------------|--------------------------------------------|-----------|---|
| Daytime Running Lamps      |                                            |           |   |
| (Canadian Only) Module     | Under LH side of I/P, taped on I/P harness | 104-17    | 5 |
| Daytime Running Lamps      |                                            |           |   |
| (Canadian Only) Relay      | Under LH side of I/P                       | 104-17    | 5 |
| Fuse Block                 | Below LH side of I/P                       | 104-17    | 5 |
| Headlamp Dimmer Switch     | Lower LH side of steering column           | 104-16    | 4 |
| Headlamp, LH High/Low Beam | LH front of vehicle                        | Not Shown |   |
| Headlamp, RH High/Low Beam | RH front of vehicle                        | Not Shown |   |
| Headlamp, LH High Beam     | LH front of vehicle                        | Not Shown |   |
| Headlamp, RH High Beam     | RH front of vehicle                        | Not Shown |   |
| Headlamp, LH Low Beam      | LH front of vehicle                        | Not Shown |   |
| Headlamp, RH Low Beam      | RH front of vehicle                        | Not Shown |   |
| Ignition Switch            | In RH side of steering column              | 104-16    | 4 |
| I/P Cluster                | LH side of I/P                             | 104-18    | 7 |
| Light Switch               | Upper LH side of I/P                       | 104-17    | 5 |
| Marker Lamp, LH Roof       | On roof, above windshield                  | Not Shown |   |
| Marker Lamp, RH Roof       | On roof panel                              | Not Shown |   |
| Park Brake Warning Switch  | At park brake under LH end of I/P          | 104-17    | 5 |

## CONNECTORS:

|      |                       |        |   |
|------|-----------------------|--------|---|
| C100 | At bulkhead connector | 104-18 | 6 |
| C102 | At bulkhead connector | 104-18 | 6 |

## DIODES:

|      |                       |        |   |
|------|-----------------------|--------|---|
| D200 | At convenience center | 104-17 | 5 |
| D201 | At Instrument cluster | 104-17 | 5 |

## 8A-104-2 HEADLAMPS WITH DAYTIME RUNNING LAMPS

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### COMPONENT LOCATION

Page — Figure

#### GROUNDING:

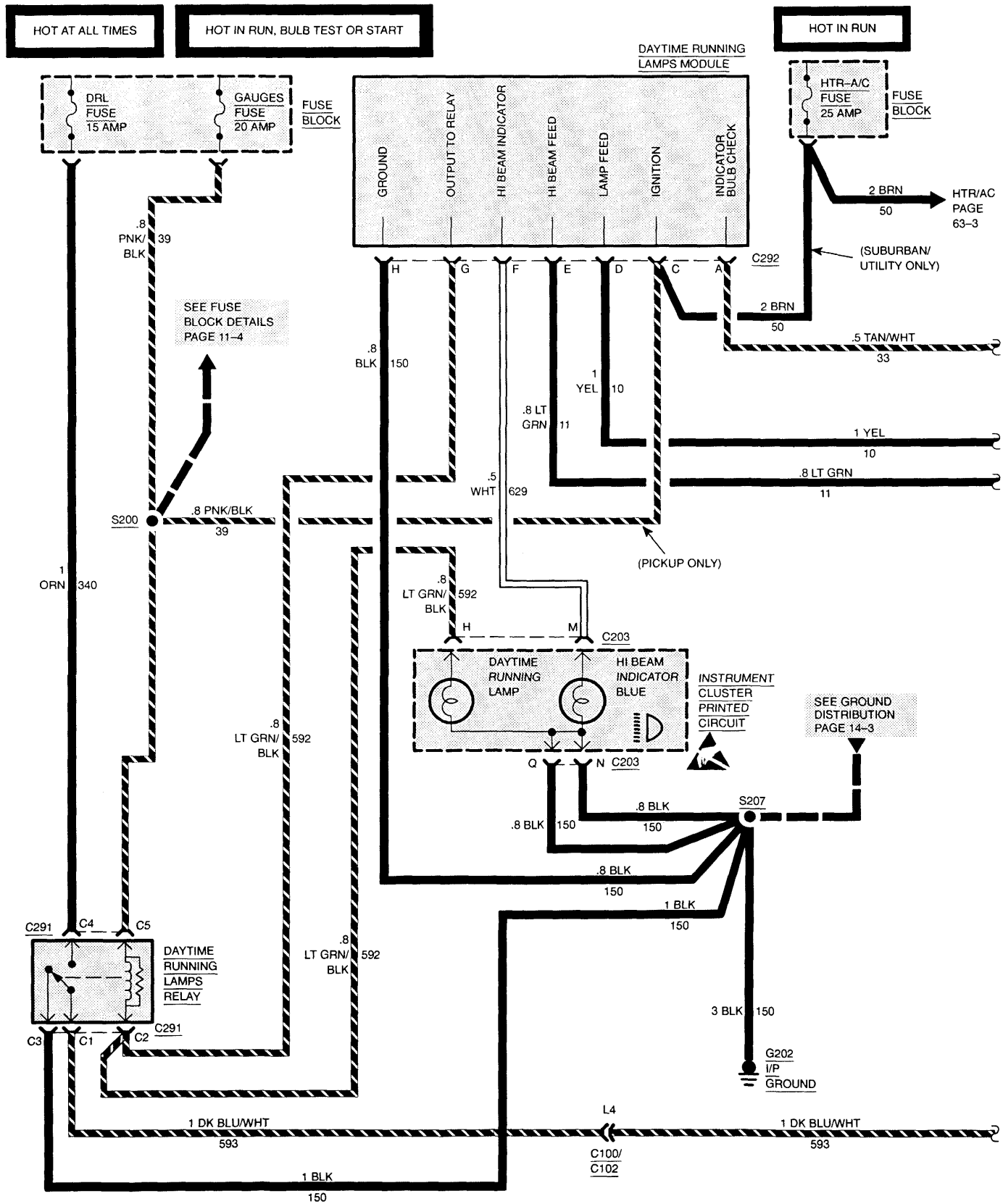
|      |                                   |           |   |
|------|-----------------------------------|-----------|---|
| G104 | On sheet metal, above LH headlamp | 104-14    | 1 |
| G105 | RH inner fender, near battery     | 104-14    | 1 |
| G126 | Near RH headlamp                  | Not Shown |   |
| G126 | Near RH headlamp                  | Not Shown |   |
| G202 | At DLC connector                  | 104-16    | 3 |

#### SPLICES:

|      |                                           |           |   |
|------|-------------------------------------------|-----------|---|
| S101 | LH side, near headlamp                    | 104-14    | 1 |
| S102 | LH side, near headlamp                    | 104-14    | 1 |
| S103 | RH side, near headlamp                    | 104-14    | 1 |
| S104 | LH side, near headlamp                    | 104-15    | 2 |
| S151 | At RH headlamp assembly                   | Not Shown |   |
| S200 | Near fuse block                           | Not Shown |   |
| S207 | Near instrument cluster                   | 104-17    | 5 |
| S213 | Under LH side of I/P                      | 104-17    | 5 |
| S250 | At in-line diode, near bulkhead connector | 104-17    | 5 |
| S252 | At in-line diode, near bulkhead connector | 104-17    | 5 |
| S253 | Under LH side of I/P                      | 104-17    | 5 |
| S254 | Under LH side of I/P                      | 104-17    | 5 |

**BLANK**

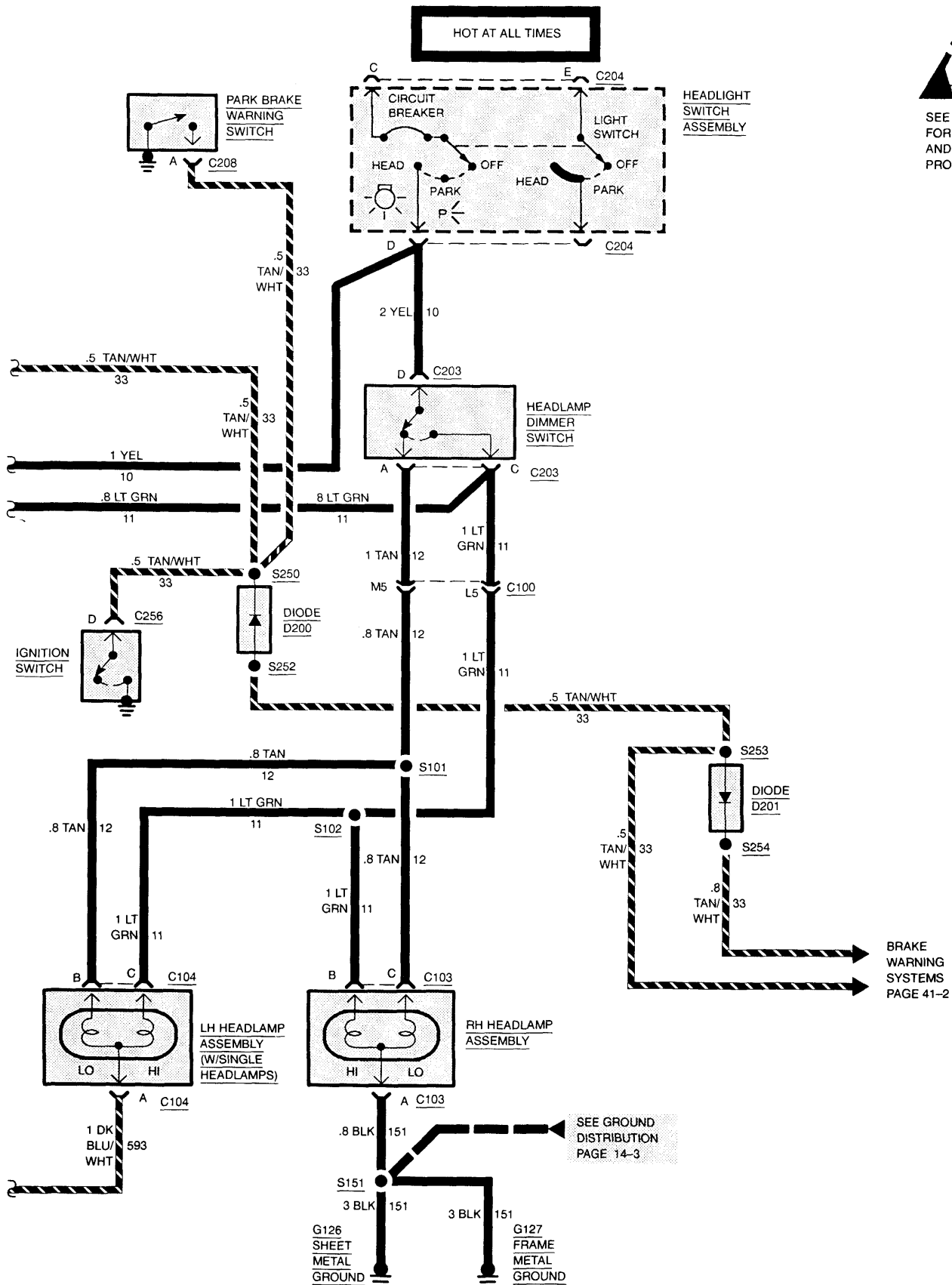
## 8A-104-4 HEADLAMPS WITH DAYTIME RUNNING LAMPS



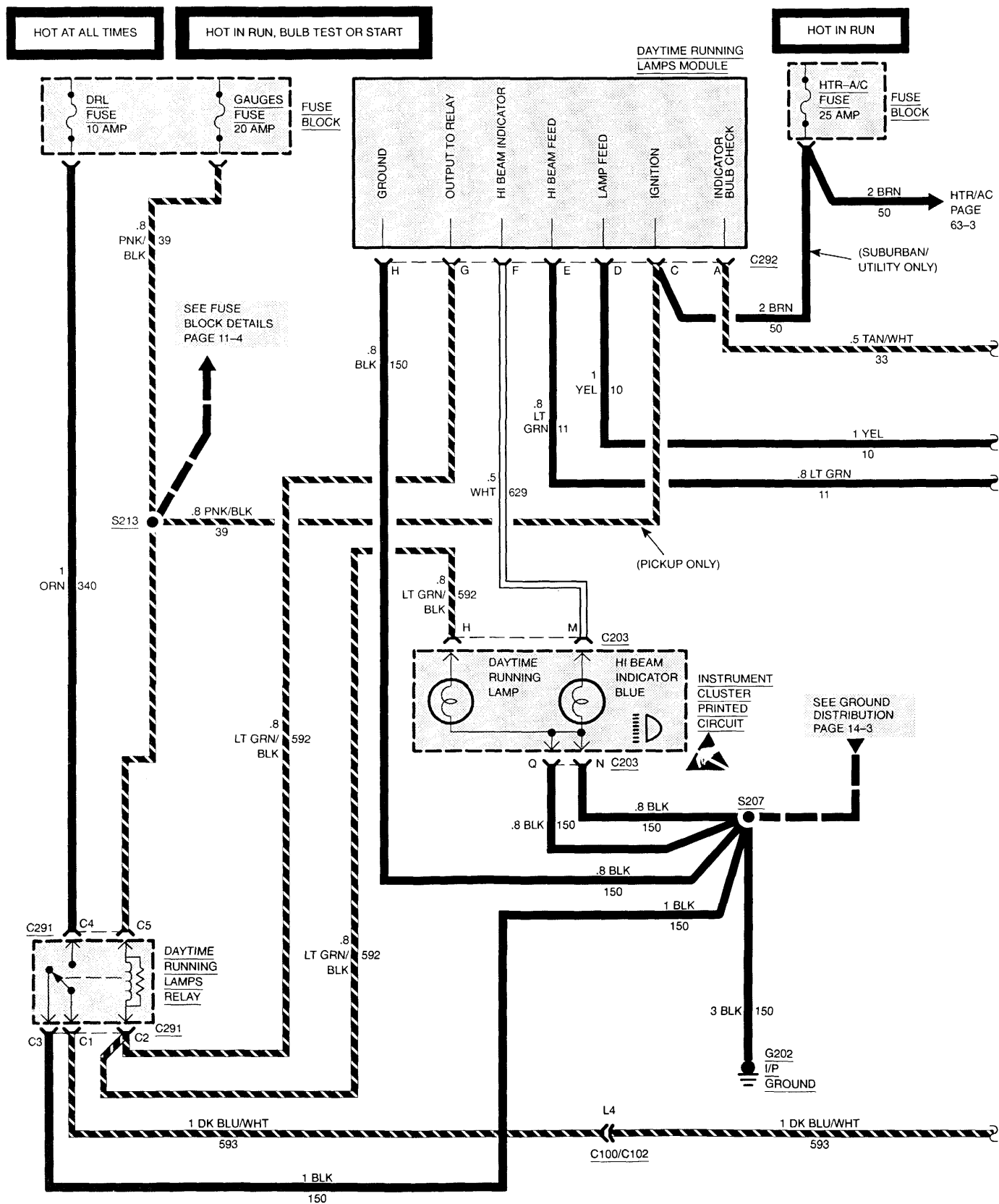
# HEADLAMPS WITH DAYTIME RUNNING LAMPS 8A-104-5



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



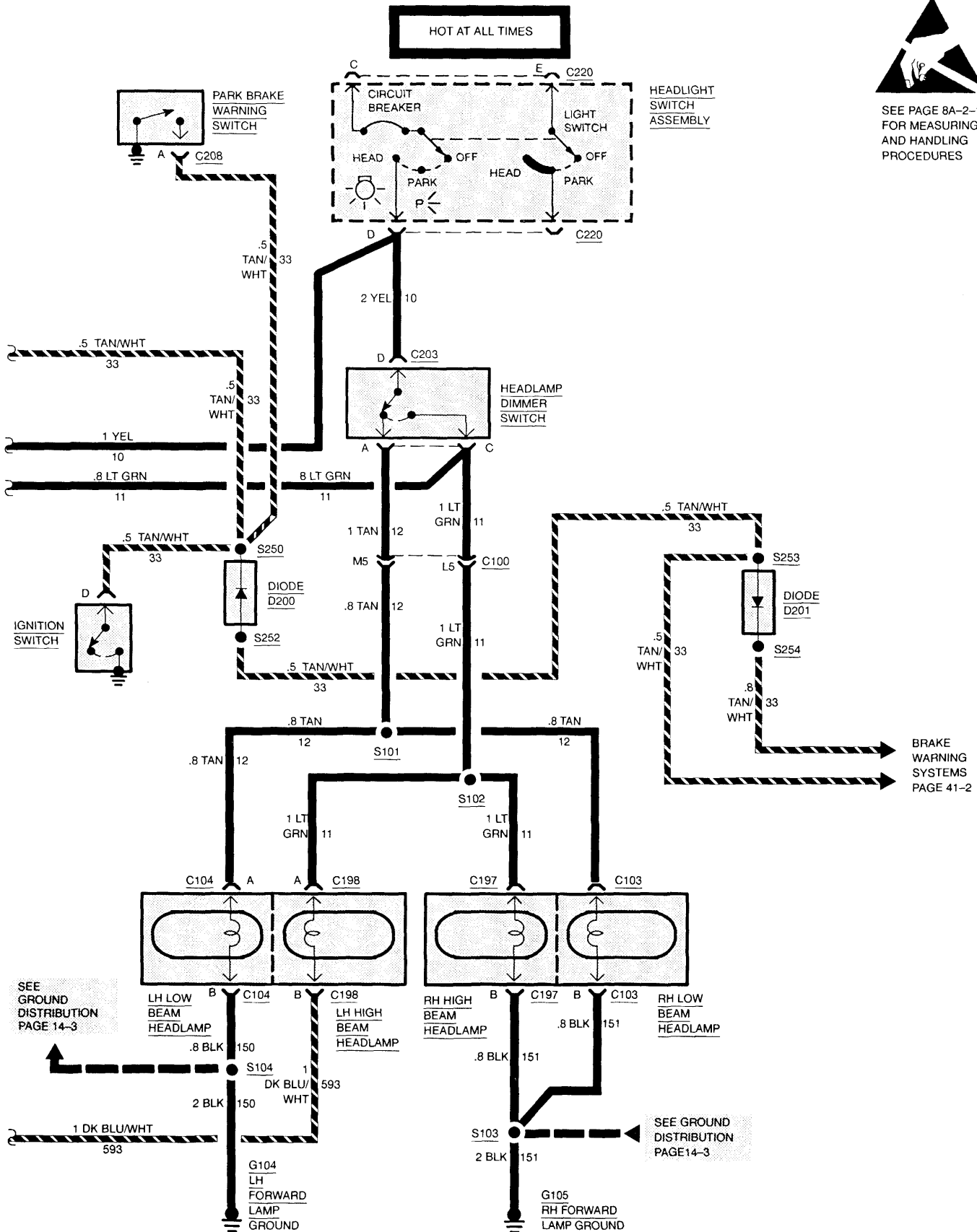
**W/QUAD HEADLAMPS**



**W/QUAD HEADLAMPS**



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES





## 8A-104-8 HEADLAMPS WITH DAYTIME RUNNING LAMPS

### DIAGNOSIS — HEADLAMP W/DAYTIME RUNNING LAMPS

#### PRELIMINARY CHECKS:

Before checking DAYTIME RUNNING LAMPS (Canadian only) system, do the following:

1. Place Park Brake in OFF position and Ignition Switch in RUN.
2. Verify condition of DRL, GAUGES and A/C HTR Fuses. If blown, locate and repair source of overload. Then replace fuse.
3. Place Light Switch in ON and Headlamp Dimmer Switch to the HIGH BEAM. If HIGH BEAM headlamp(s) are inoperative, refer to HIGH BEAM LAMP(S) DO NOT OPERATE (CANADIAN VEHICLES) diagnostic procedure.
4. If the High Beam Lamp(s) are operative, use the following diagnostic procedures, after placing the Light Switch to OFF position.

#### DAYTIME RUNNING LAMPS (CANADIAN ONLY) DO NOT OPERATE

| TEST                                                                                                                                   | RESULT                    | ACTION                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (340) wire at daytime running lamps relay (Canadian only) connector C291 to ground.                      | Test lamp lights.         | GO to step 2.                                                                                                                                                                      |
|                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in ORN (340) wire between relay connector C291 and fuse block.                                                                                              |
| 2. Connect test lamp from PNK/BLK (39) wire at relay connector C291 to ground.                                                         | Test lamp lights.         | GO to step 4.                                                                                                                                                                      |
|                                                                                                                                        | Test lamp does not light. | GO to step 3.                                                                                                                                                                      |
| 3. Place park brake in ON. Observe BRAKE indicator lamp on I/P Cluster.                                                                | Lamp lights.              | LOCATE and REPAIR open in PNK/BLK (39) wire between relay connector C291 and splice S213.                                                                                          |
|                                                                                                                                        | Lamp does not light.      | LOCATE and REPAIR open in PNK/BLK (39) wire between splice S213 and fuse block.                                                                                                    |
| 4. Connect self-powered test lamp from LT GRN/BLK (592) wire at relay connector C291 to ground.                                        | Test lamp lights.         | GO to step 5.                                                                                                                                                                      |
|                                                                                                                                        | Test lamp does not light. | GO to step 6.                                                                                                                                                                      |
| 5. Connect test lamp from DK BLU/WHT (593) wire at relay connector C291 to ground.                                                     | Test lamp lights.         | System operating normally.                                                                                                                                                         |
|                                                                                                                                        | Test lamp does not light. | REPLACE daytime running lamps relay (Canadian only).                                                                                                                               |
| 6. Connect self-powered test lamp from LT GRN/BLK (592) wire at daytime running lamps module (Canadian only) connector C292 to ground. | Test lamp lights.         | LOCATE and REPAIR open in LT GRN/BLK (592) wire between module connector C292 and relay connector C291.                                                                            |
|                                                                                                                                        | Test lamp does not light. | GO to step 7.                                                                                                                                                                      |
| 7. Connect test lamp from PNK/BLK (39) wire (pickup) or BRN (50) wire (suburban/utility) at module connector C292 to ground.           | Test lamp lights.         | GO to step 8.                                                                                                                                                                      |
|                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire between module connector C292 to splice S213 (pickup) or BRN (50) wire between module connector C292 to fuse block (suburban/utility). |

## HEADLAMPS WITH DAYTIME RUNNING LAMPS 8A-104-9

### DAYTIME RUNNING LAMPS (CANADIAN ONLY) DO NOT OPERATE (CONTINUED)

| TEST                                                                                          | RESULT                    | ACTION                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8. Connect self-powered test lamp from BLK (150) wire at module connector C292 to ground.     | Test lamp lights.         | GO to step 10.                                                                                                                                                              |
|                                                                                               | Test lamp does not light. | GO to step 9.                                                                                                                                                               |
| 9. Turn on radio.                                                                             | Radio operates.           | LOCATE and REPAIR open in BLK (150) wire from module connector C292 to splice S207.                                                                                         |
|                                                                                               | Radio does not operate.   | LOCATE and REPAIR open in BLK (150) wire between splice S207 and ground G202.                                                                                               |
| 10. Connect self-powered test lamp from TAN/WHT (33) wire at module connector C292 to ground. | Test lamp lights.         | LOCATE and REPAIR short to ground in TAN/WHT (33) wire between module connector C292 and park brake switch connector C226. If no short is found, REPLACE park brake switch. |
|                                                                                               | Test lamp does not light. | REPLACE daytime running lamps module (Canadian only).                                                                                                                       |

### DAYTIME RUNNING LAMPS (CANADIAN ONLY) STAY ON

| TEST                                                                                                                                                                                                         | RESULT                    | ACTION                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------|
| 1. Disconnect daytime running lamps module (Canadian only) connector C292. Place ignition switch in RUN and light switch in ON position. Connect test lamp from YEL (10) wire at module connector to ground. | Test lamp lights.         | REPLACE daytime running lamps module (Canadian only).                                              |
|                                                                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in YEL (10) wire from module connector C292 to light switch connector C204. |

### LOW BEAM LAMP(S) DO NOT OPERATE (CANADIAN ONLY)

| TEST                                                                                                                                                | RESULT                    | ACTION                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place light switch in ON and headlamp dimmer switch in LOW BEAM position. Connect test lamp from TAN (12) wire at inoperative lamp(s) to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                     |
|                                                                                                                                                     | Test lamp does not light. | GO to step 6.                                                                                                                                     |
| 2. Connect test lamp from TAN (12) wire to BLK (151) wire at RH headlamp connector C103 or DK BLU/WHT (593) wire at LH headlamp connector C104.     | Test lamp lights.         | REPLACE headlamp(s).                                                                                                                              |
|                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire from RH headlamp connector C103 ground G105. GO to step 3 for LH headlamp.                               |
| 3. Connect self-powered test lamp from DK BLU/WHT (593) wire at daytime running lamps relay (Canadian only) connector C291 to ground.               | Test lamp lights.         | LOCATE and REPAIR open in DK BLU/WHT (593) wire between relay connector C291 and connector C100 or connector C100 and LH headlamp connector C104. |
|                                                                                                                                                     | Test lamp does not light. | GO to step 4.                                                                                                                                     |

## 8A-104-10 HEADLAMPS WITH DAYTIME RUNNING LAMPS

### LOW BEAM LAMP(S) DO NOT OPERATE (CANADIAN ONLY) (CONTINUED)

| TEST                                                                                        | RESULT                    | ACTION                                                                                                                    |
|---------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 4. Connect self-powered test lamp from BLK (150) wire at relay connector C291 to ground.    | Test lamp lights.         | REPLACE daytime running lamps relay (Canadian only).                                                                      |
|                                                                                             | Test lamp does not light. | Go to step 5.                                                                                                             |
| 5. Turn on radio.                                                                           | Radio operates.           | LOCATE and REPAIR open in BLK (150) wire between relay connector C291 and splice S207.                                    |
|                                                                                             | Radio does not operate.   | LOCATE and REPAIR open in BLK (150) wire between splice S207 and ground G202.                                             |
| 6. Connect test lamp from TAN (12) wire at headlamp dimmer switch connector C205 to ground. | Test lamp lights.         | LOCATE and REPAIR open in TAN (12) wire from headlamp dimmer switch connector C205 to headlamp connector(s) C103 or C104. |
|                                                                                             | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                           |

### HIGH BEAM LAMP(S) DO NOT OPERATE (CANADIAN ONLY)

| TEST                                                                                                                                                       | RESULT                    | ACTION                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place headlamp switch in ON and headlamp dimmer switch in HIGH BEAM position. Connect test lamp from LT GRN (11) wire at inoperative lamp(s) to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                     |
|                                                                                                                                                            | Test lamp does not light. | GO to step 6.                                                                                                                                     |
| 2. Connect test lamp from LT GRN (11) wire to BLK (151) wire at RH headlamp connector C103 or DK BLU/WHT (593) wire at LH headlamp connector C104.         | Test lamp lights.         | REPLACE headlamp(s).                                                                                                                              |
|                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in BLK (151) wire from RH headlamp connector C103 ground G105. GO to step 3 for LH headlamp.                               |
| 3. Connect self-powered test lamp from DK BLU/WHT (593) wire at daytime running lamps relay (Canadian only) connector C291 to ground.                      | Test lamp lights.         | LOCATE and REPAIR open in DK BLU/WHT (593) wire between relay connector C291 and connector C100 or connector C100 and LH headlamp connector C104. |
|                                                                                                                                                            | Test lamp does not light. | GO to step 4.                                                                                                                                     |
| 4. Connect self-powered test lamp from BLK (150) wire at relay connector C291 to ground.                                                                   | Test lamp lights.         | REPLACE daytime running lamps relay (Canadian only).                                                                                              |
|                                                                                                                                                            | Test lamp does not light. | GO to step 5.                                                                                                                                     |

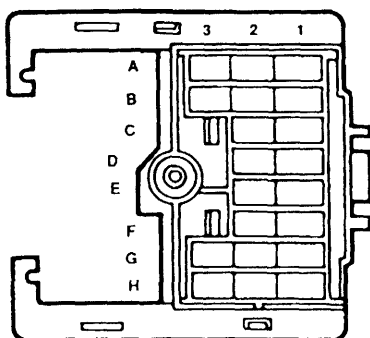
## HEADLAMPS WITH DAYTIME RUNNING LAMPS 8A-104-11

### HIGH BEAM LAMP(S) DO NOT OPERATE (CANADIAN ONLY) (CONTINUED)

| TEST                                                                                           | RESULT                    | ACTION                                                                                                                       |
|------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 5. Turn on radio.                                                                              | Radio operates.           | LOCATE and REPAIR open in BLK (150) wire between relay connector C291 and splice S207.                                       |
|                                                                                                | Radio does not operate.   | LOCATE and REPAIR open in BLK (150) wire between splice S207 and ground G202.                                                |
| 6. Connect test lamp from LT GRN (11) wire at headlamp dimmer switch connector C205 to ground. | Test lamp lights.         | LOCATE and REPAIR open in LT GRN (11) wire from headlamp dimmer switch connector C205 to headlamp connector(s) C103 or C104. |
|                                                                                                | Test lamp does not light. | REPLACE headlamp dimmer switch.                                                                                              |

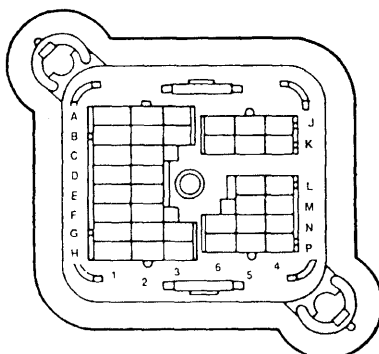
# 8A-104-12 HEADLAMPS WITH DAYTIME RUNNING LAMPS

12020183



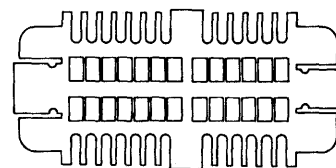
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



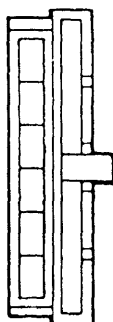
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12089908



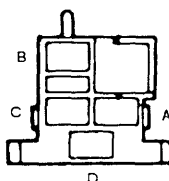
**BLACK**  
Bow Series  
**C203**  
I/P Cluster

12034061



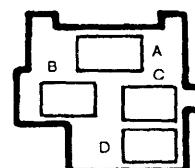
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

08917693



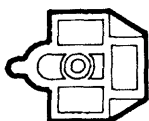
**BLACK**  
56 Series  
**C203**  
Headlamp Dimmer Switch

06294641



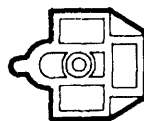
**BLACK**  
56 Series  
**C256**  
Ignition Switch

06288471



**NATURAL**  
56 Series  
**C103**  
RH High-Low Beam Headlamp

06288471



**NATURAL**  
56 Series  
**C104**  
LH High-Low Beam Headlamp

12059181



**MED. GRAY**  
Metri-Pack 280  
**C103**  
RH Low Beam Headlamp

# HEADLAMPS WITH DAYTIME RUNNING LAMPS 8A-104-13

12059181



**MED. GRAY**  
Metri-Pack 280  
**C104**  
LH Low Beam Headlamp

12059183



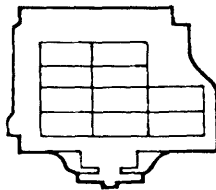
**BLACK**  
Metri-Pack 280  
**C197**  
RH High Beam Headlamp

12059183



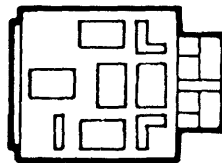
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Metri-Pack 280  
**C198**  
LH High Beam Headlamp

12020100



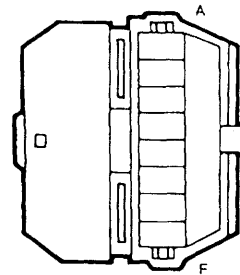
**C102**  
Bulkhead - Forward Lamps

12034003



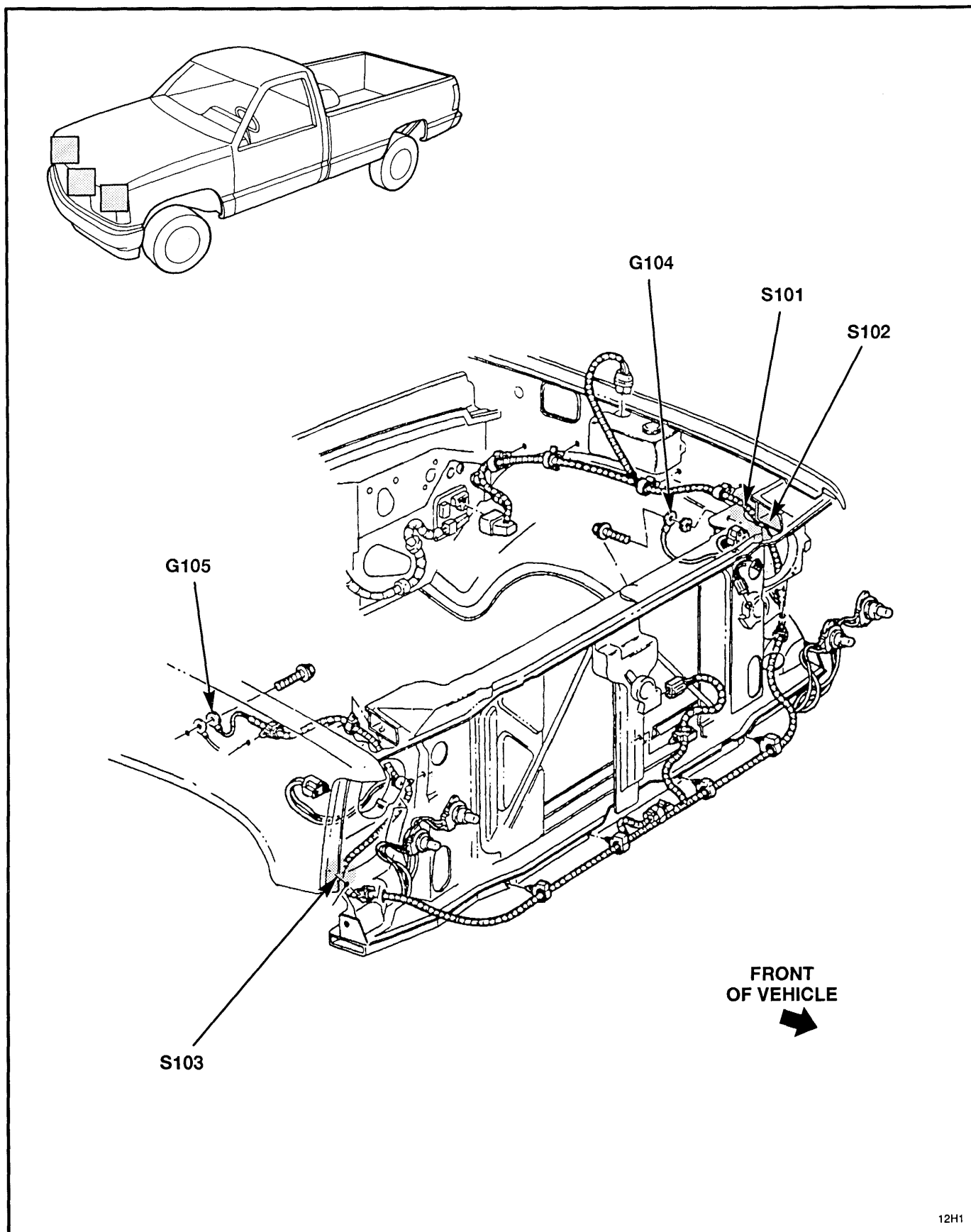
**BLACK**  
Metri-Pack 630  
**C291**  
Daytime Running Lamps Relay

12015308



**GRAY**  
P/C Edgeboard  
**C292**  
Daytime Running Lamps Module

## 8A-104-14 HEADLAMPS WITH DAYTIME RUNNING LAMPS



12H1

Figure 1 — Forward Lamp Harness, Dual Headlamp — 2 Door Pickup

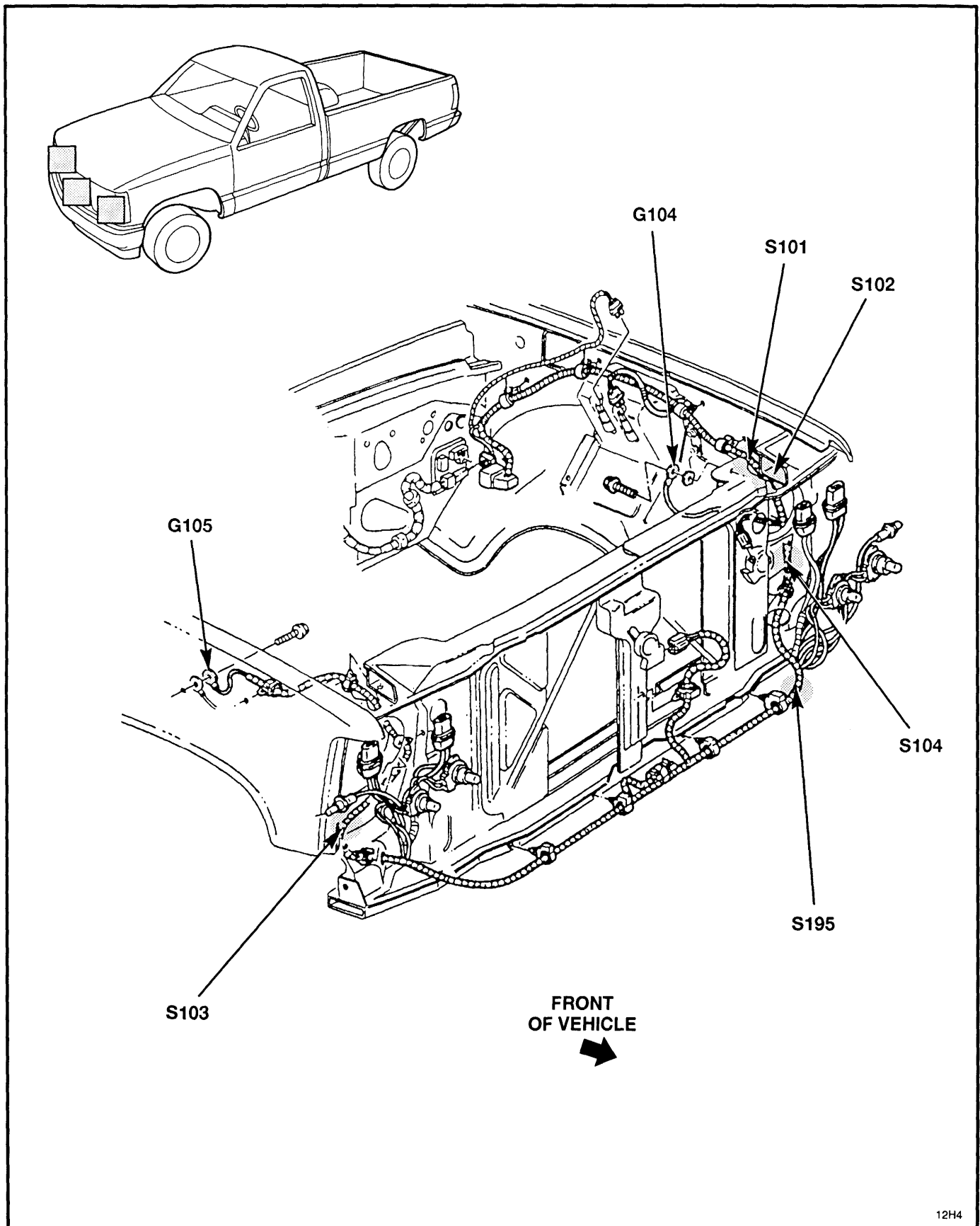


Figure 2 — Forward Lamp Harness, Quad Headlamps



## 8A-104-16 HEADLAMPS WITH DAYTIME RUNNING LAMPS

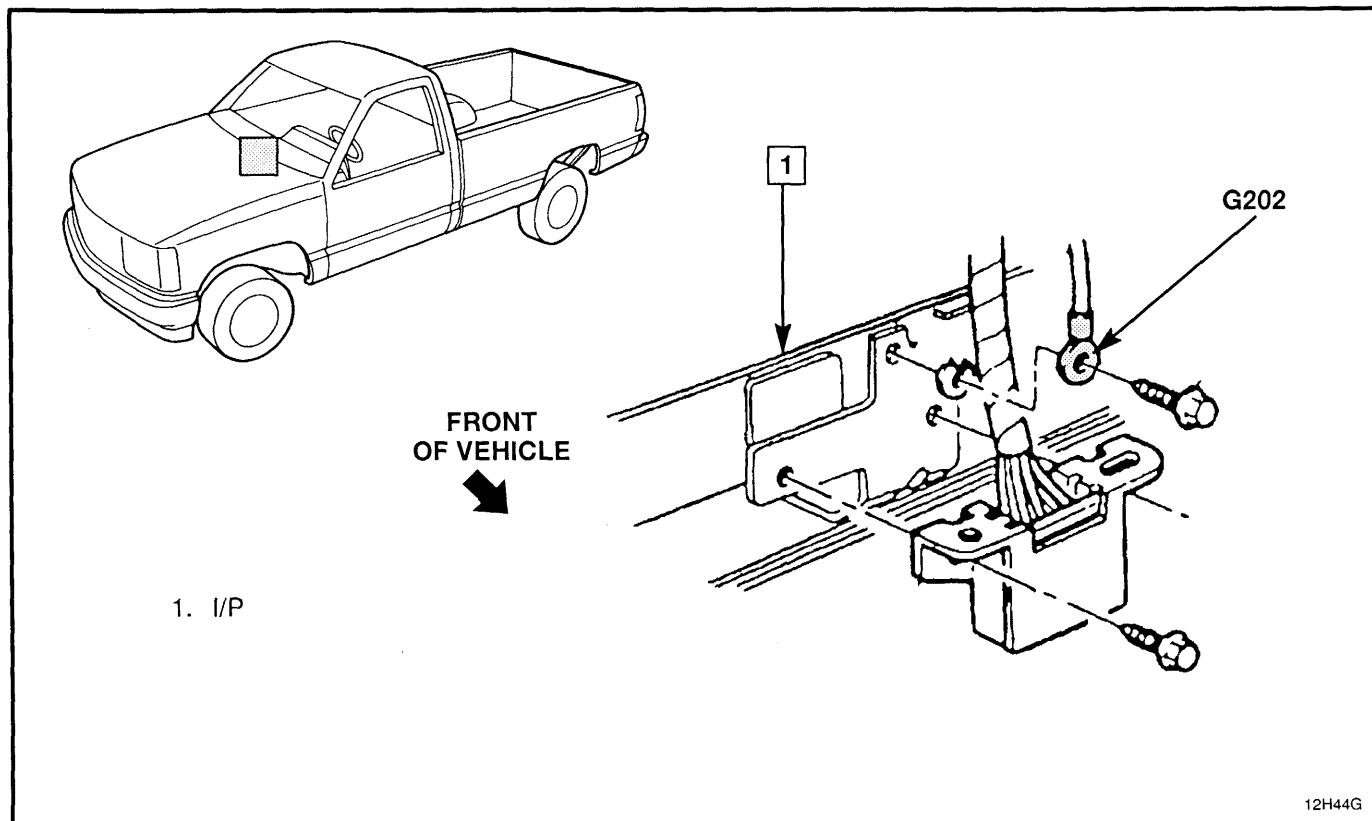


Figure 3 — I/P Ground

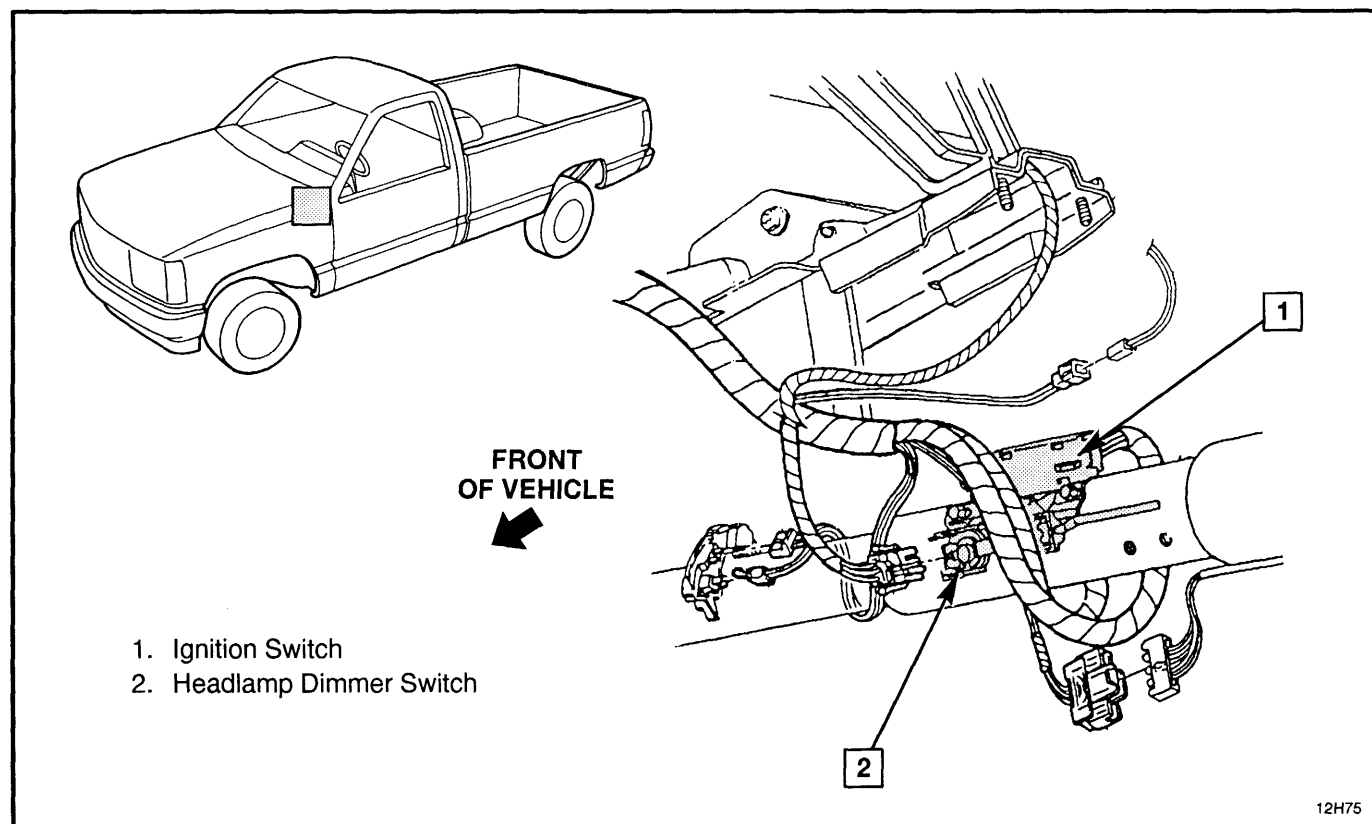


Figure 4 — Steering Column Wiring, LH Side

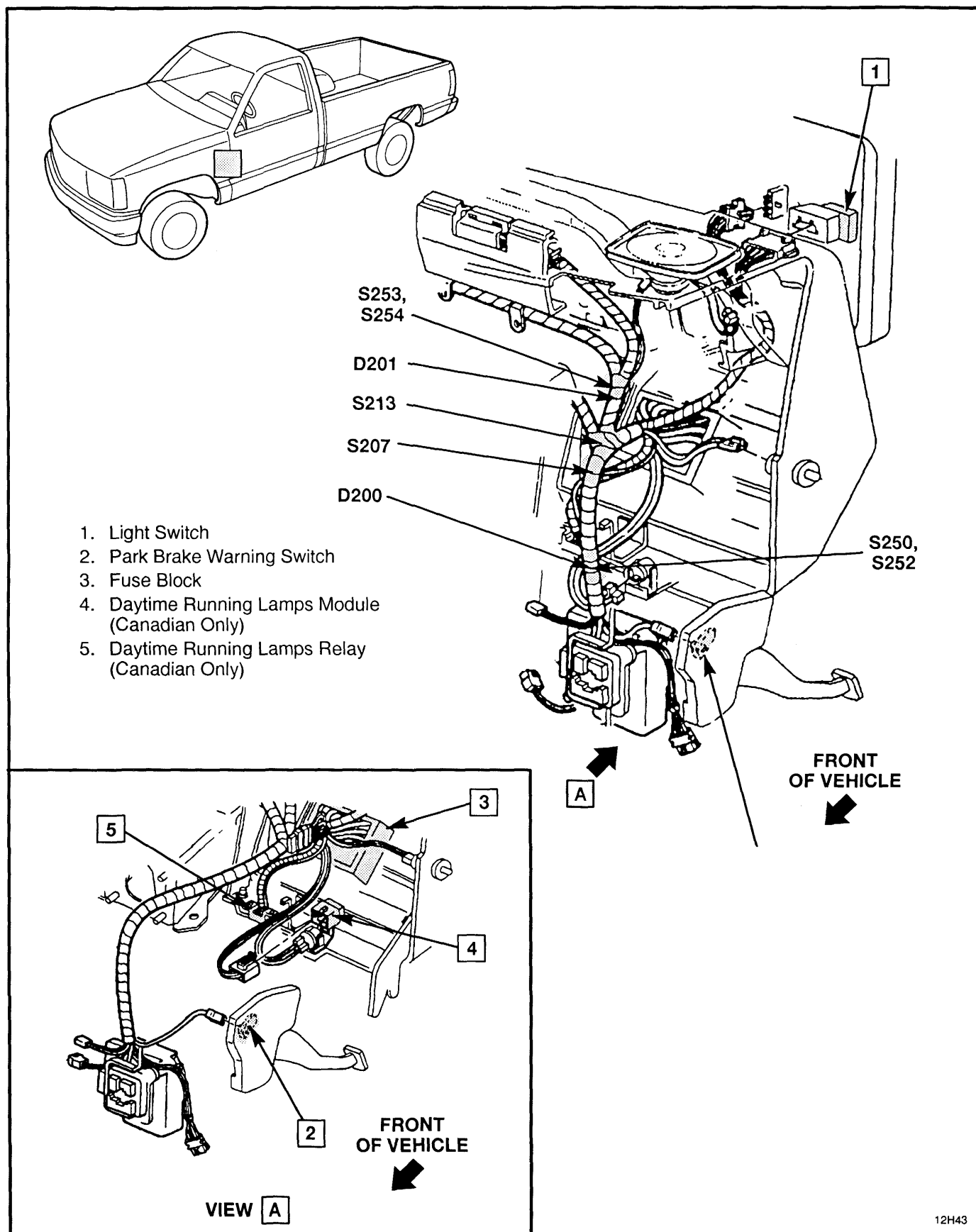


Figure 5 — LH Side of Instrument Panel

## 8A-104-18 HEADLAMPS WITH DAYTIME RUNNING LAMPS

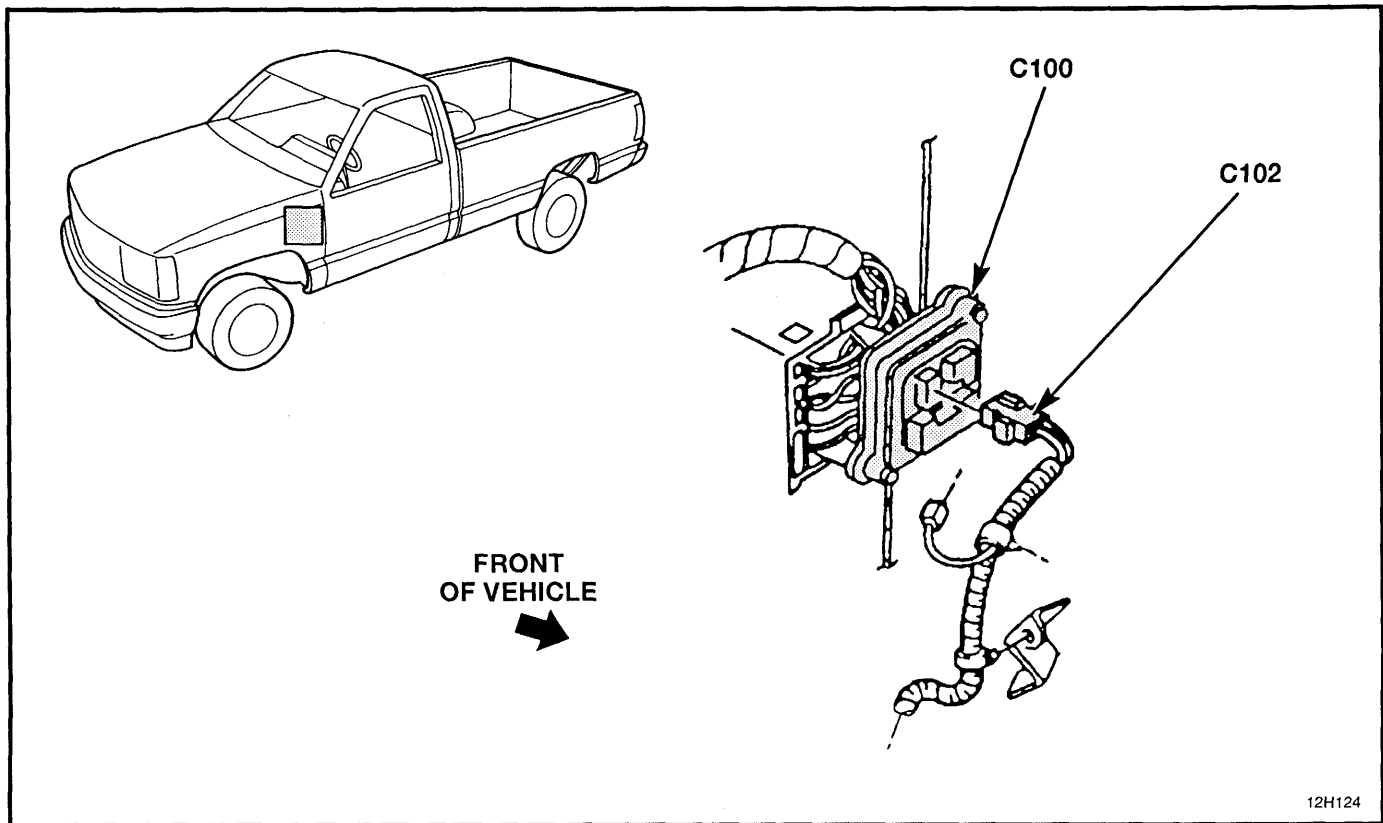


Figure 6 — I/P Wiring

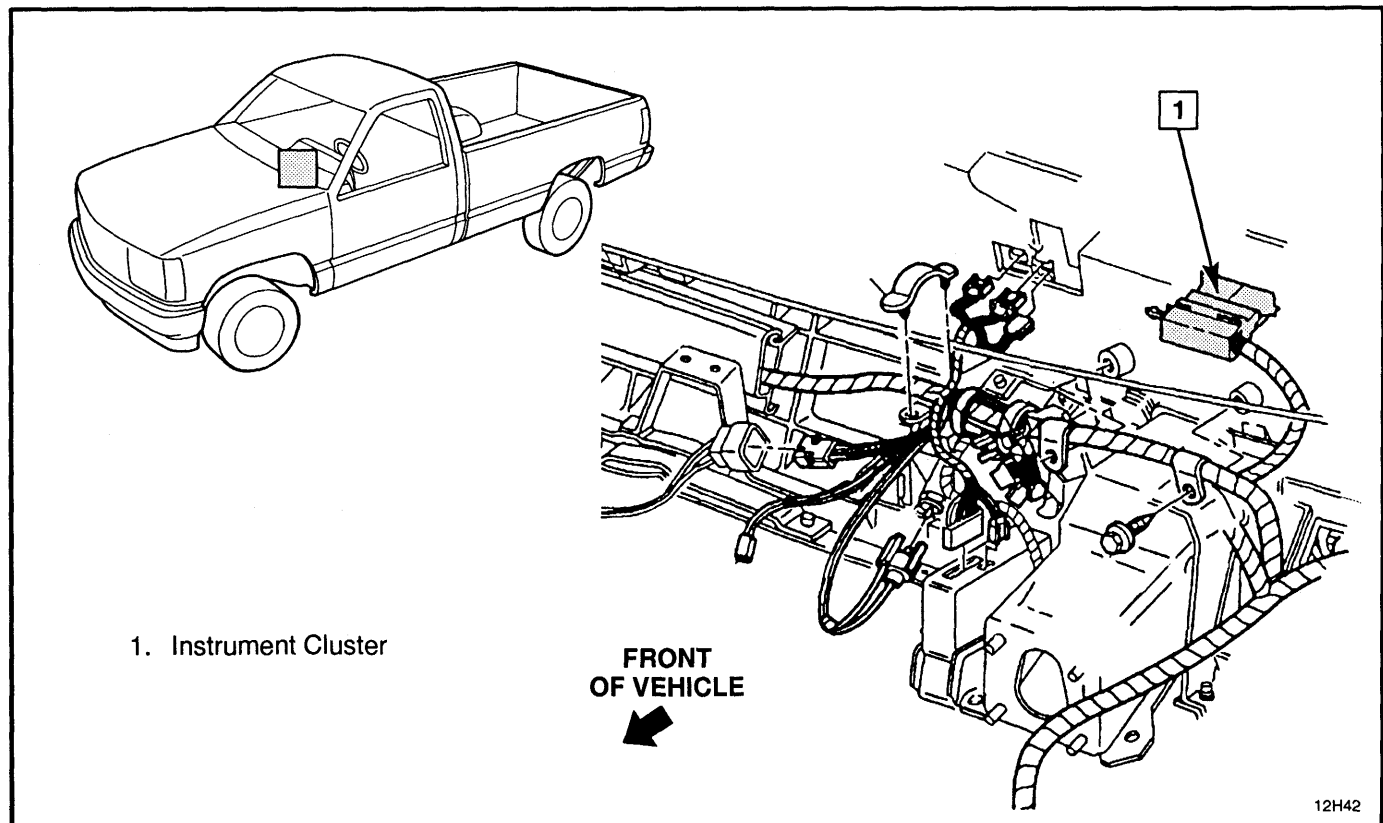


Figure 7 — Instrument Panel Wiring, RH Side

## **CIRCUIT OPERATION**

### **TAIL, MARKER, ENDGATE CLEARANCE AND LICENSE LAMPS**

Voltage is supplied through the PARK LP Fuse to the Light Switch at all times. With Light Switch in PARK or HEAD, voltage is supplied to the Tail, Marker, Endgate Clearance and License Lamps.

### **STOPLAMPS**

Voltage is supplied at all times through the STOP Fuse to the Brake Switch. When the brake pedal is depressed, the contacts in the TCC/Stoplamp Switch close. Voltage is supplied through the Turn Switch Assembly to the LH and RH Stoplamp, and the Stoplamp lights. If a Turn Signal is on, the Stoplamp on that side will flash as a Turn Signal. The other Stoplamp will serve as a Stoplamp.

### **TURN SIGNAL LAMPS**

With the Ignition Switch in RUN or START, voltage is supplied through the TURN-B/U Fuse and Turn Flasher to the normally closed contact of the Hazard Flasher Switch in the Turn Signal Switch Assembly.

With the Signal Switch in LH Turn position, voltage is supplied to both the LH Turn Indicator and the LH Front Park/Turn Lamp LT BLU (14) wire. Voltage is supplied to the LH Rear Turn Lamp YEL (18) wire.

The Lamps go on immediately. They begin to flash when the current flow heats up the timing element in the flasher and it repeatedly opens and closes the circuit.

The voltage supplied to the LH Front Park/Turn Lamp will also be supplied to the LH Front Marker Lamp. If the Light Switch is in the OFF position, the LH Front Marker Lamp will find a path to ground through splice S105 and the many Lamps connected in parallel to ground. These Lamps provide low resistance paths to ground. The Marker Lamp will flash with the Turn Lamps. The Lamps used for the ground path will not flash, however, since the voltage drop across the Marker Lamp is much higher than that across the other Lamps.

When the Light Switch is in either PARK or HEAD, voltage is supplied through the PARK LP Fuse, Lamp Switch and Splice 105 to the Marker and Park Lamps. If the

Turn Signal Switch Assembly is in TURN LEFT, the LH Front Marker Lamp will have voltage at both connections and will go out. When the flasher removes voltage to the Turn Lamp, the Marker Lamp will be grounded through the Turn Lamp and will go on. In this way, the LH Front Marker Lamp will flash on when the LH Front Park/Turn Lamp goes off, and off when the Turn Lamp goes on.

With the Turn Signal Switch Assembly in TURN RIGHT, voltage will be supplied to the RH Lamps in the same way.

### **HAZARD LAMPS**

Voltage is supplied at all times, through the STOP Fuse and the Hazard Flasher to the normally open contact of the Hazard Switch in the Turn Signal Switch Assembly. With the Hazard Switch in HAZARD FLASH, voltage is supplied to both Front and Rear Turn Lamps. All of the Turn Lamps and Turn Indicators flash on and off.

The Front Marker Lamps flash in HAZARD FLASH just as they did in TURN RIGHT and TURN LEFT. If the Lamp Switch is in OFF, they flash on when the Hazard Lamps are on. If the Lamp Switch is in either PARK or HEAD, they flash on when the Hazard Lamps are off and off when the Hazard Lamps are on.

In HAZARD, the circuit is always open and the Hazard Flasher controls the Lamps.

### **PARK AND MARKER LAMPS**

Voltage is supplied through the PARK LP Fuse to the Lamp Switch at all times. With the Lamp Switch in PARK or HEAD, voltage is supplied to the Park, Tail, Marker, Roof Marker and License Lamps.

### **SNOWPLOW PREPARATION PACKAGE**

Voltage is supplied to the RH and LH Snowplow Turn Signal Relays through the Battery Junction Block at all times. When the Turn Signal Switch is placed in LH or RH turn the appropriate relay will energize, providing battery voltage to the associated turn signal on the snowplow assembly. As the turn signal flashes on and off, the relay will also cycle on and off, causing the snowplow turn signal lamp to flash.

## 8A-110-2 EXTERIOR LAMPS

### COMPONENT LOCATION

### Page — Figure

|                                                         |                                         |           |    |
|---------------------------------------------------------|-----------------------------------------|-----------|----|
| Center High Mount Stoplamp<br>(Pickup) .....            | Back, top of cab .....                  | Not Shown |    |
| Center High Mount Stoplamp<br>(Suburban, Utility) ..... | At rear of vehicle .....                | Not Shown |    |
| Center High Mount Stoplamp<br>Relay (Pickup) .....      | On RH cowl, in engine compartment ..... | Not Shown |    |
| Convenience Center .....                                | Under LH side of I/P .....              | 110-23    | 7  |
| Clearance Lamp, LH Front .....                          | Front of LH rear fender .....           | 110-24    | 9  |
| Clearance Lamp, RH Front .....                          | Front of RH rear fender .....           | 110-24    | 9  |
| Clearance Lamp, LH Rear .....                           | Rear of LH rear fender .....            | 110-24    | 9  |
| Clearance Lamp, RH Rear .....                           | Rear of RH rear fender .....            | 110-24    | 9  |
| Endgate Clearance Lamps .....                           | On rear of endgate .....                | 110-28    | 14 |
| Front Identification Lamps .....                        | On outside front of roof panel .....    | Not Shown |    |
| Fuse Block .....                                        |                                         | 110-22    | 6  |
| Hazard Flasher .....                                    | Under LH side of I/P .....              | 110-22    | 6  |
| License Lamp .....                                      | Rear of vehicle at license holder ..... | 110-29    | 15 |
| License Lamp, LH .....                                  | Center of rear bumper .....             | 110-29    | 15 |
| License Lamp, RH .....                                  | Center of rear bumper .....             | 110-29    | 15 |
| Light Switch .....                                      | Upper LH side of I/P .....              | 110-22    | 6  |
| Marker Lamp, LH Roof .....                              | On roof above windshield .....          | 110-23    | 7  |
| Marker Lamp, RH Roof .....                              | On roof panel .....                     | 110-23    | 7  |
| Park and Turn Lamp, LH .....                            | LH front of vehicle .....               | 110-19    | 1  |
| Park and Turn Lamp, RH .....                            | RH front of vehicle .....               | 110-19    | 1  |
| Side Marker Lamp, LH .....                              | LH front side of vehicle .....          | 110-19    | 1  |
| Side Marker Lamp, RH .....                              | RH front side of vehicle .....          | 110-19    | 1  |
| Snowplow Turn Signal Relay, LH ...                      | On LH front of core support .....       | Not Shown |    |
| Snowplow Turn Signal Relay, RH ...                      | On RH front of core support .....       | Not Shown |    |
| Tail, Stop, Turn Signal and Backup<br>Lamp, LH .....    | LH rear of vehicle .....                | Not Shown |    |
| Tail, Stop, Turn Signal and Backup<br>Lamp, RH .....    | RH rear of vehicle .....                | Not Shown |    |
| TCC/Stoplamp Switch .....                               | Top of brake pedal .....                | 110-24    | 8  |
| Turn Signal Flasher .....                               | At convenience center .....             | 110-23    | 7  |
| Turn Signal Switch .....                                | LH upper side of steering column .....  | 110-25    | 10 |

### CONNECTORS:

|             |                                    |           |    |
|-------------|------------------------------------|-----------|----|
| C100 .....  | At bulkhead connector .....        | 110-20    | 3  |
| C101 .....  | At bulkhead connector .....        | 110-19    | 1  |
| C102 .....  | At bulkhead connector .....        | 110-20    | 3  |
| C200 .....  | Behind RH side of I/P .....        | 110-21    | 5  |
| C206 .....  | At turn hazard switch .....        | Not Shown |    |
| C267 .....  | Lower edge of tailgate .....       | Not Shown |    |
| C284 .....  | At convenience center .....        | 110-23    | 7  |
| C288A ..... | Below LH side of I/P .....         | Not Shown |    |
| C299A ..... | Below LH side of I/P .....         | Not Shown |    |
| C400 .....  | At rear crossmember, LH side ..... | 110-30    | 16 |
| C401 .....  | Rear of LH frame rail .....        | 110-27    | 13 |
| C403 .....  | Behind center of rear bumper ..... | 110-27    | 13 |

### GROMMETS:

|            |                                          |        |   |
|------------|------------------------------------------|--------|---|
| P101 ..... | RH lower cowl (engine compartment) ..... | 110-21 | 5 |
|------------|------------------------------------------|--------|---|

COMPONENT LOCATION (continued)

Page — Figure

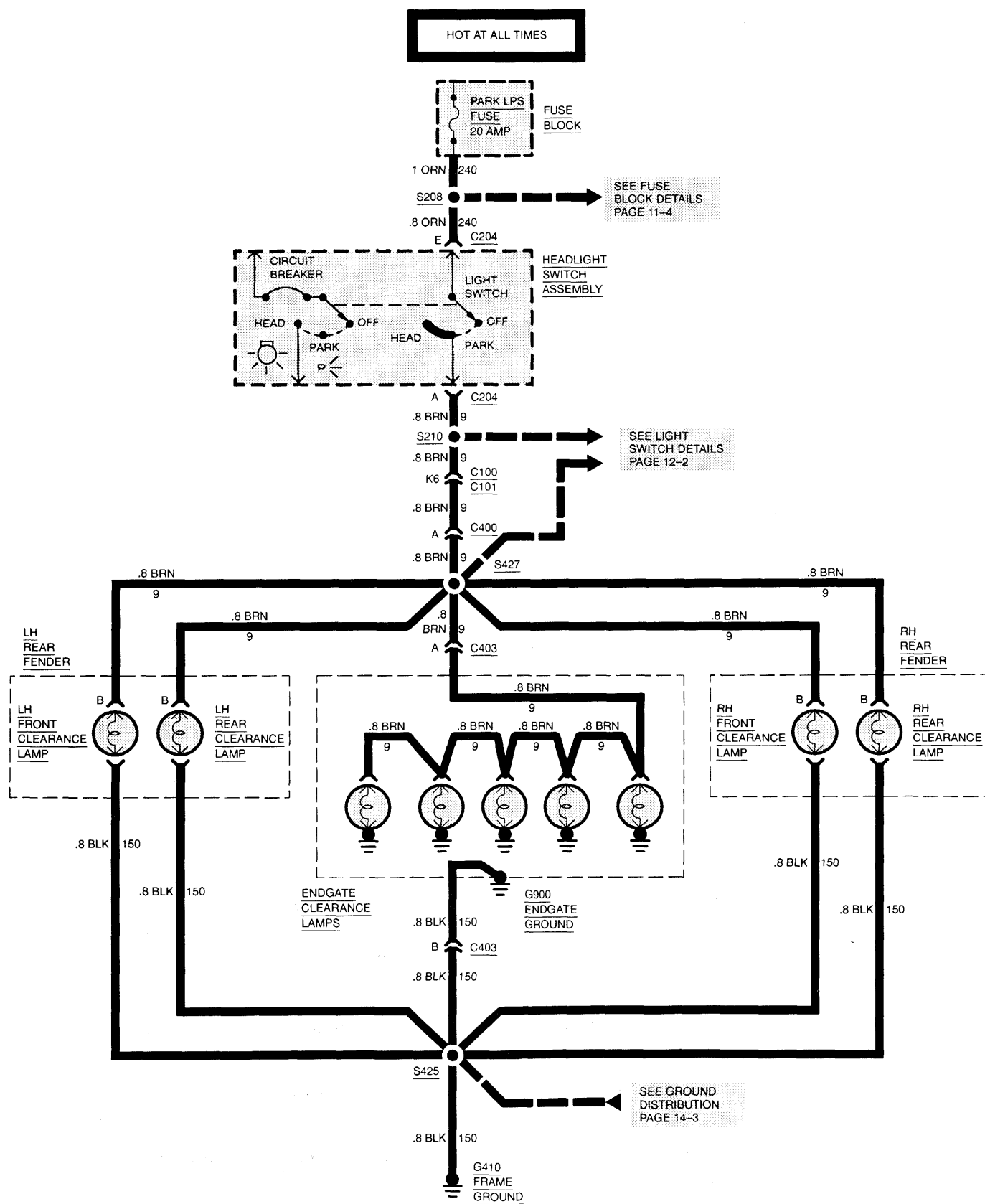
GROUNDS:

|                 |                                   |           |    |
|-----------------|-----------------------------------|-----------|----|
| G104            | On sheet metal, above LH headlamp | 110-19    | 1  |
| G105            | RH inner fender, near battery     | 110-19    | 1  |
| G106            | Rear of RH cylinder head          | 110-20    | 2  |
| G202            | At DLC connector                  | 110-21    | 4  |
| G400 (Suburban) | At RH D-pillar                    | Not Shown |    |
| G400 (Utility)  | At RH C-pillar                    | Not Shown |    |
| G410            | At LH side of platform hitch      | 110-27    | 13 |
| G900            | Bottom center of endgate          | Not Shown |    |

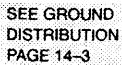
SPLICES:

|                          |                                                      |           |    |
|--------------------------|------------------------------------------------------|-----------|----|
| S103                     | RH side, near headlamp                               | Not Shown |    |
| S104                     | LH side, near headlamp                               | 110-19    | 1  |
| S105                     | LH front fender                                      | 110-19    | 1  |
| S106                     | LH side, near headlamp                               | 110-19    | 1  |
| S107                     | RH side, near headlamp                               | 110-19    | 1  |
| S118                     | Engine harness, near cowl LH rear engine compartment | 110-20    | 2  |
| S190 (Pickup Only)       | LH cowl in engine compartment                        | Not Shown |    |
| S207                     | Under LH side of I/P                                 | 110-22    | 6  |
| S208                     | Under LH side of I/P                                 | 110-22    | 6  |
| S210                     | Under LH side of I/P                                 | 110-22    | 6  |
| S251                     | Under LH side of I/P                                 | 110-22    | 6  |
| S260A (Suburban/Utility) | Behind LH side of I/P                                | Not Shown |    |
| S275A (Pickup Only)      | Behind LH side of I/P                                | Not Shown |    |
| S402 (Suburban/Utility)  | Above rear liftgate glass opening                    | 110-26    | 11 |
| S403                     | License lamps harness, near LH license lamp lead     | 110-27    | 13 |
| S404                     | License lamps harness, near LH license lamp lead     | 110-27    | 13 |
| S425                     | Rear lamp harness, LH side at rear crossmember       | 110-27    | 13 |
| S427                     | Rear lamp harness, LH side at rear crossmember       | 110-26    | 12 |

### CLEARANCE LAMPS (PICKUP WITH DUAL REAR WHEELS)



## REAR PARK/MARKER AND LICENSE LAMPS

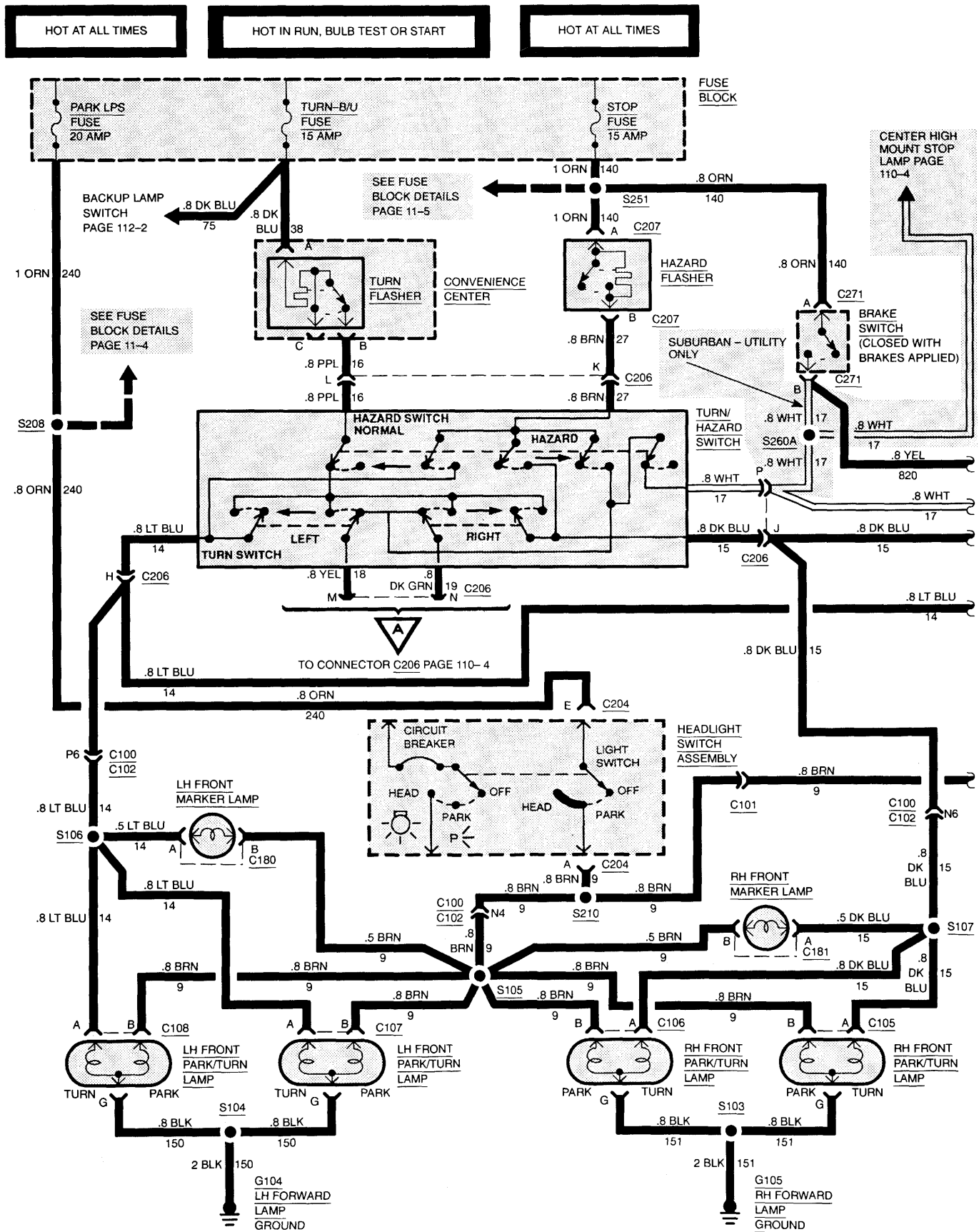


G410  
FRAME  
GROUND



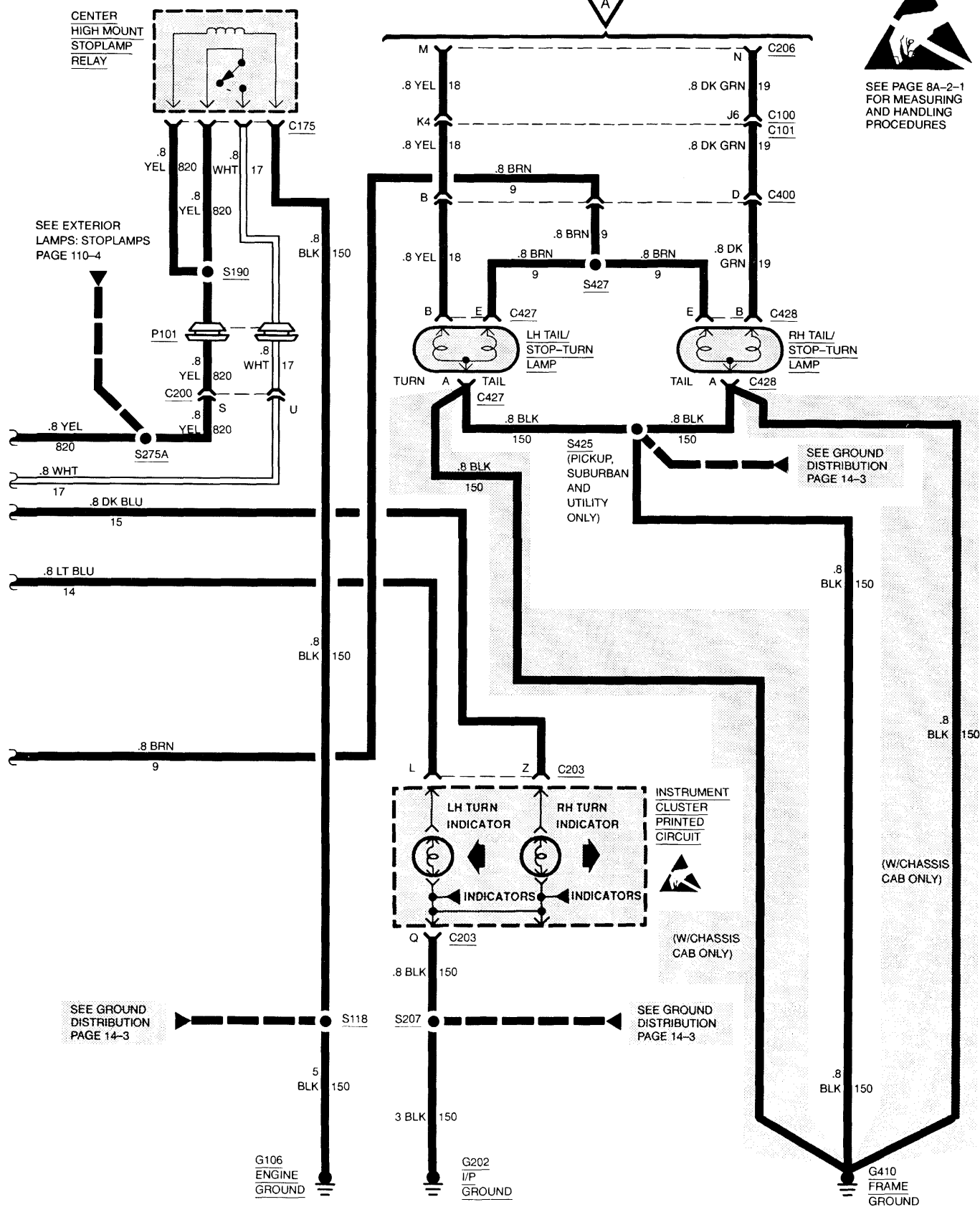
# 8A-110-6 EXTERIOR LAMPS

## TURN AND HAZARD LAMPS PARK AND MARKER LAMPS

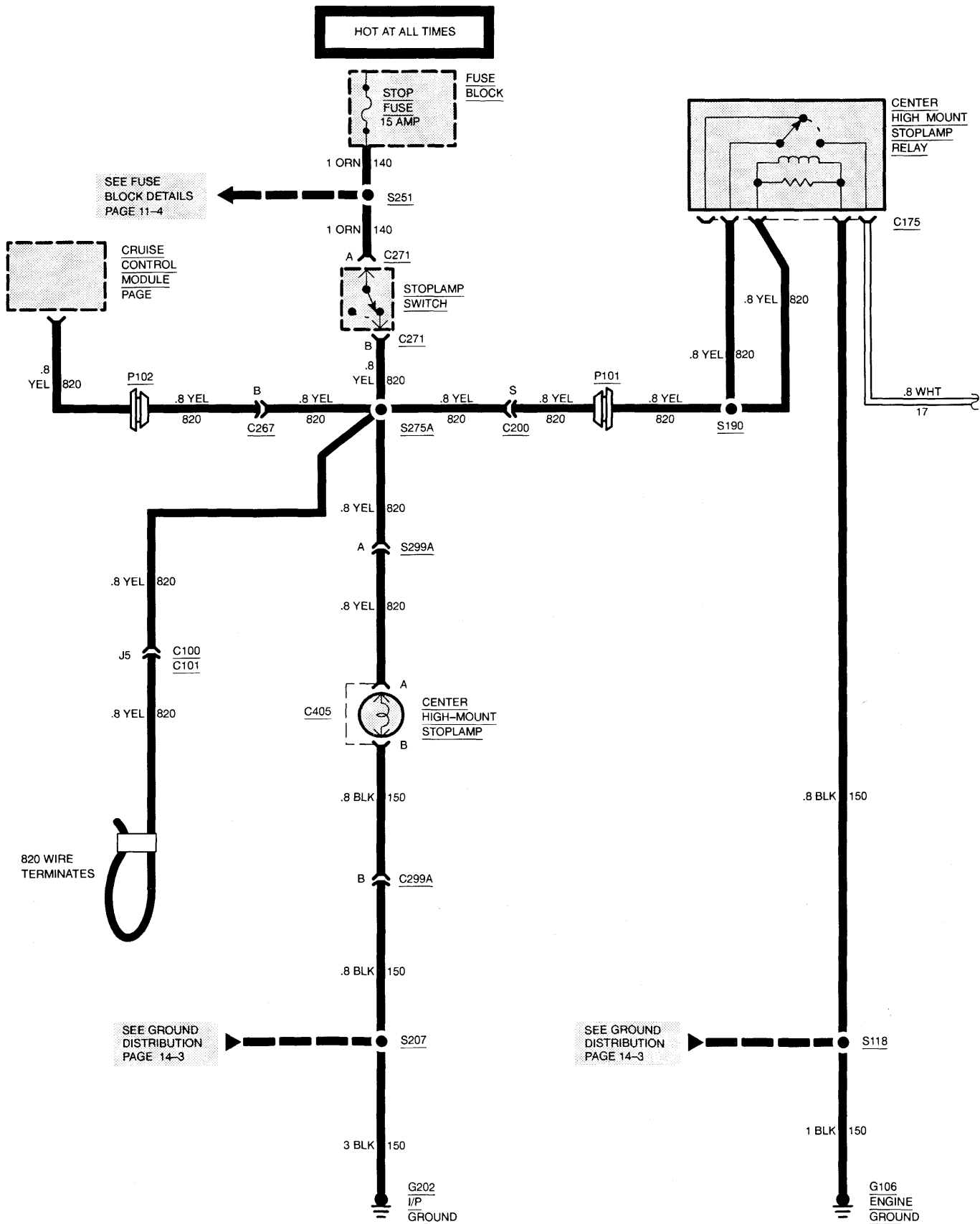


## TURN AND HAZARD LAMPS PARK AND MARKER LAMPS

FROM CONNECTOR C206 PAGE 110-6

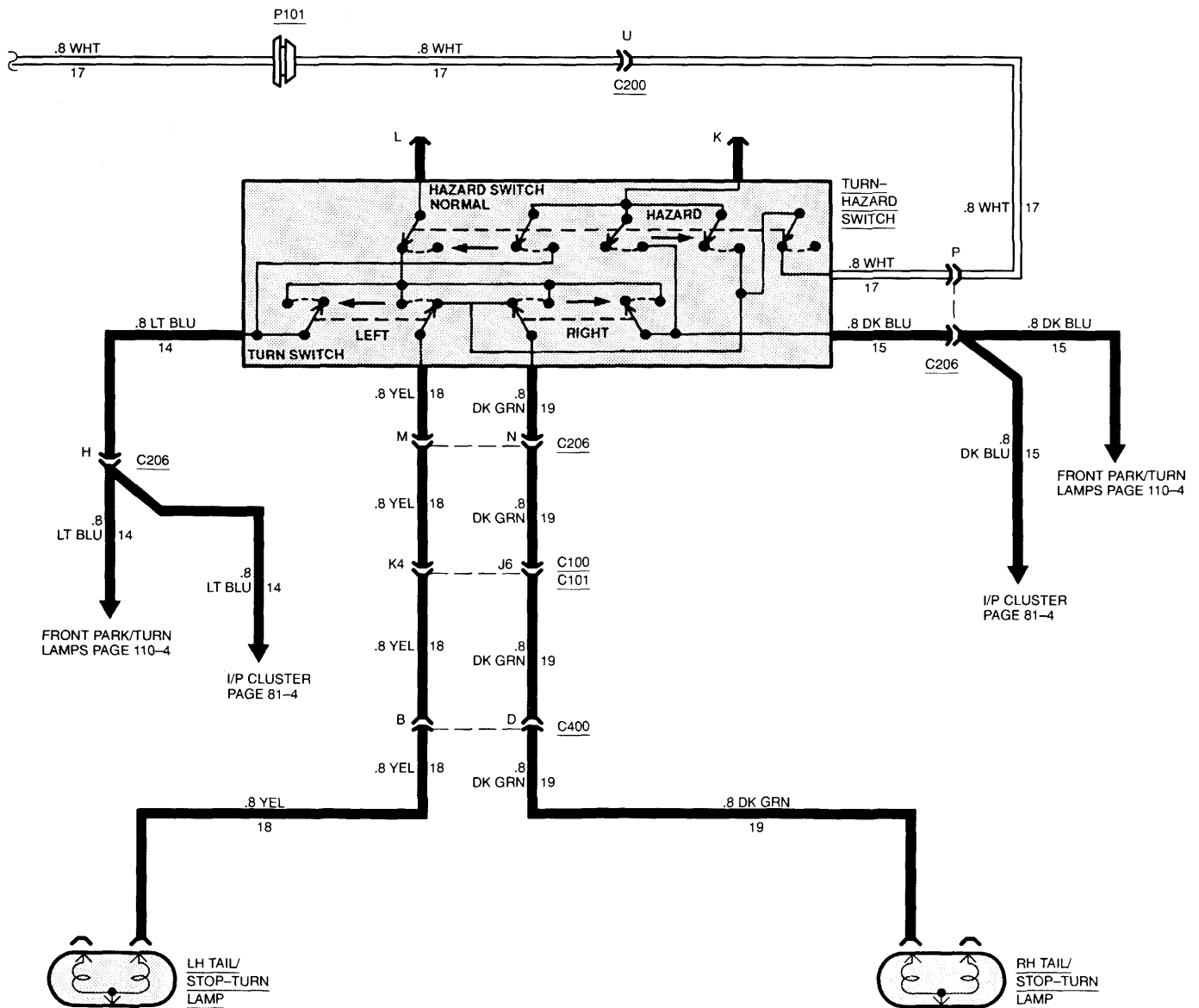


### STOPLAMP (PICKUP)

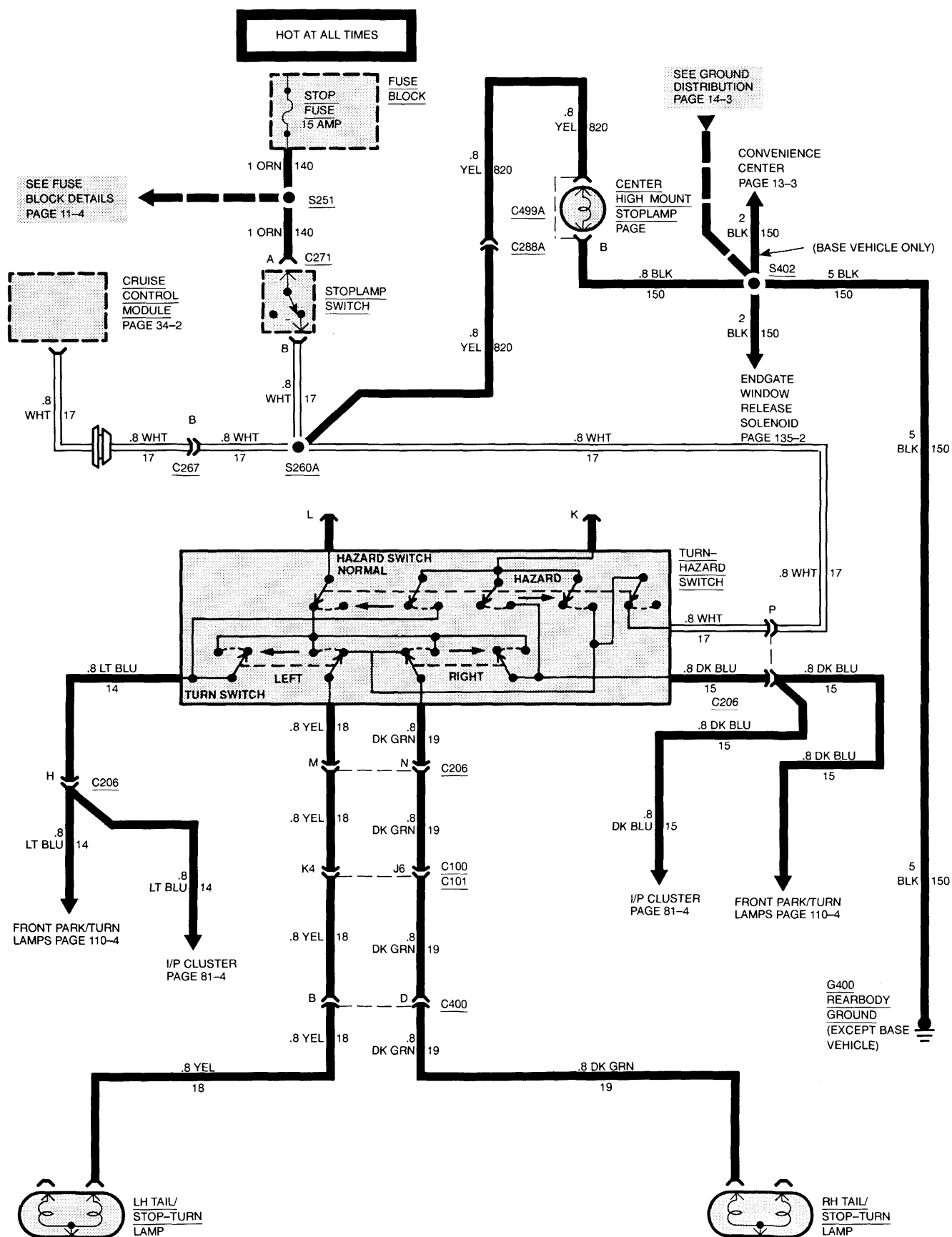


# EXTERIOR LAMPS 8A-110-9

## STOPLAMP (PICKUP)

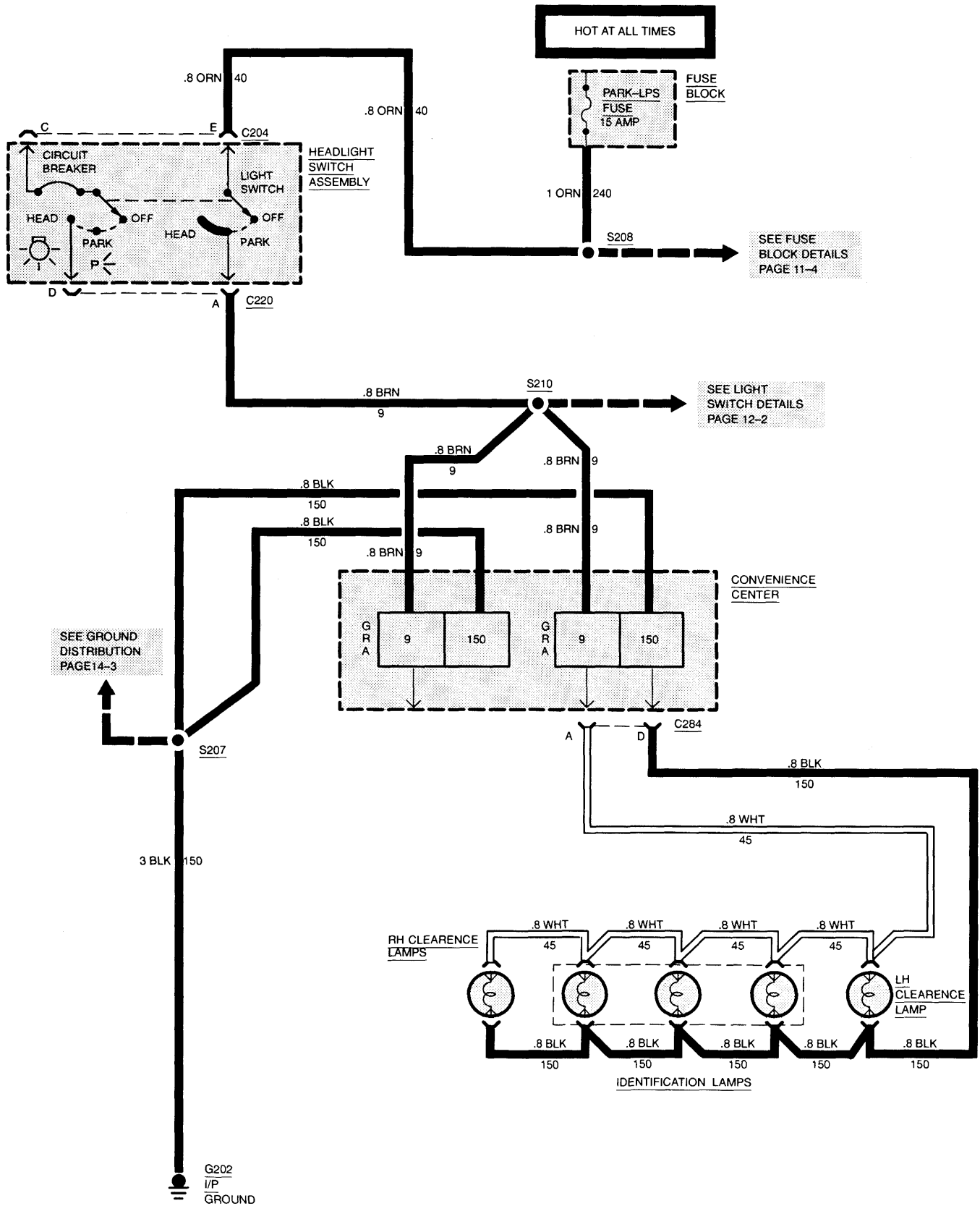


## STOPLAMP (SUBURBAN-UTILITY)



# EXTERIOR LAMPS 8A-110-11

## ROOR MARKER LAMPS



## 8A-110-12 EXTERIOR LAMPS

### DIAGNOSIS — REAR EXTERIOR LAMPS

#### PRELIMINARY CHECKS:

1. Rear lamp systems (taillamps, clearance lamps, endgate lamps and license plate lamps) all receive voltage from same wire circuit BRN (9) and share same ground terminal G410. If only one system is not working, LOCATE and REPAIR open in wiring and/or bulbs that pertain to that system.
2. Check condition of STOP, PARK LP, TURN-B/U Fuse(s). If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).

#### STOPLAMPS DO NOT OPERATE

| TEST                                                                                                                        | RESULT                          | ACTION                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (140) wire at stoplamp switch connector C271 to ground.                                       | Test lamp lights.               | GO to step 3.                                                                                                         |
|                                                                                                                             | Test lamp does not light.       | GO to step 2.                                                                                                         |
| 2. Place hazard flasher switch to ON position.                                                                              | Hazard flashers operate.        | LOCATE and REPAIR open in ORN (140) wire between splice S251 and stoplamp switch connector C271.                      |
|                                                                                                                             | Hazard flashers do not operate. | LOCATE and REPAIR open in ORN (140) wire between fuse block and splice S251.                                          |
| 3. Connect test lamp from WHT (17) wire at stoplamp switch connector C271 to ground. Depress brake pedal.                   | Test lamp lights.               | GO to step 4.                                                                                                         |
|                                                                                                                             | Test lamp does not light.       | REPLACE stoplamp switch.                                                                                              |
| 4. Connect test lamp from WHT (17) wire at turn signal switch connector C206 to ground. Depress brake pedal.                | Test lamp lights.               | GO to step 5.                                                                                                         |
|                                                                                                                             | Test lamp does not light.       | LOCATE and REPAIR open in WHT (17) wire between stoplamp switch connector C271 and turn signal switch connector C206. |
| 5. Connect test lamp from YEL (18) or DK GRN (19) wire at turn signal switch connector C206 to ground. Depress brake pedal. | Test lamp lights.               | VERIFY condition of connectors C100 and C400.                                                                         |
|                                                                                                                             | Test lamp does not light.       | REPLACE turn signal switch.                                                                                           |

#### STOPLAMPS DO NOT OPERATE ON ONE SIDE

| TEST                                                                                                                                      | RESULT                    | ACTION                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from YEL (18) or DK GRN (19) wire at affected stoplamp connector to ground. Depress brake pedal.                     | Test lamp lights.         | GO to step 4.                                                                                        |
|                                                                                                                                           | Test lamp does not light. | GO to step 2.                                                                                        |
| 2. Connect test lamp from YEL (18) or DK GRN (19) wire (depending on side with failure) at connector C400 to ground. Depress brake pedal. | Test lamp lights.         | LOCATE and REPAIR open in YEL (18) or DK GRN (19) wire between connector C400 and affected stoplamp. |
|                                                                                                                                           | Test lamp does not light. | GO to step 3.                                                                                        |

**STOPLAMPS DO NOT OPERATE ON ONE SIDE (CONTINUED)**

| TEST                                                                                                                                      | RESULT                    | ACTION                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3. Connect test lamp from YEL (18) or DK GRN (19) wire (depending on side with failure) at connector C101 to ground. Depress brake pedal. | Test lamp lights.         | LOCATE and REPAIR open in YEL (18) or DK GRN (19) wire between connector C101 and connector C400.                                                                     |
|                                                                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in YEL (18) or DK GRN (19) wire between connector C101 and turn signal switch connector C206. If no open is found, REPLACE turn signal switch. |
| 4. Connect self-powered test lamp from BLK (150) wire at affected stoplamp to ground.                                                     | Test lamp lights.         | REPLACE stoplamp.                                                                                                                                                     |
|                                                                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between stoplamp and ground G410.                                                                                            |

**REAR LAMP SYSTEMS DO NOT OPERATE**

| TEST                                                                                                    | RESULT                                      | ACTION                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place light switch in PARK. Observe front park and marker lamps.                                     | Front park and marker lamps operate.        | GO to step 3.                                                                                                                                        |
|                                                                                                         | Front park and marker lamps do not operate. | GO to step 2.                                                                                                                                        |
| 2. Push horn button.                                                                                    | Horn sounds.                                | LOCATE and REPAIR open in ORN (240) wire between splice S209 and light switch connector C204. If no open is found, REPLACE light switch.             |
|                                                                                                         | Horn does not sound.                        | LOCATE and REPAIR open in ORN (240) wire between fuse block and splice S209.                                                                         |
| 3. Connect test lamp from BRN (9) wire at LH tail, stop, turn and backup lamp connector C427 to ground. | Test lamp lights.                           | LOCATE and REPAIR open in BLK (150) wire between splice S425 and ground G410 (all except chassis cab), CHECK condition of ground G410 (chassis cab). |
|                                                                                                         | Test lamp does not light.                   | GO to step 4.                                                                                                                                        |
| 4. Connect test lamp from BRN (9) wire at connector C400 to ground.                                     | Test lamp lights.                           | LOCATE and REPAIR open in BRN (9) wire between connector C400 and splice S427.                                                                       |
|                                                                                                         | Test lamp does not light.                   | GO to step 5.                                                                                                                                        |
| 5. Connect test lamp from BRN (9) connector C101 to ground.                                             | Test lamp lights.                           | LOCATE and REPAIR open in BRN (9) wire between connector C101 and connector C400.                                                                    |
|                                                                                                         | Test lamp does not light.                   | LOCATE and REPAIR open in BRN (9) wire between splice S210 and connector C101.                                                                       |



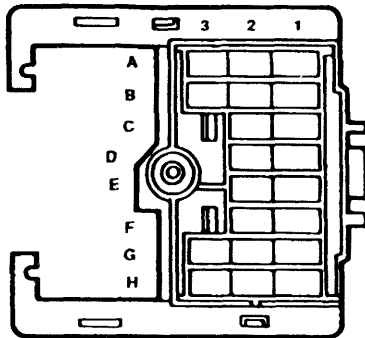
## 8A-110-14 EXTERIOR LAMPS

### TURN SIGNALS DO NOT OPERATE ON ONE SIDE

| TEST                                                                                                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Turn hazard flasher ON. Observe lights on side of turn signals that does not work.                                                                                                                                                                             | Lights flash.             | GO to step 2.                                                                                                                                                       |
|                                                                                                                                                                                                                                                                   | Lights do not flash.      | GO to step 3.                                                                                                                                                       |
| 2. Turn hazard warning system OFF. Place ignition switch in RUN and turn signal switch to side that does not work. Connect test lamp from LT BLU (14) or DK BLU (15) wire (depending on which side does not work) at turn signal switch connector C206 to ground. | Test lamp flashes.        | System operating normally.                                                                                                                                          |
|                                                                                                                                                                                                                                                                   | Test lamp does not flash. | REPLACE turn signal switch.                                                                                                                                         |
| 3. Connect test lamp from LT BLU (14) or DK BLU (15) wire (depending on which side does not work) at park lamp connector C105, C106, C107 or C108 to ground.                                                                                                      | Test lamp lights.         | GO to step 4.                                                                                                                                                       |
|                                                                                                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in either LT BLU (14) or DK BLU (15) wires between affected lamp and connector C102 or connector C100 and turn signal switch connector C206. |
| 4. Connect test lamp from LT BLU (14) or DK BLU (15) wire to BLK (150 or 151) wire at park lamp C105, C106, C107 or C108.                                                                                                                                         | Test lamp lights.         | CHECK condition of bulb sockets.                                                                                                                                    |
|                                                                                                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in BLK (150 or 151) wire between affected lamp and ground G104 or G105.                                                                      |

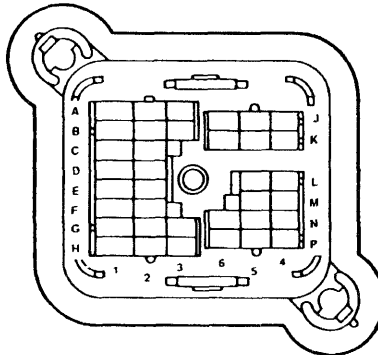
# EXTERIOR LAMPS 8A-110-15

12020183



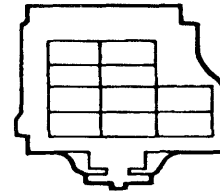
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



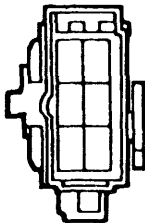
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12020100



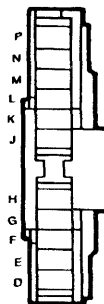
**C102**  
Bulkhead – Forward Lamps

12020099



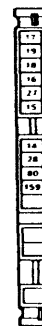
**C101**  
Bulkhead – Rear Lamps

12004147



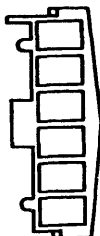
**BLACK**  
Pac/on  
**C206**  
Turn Signal Switch

12004148



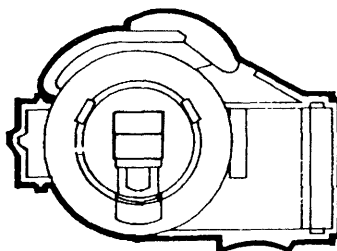
**BLACK**  
Pac/on  
**C206**  
Turn Signal Switch

12040551



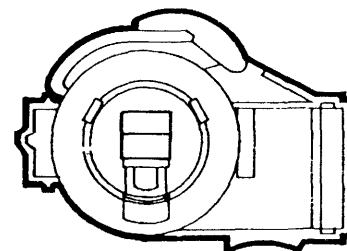
**BLACK**  
Metri-Pack 480  
**C271**  
TCC/Brake Switch

12089345



**GRAY**  
**C105**  
RH Park and Turn Signal Lamp

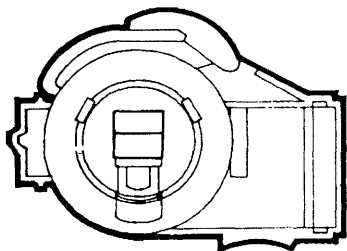
12089345



**GRAY**  
**C106**  
RH Park and Turn Signal Lamp

# 8A-110-16 EXTERIOR LAMPS

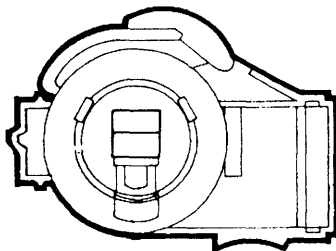
12089345



GRAY

**C107**  
LH Park and Turn Signal Lamp

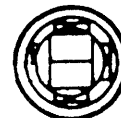
12089345



GRAY

**C108**  
LH Park and Turn Signal Lamp

12077765



CREAM  
Molded-on

**C180**  
LH Side Marker Lamp

12077765



CREAM  
Molded-on

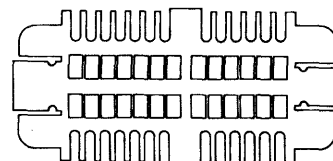
**C181**  
RH Side Marker Lamp

02973385



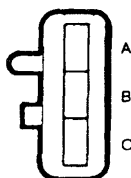
BLACK  
56 Series  
**C271**  
Hazard Flasher

12089908



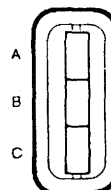
BLACK  
Bow Series  
**C203**  
I/P Cluster

12047781



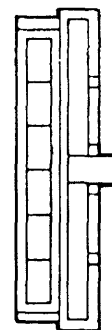
BLACK  
Metri-Pack 150  
**C267**  
Cruise Control Module to PCM

12047782



BLACK  
Metri-Pack 150  
**C267**  
PCM to Cruise Control Module

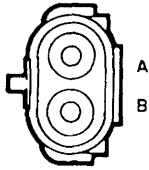
12034061



NATURAL  
Metri-Pack 480  
**C204**  
Light Switch

# EXTERIOR LAMPS 8A-110-17

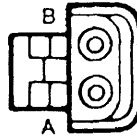
12010973



**BLACK**  
Weather Pack

**C403**  
Endgate to Rear Lamps Harness

12015792



**BLACK**  
Weather Pack

**C403**  
Rear Lamps Harness to Endgate

12020348



**CREAM**  
Molded On

**C409**  
License Lamp (W/VF6)

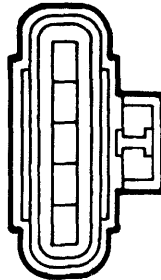
12020348



**CREAM**  
Molded On

**C410**  
License Lamp (W/VF6)

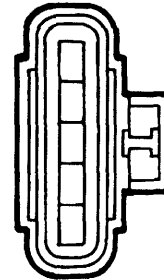
12065862



**BLACK**  
Metri-Pack 280

**C427**  
LH Tail and Stoplamp

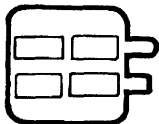
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**BLACK**  
Metri-Pack 280

**C428**  
RH Tail and Stoplamp

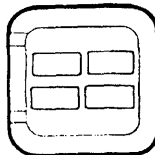
12047785



**BLACK**  
Metri-Pack 150

**C299A**  
In-Line CHMSL to I/P

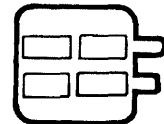
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**BLACK**  
Metri-Pack 150

**C299A**  
In-Line I/P to CHMSL

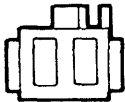
12047785



**BLACK**  
Metri-Pack 150

**C405**  
CHMSL

**8A-110-18 EXTERIOR LAMPS**

|                                                                                                                                                                                                    |                                                                                                                                                                                                    |                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>12047683</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C288A<br/>In-Line I/P to CHMSL (Suburban)</div> | <div>12047682</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C288A<br/>In-Line CHMSL to I/P (Suburban)</div> | <div>12033701</div> <div></div> <div>C284<br/>Front Identifications Lamps</div> |
|                                                                                                                                                                                                    |                                                                                                                                                                                                    |                                                                                                                                                                    |
|                                                                                                                                                                                                    |                                                                                                                                                                                                    |                                                                                                                                                                    |

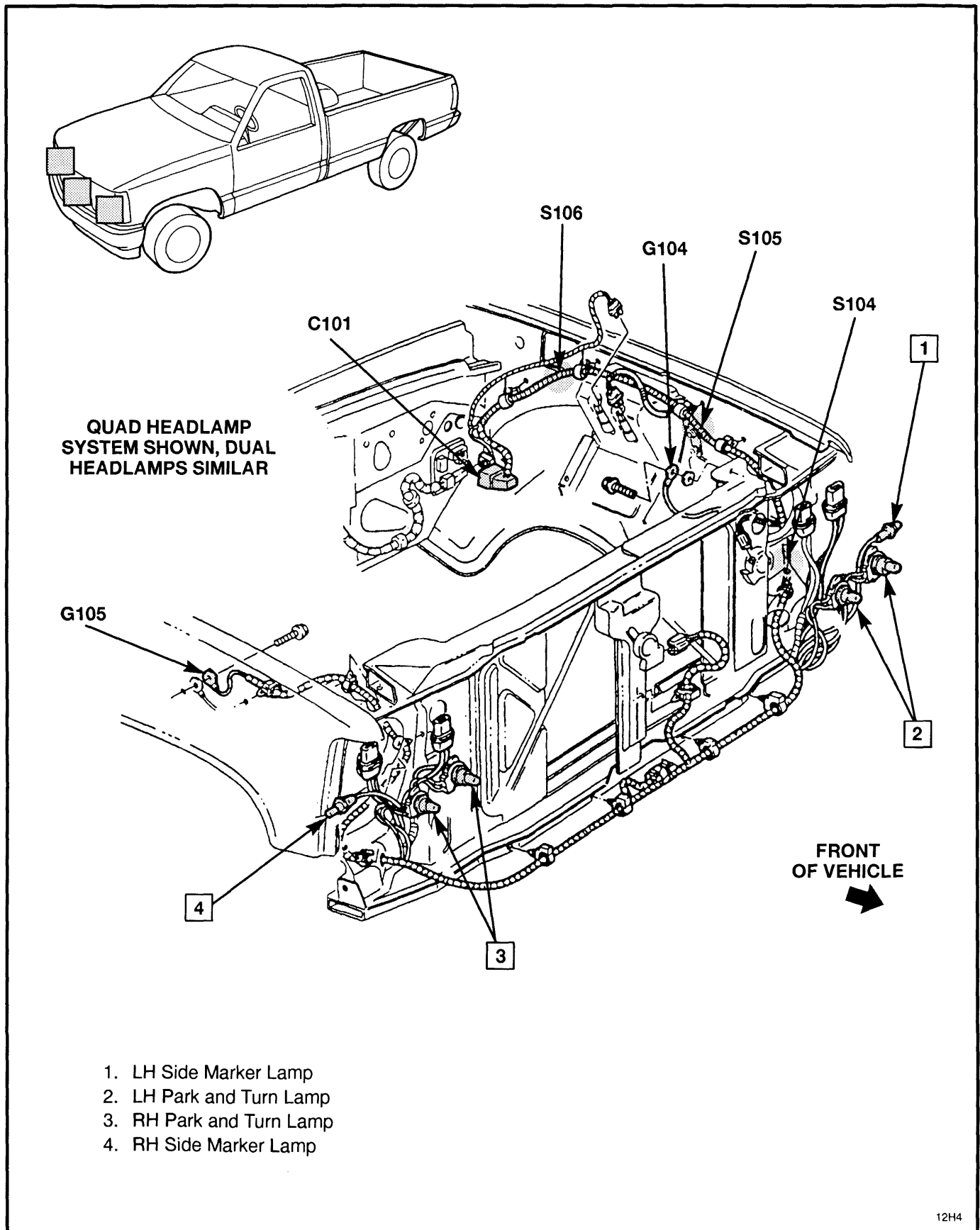


Figure 1 — Forward Lamps Harness, Quad Headlamps

## 8A-110-20 EXTERIOR LAMPS

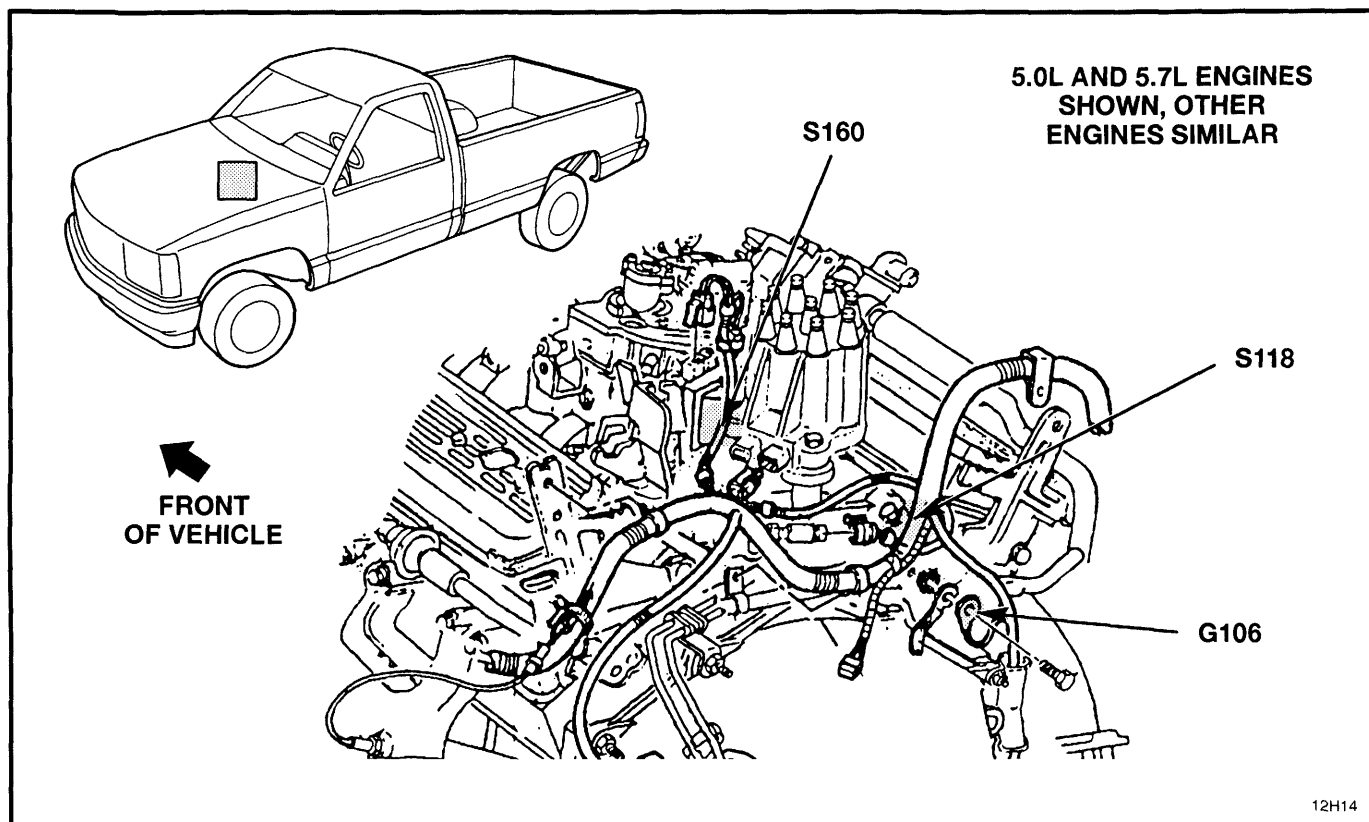


Figure 2 — LH Side of Engine, 5.0L (305 CID) 5.7L (350 CID) — Gasoline Engines

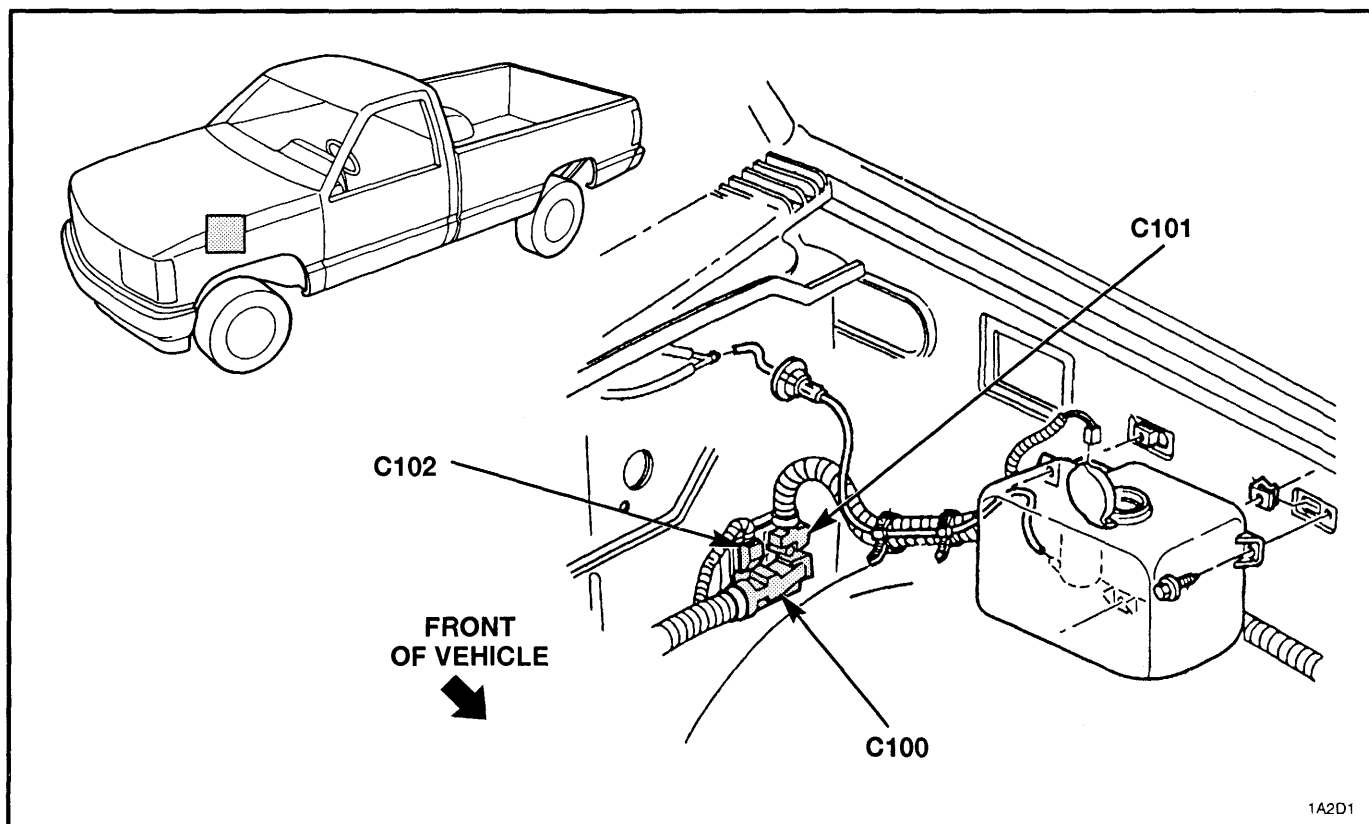


Figure 3 — Windshield Washer Reservoir and Pump, Except Suburban and Utility

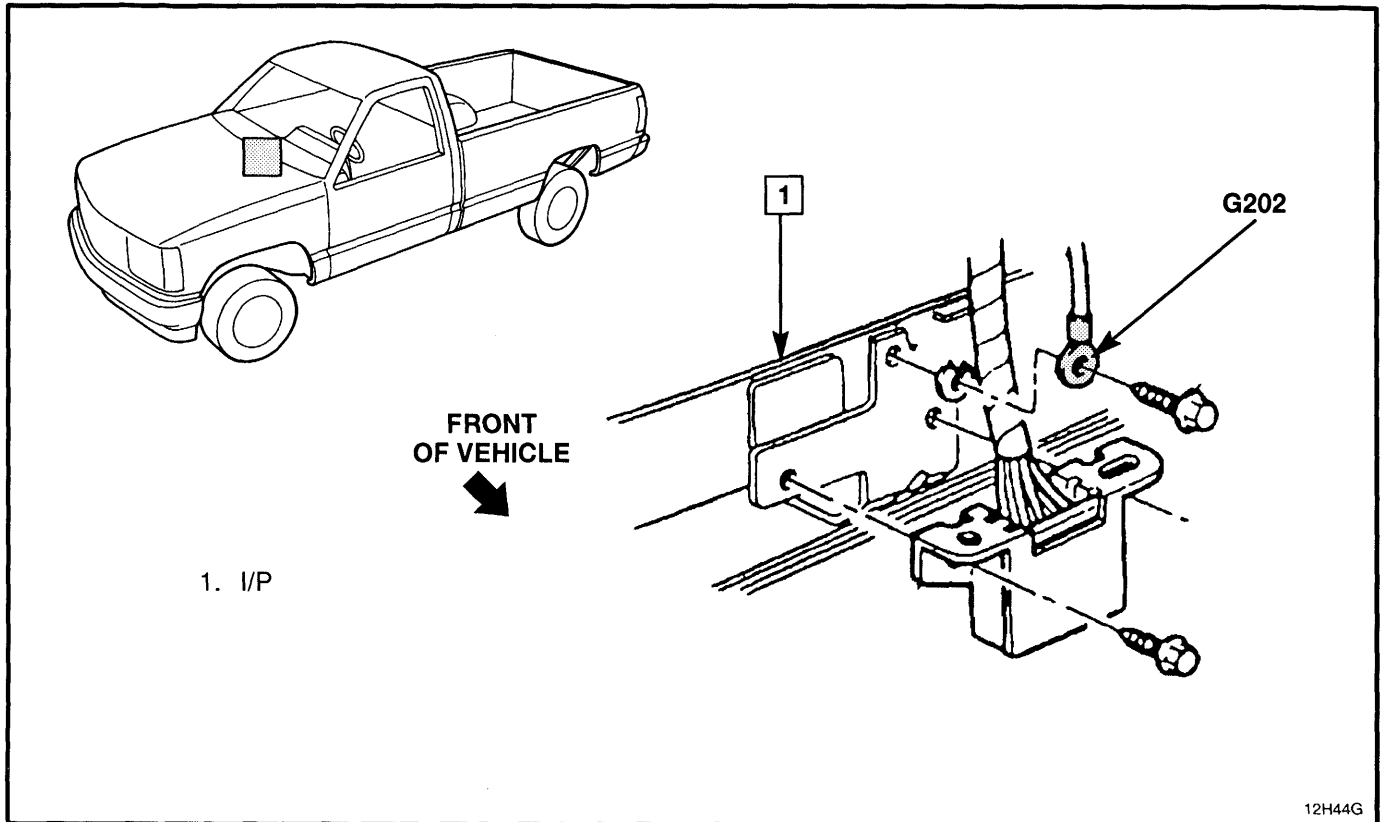


Figure 4 — I/P Ground Wiring

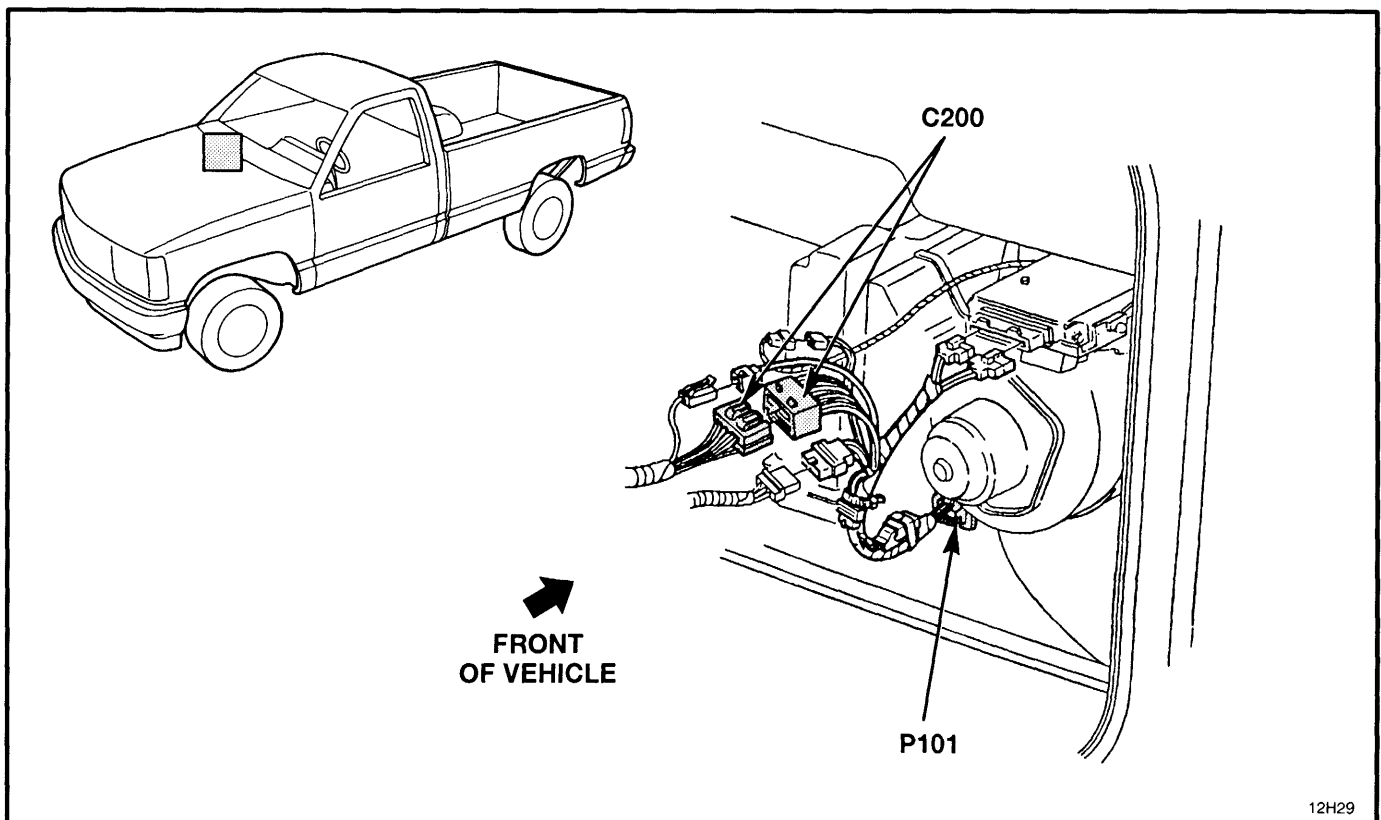


Figure 5 — Behind RH Side of I/P



## 8A-110-22 EXTERIOR LAMPS

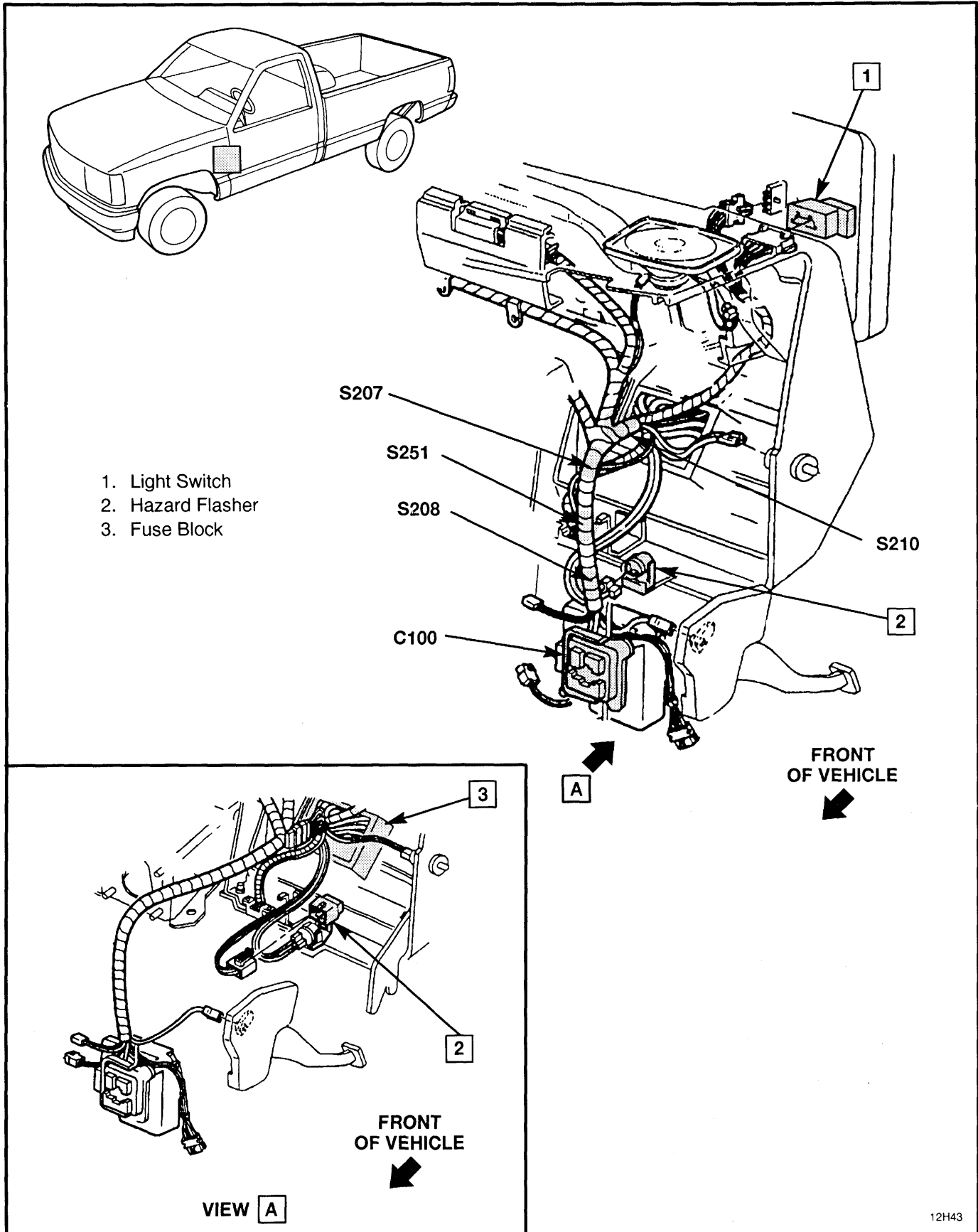


Figure 6 — LH Side of Instrument Panel

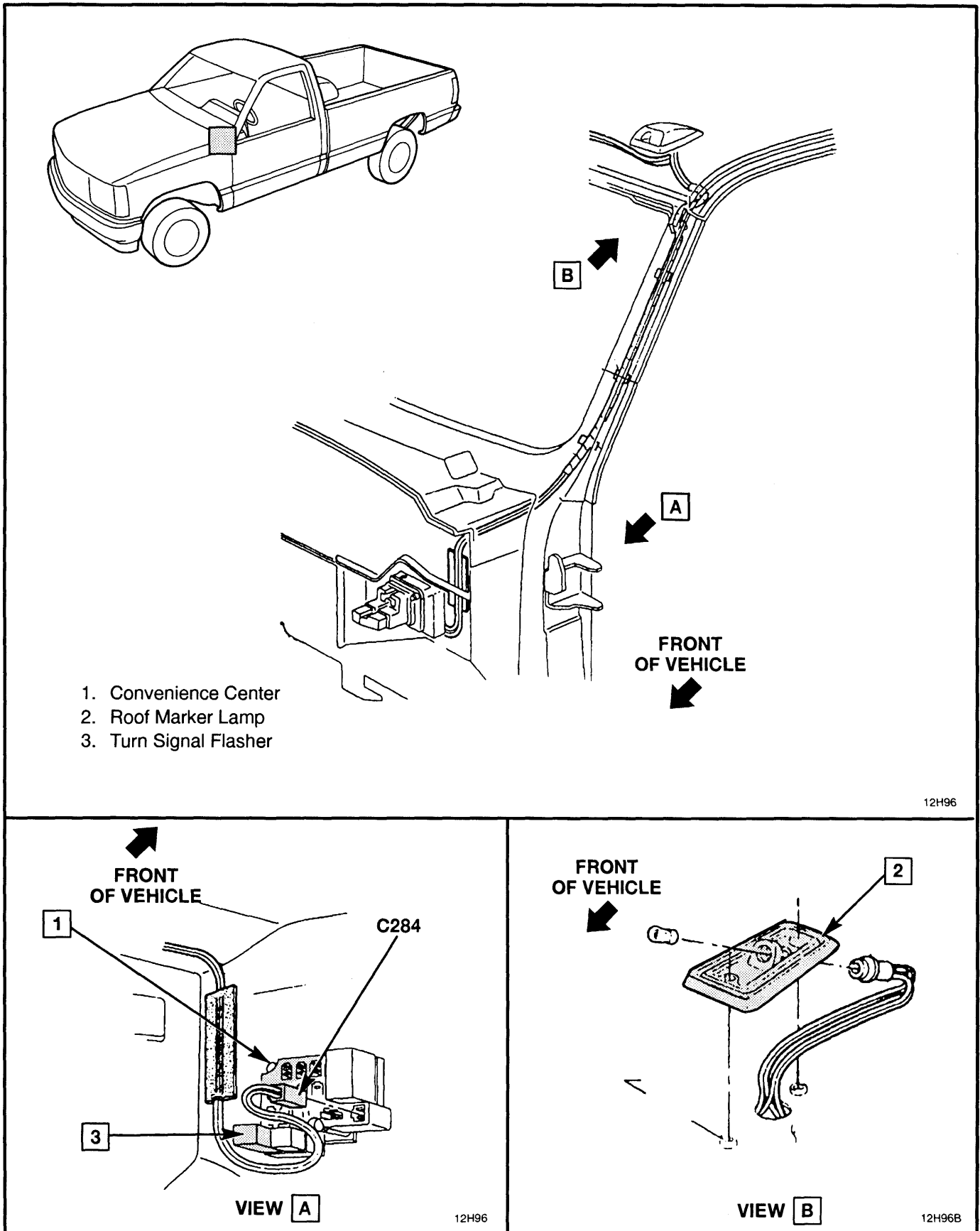


Figure 7 — Roof Marker Lamp Wiring

## 8A-110-24 EXTERIOR LAMPS

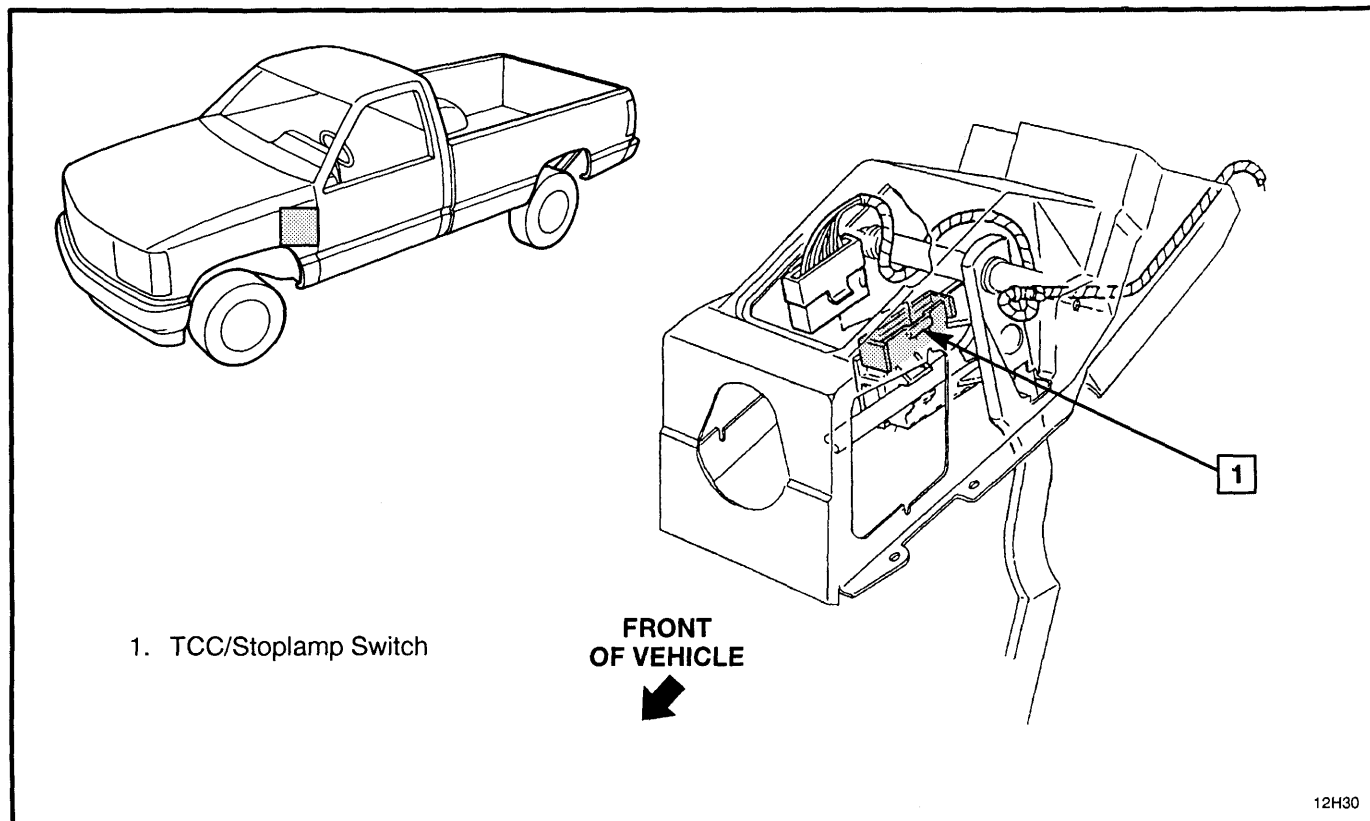


Figure 8 — TCC/Stoplamp Switch

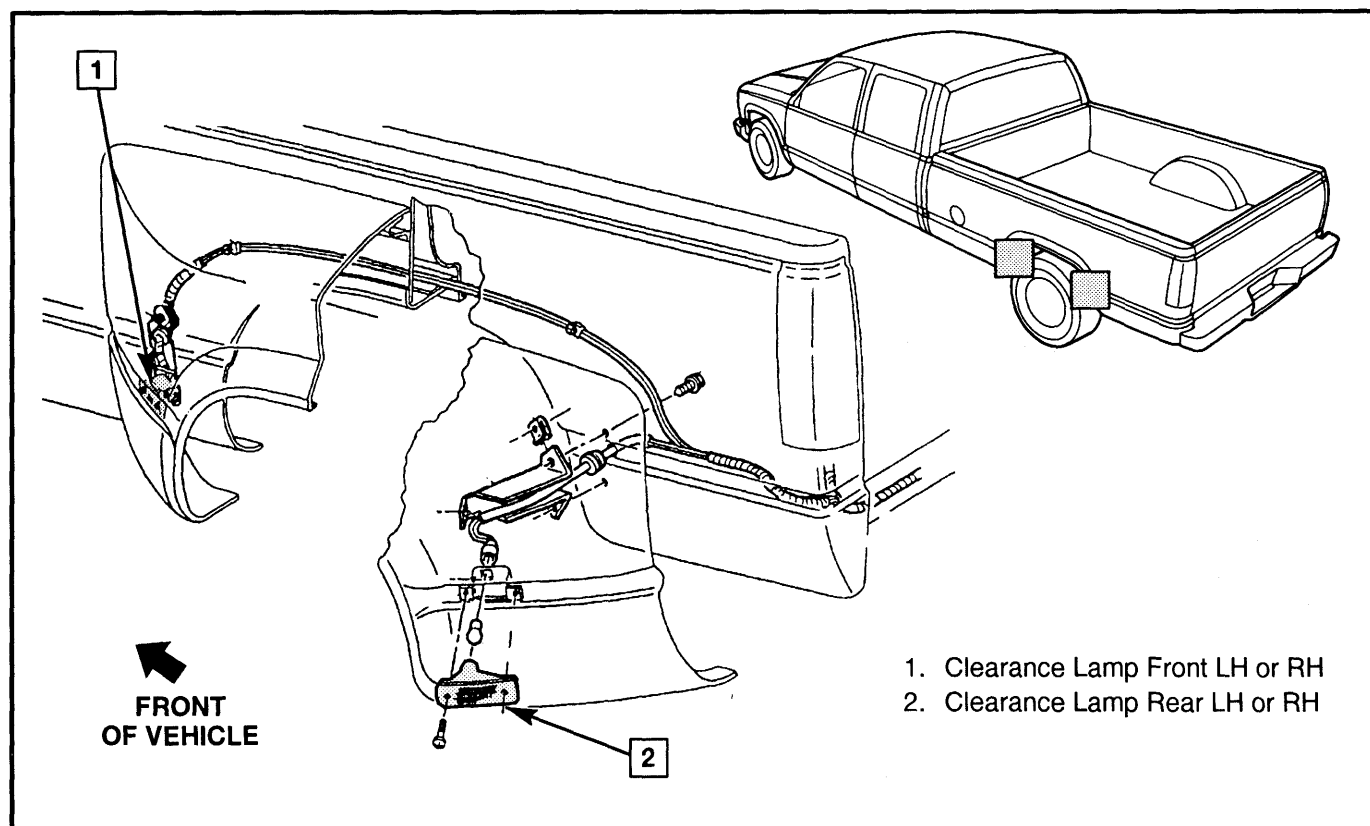


Figure 9 — Rear Clearance Lamps W/Dual Rear Wheels

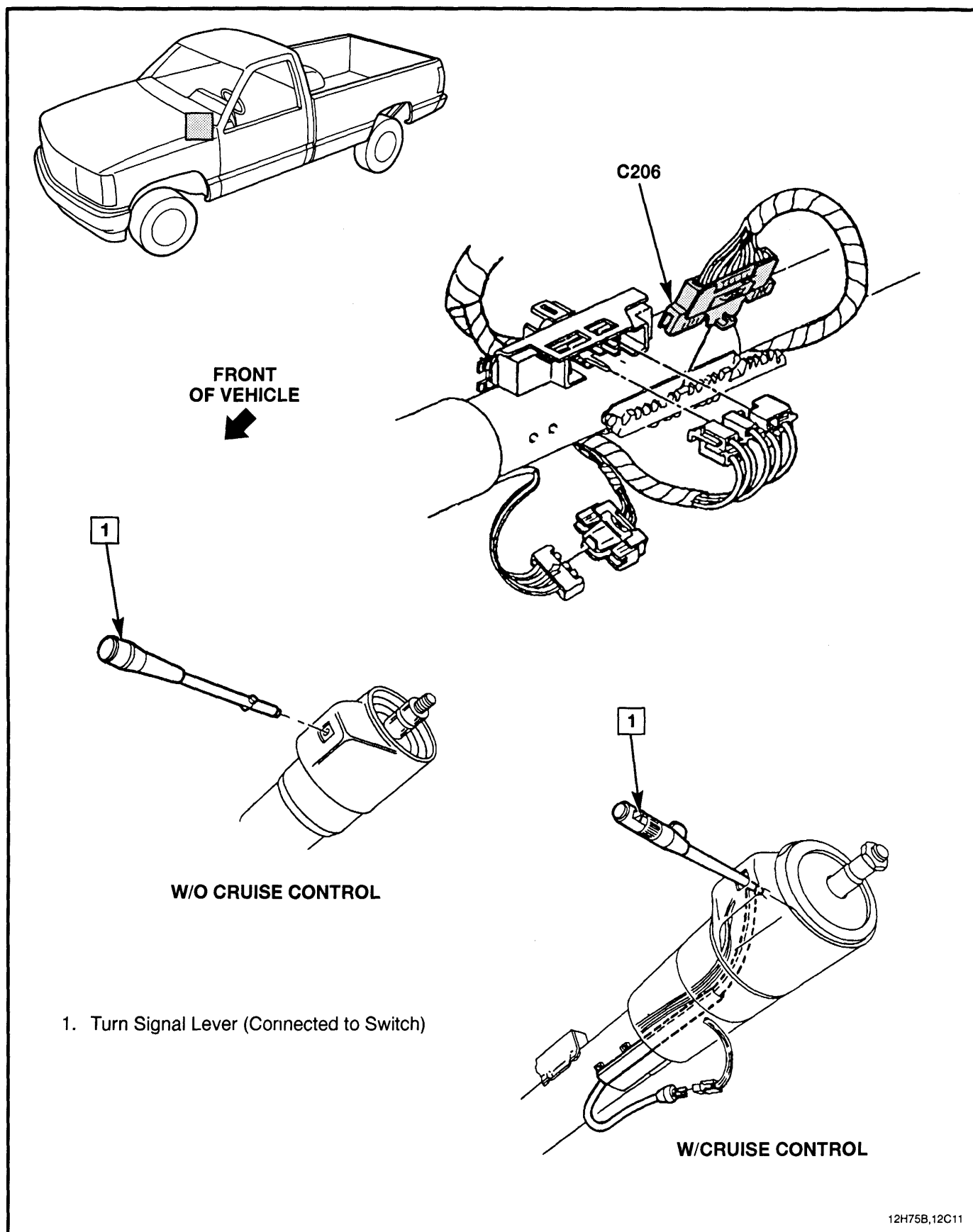


Figure 10 — RH side of Steering Column Wiring

## 8A-110-26 EXTERIOR LAMPS

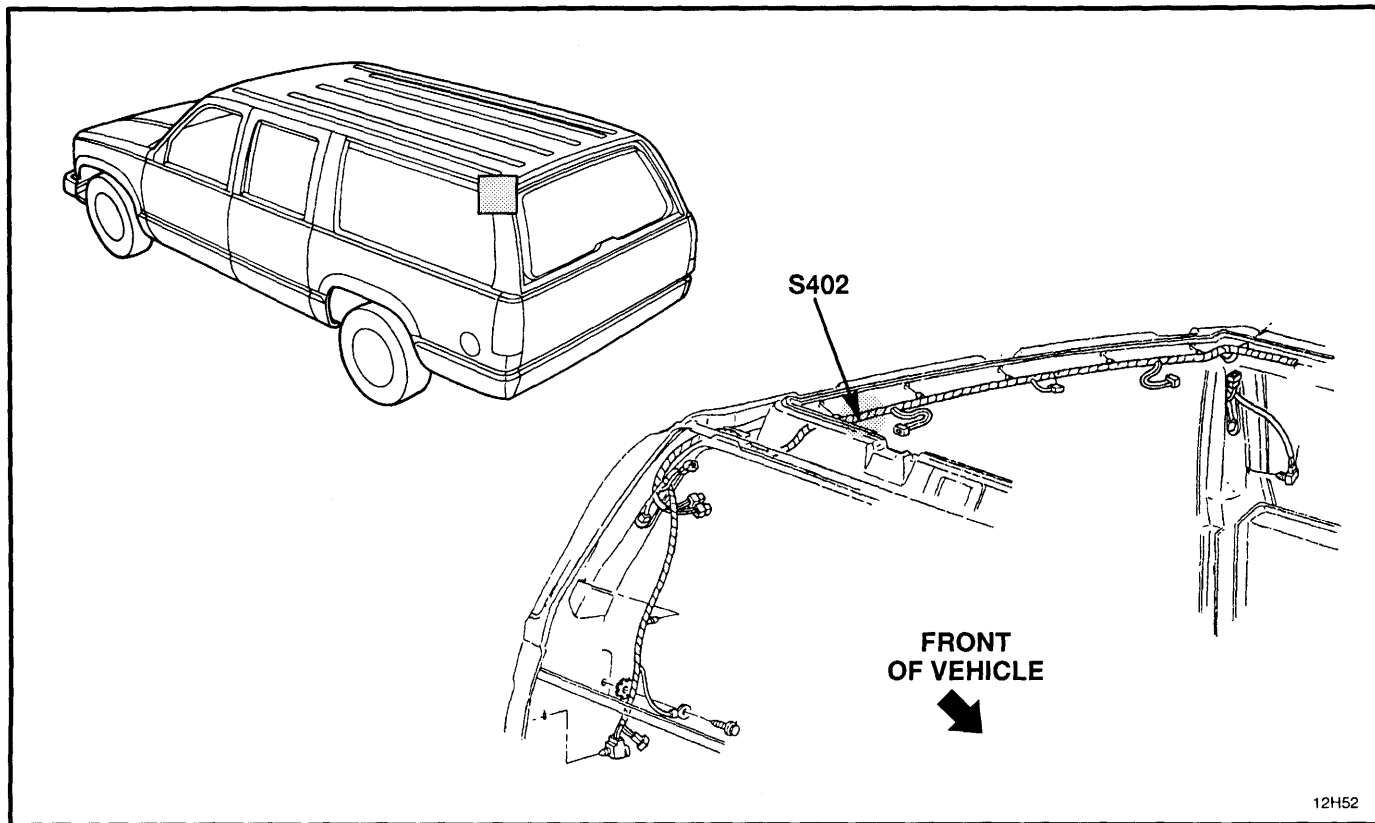


Figure 11 — Body Wiring, Rear – Suburban

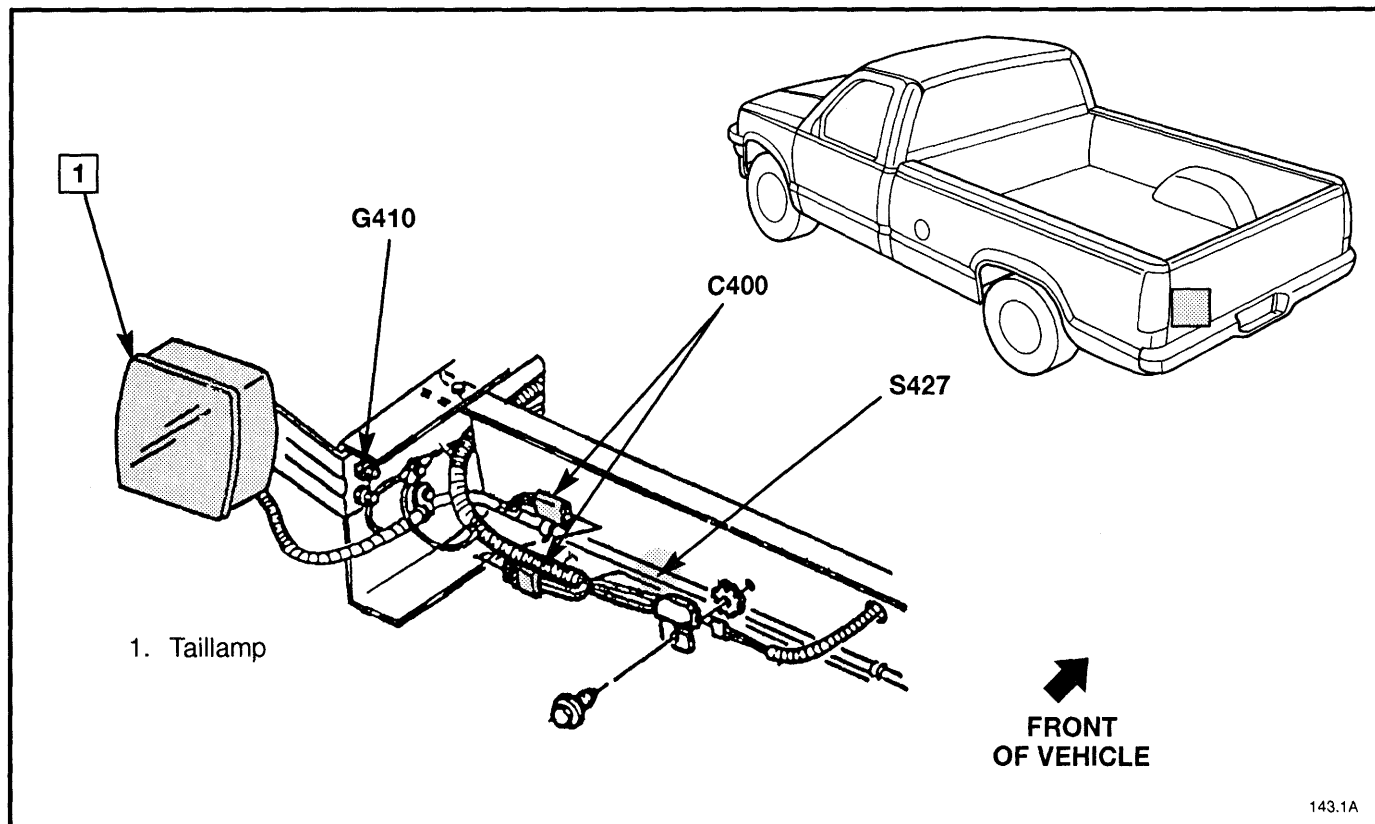
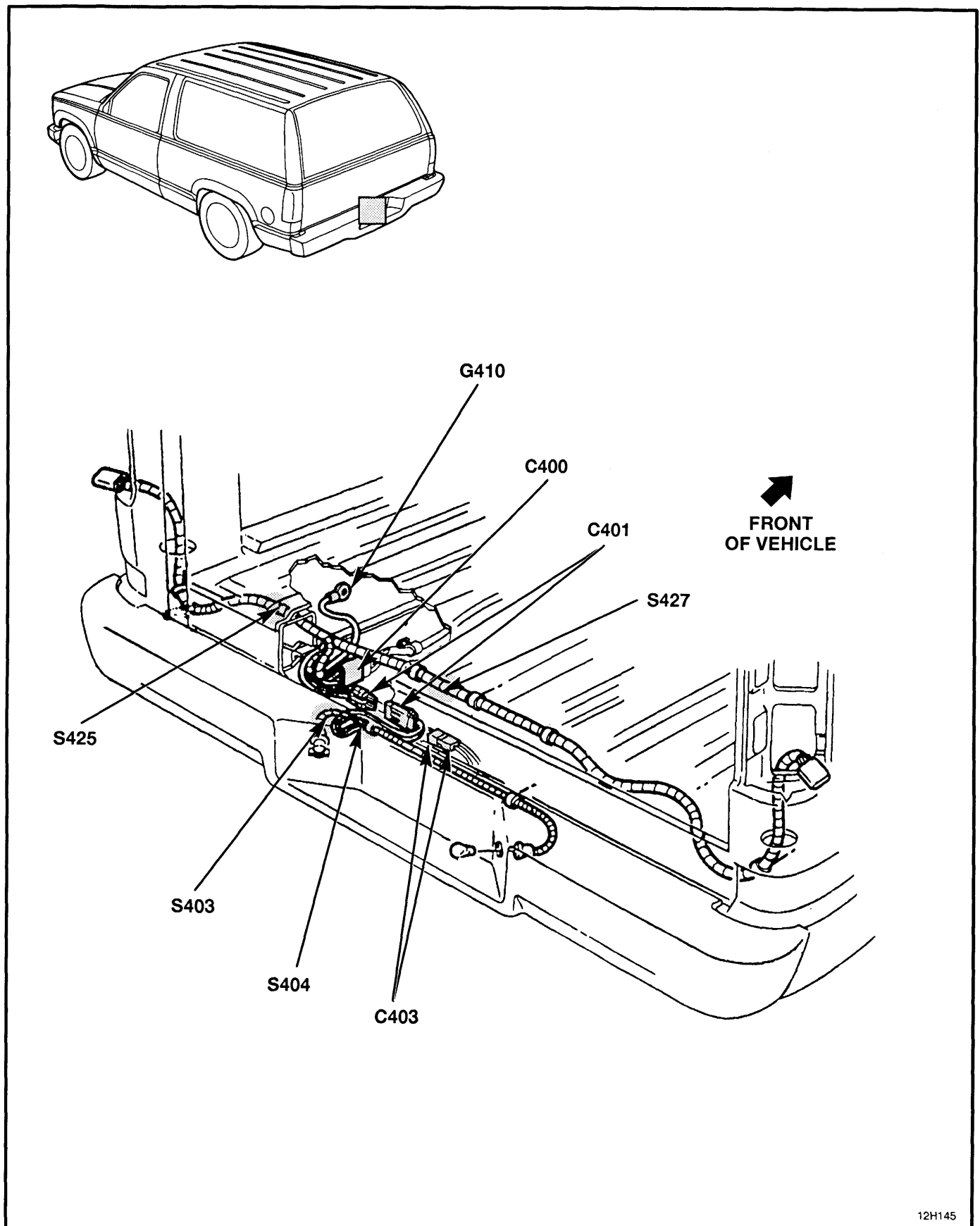


Figure 12 — Rear Lamp Wiring – Chassis Cab



12H145

Figure 13 — Tail and Stoplamp Harness Wiring (Pickup, Utility, and Suburban)

8A-110-28 EXTERIOR LAMPS

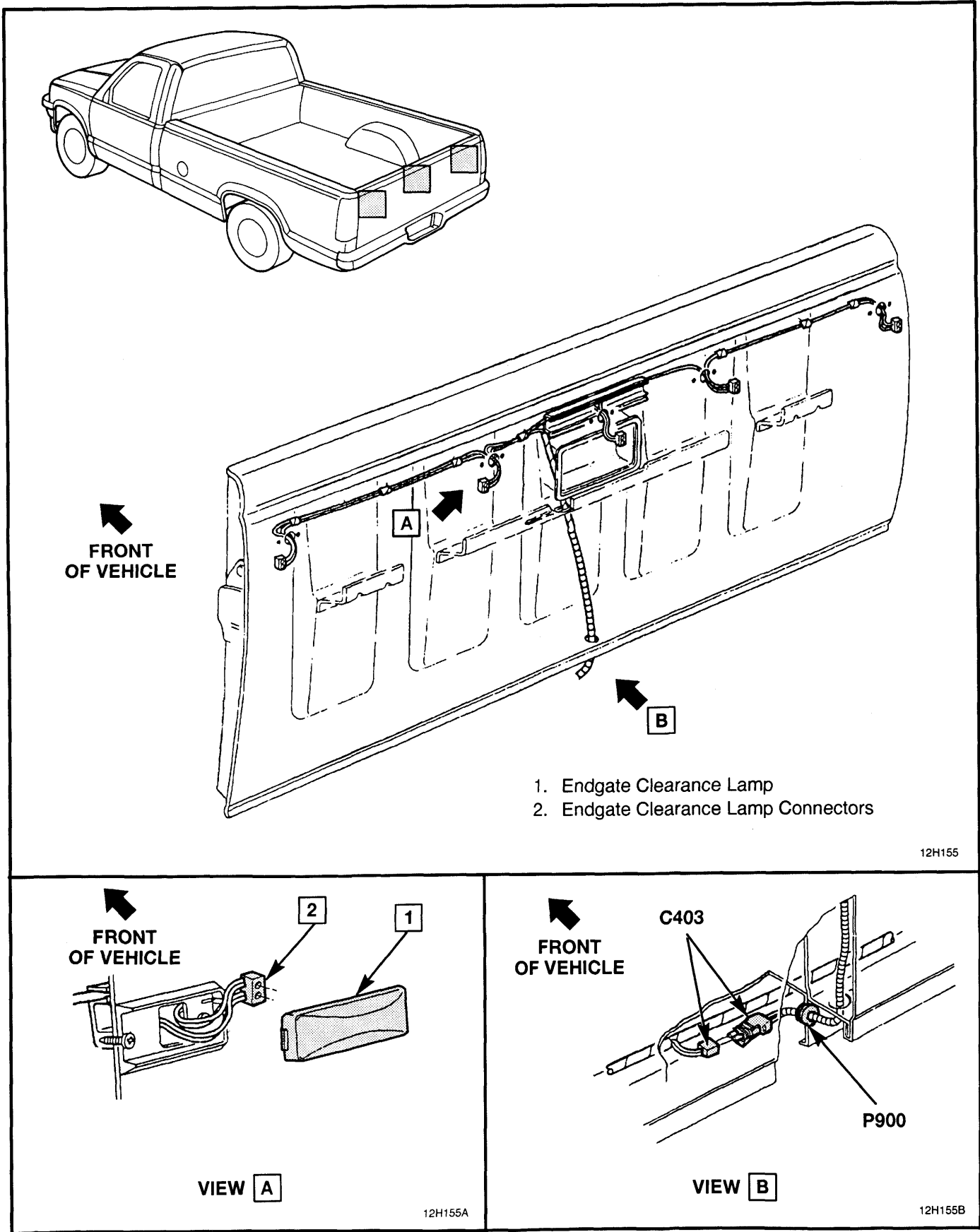
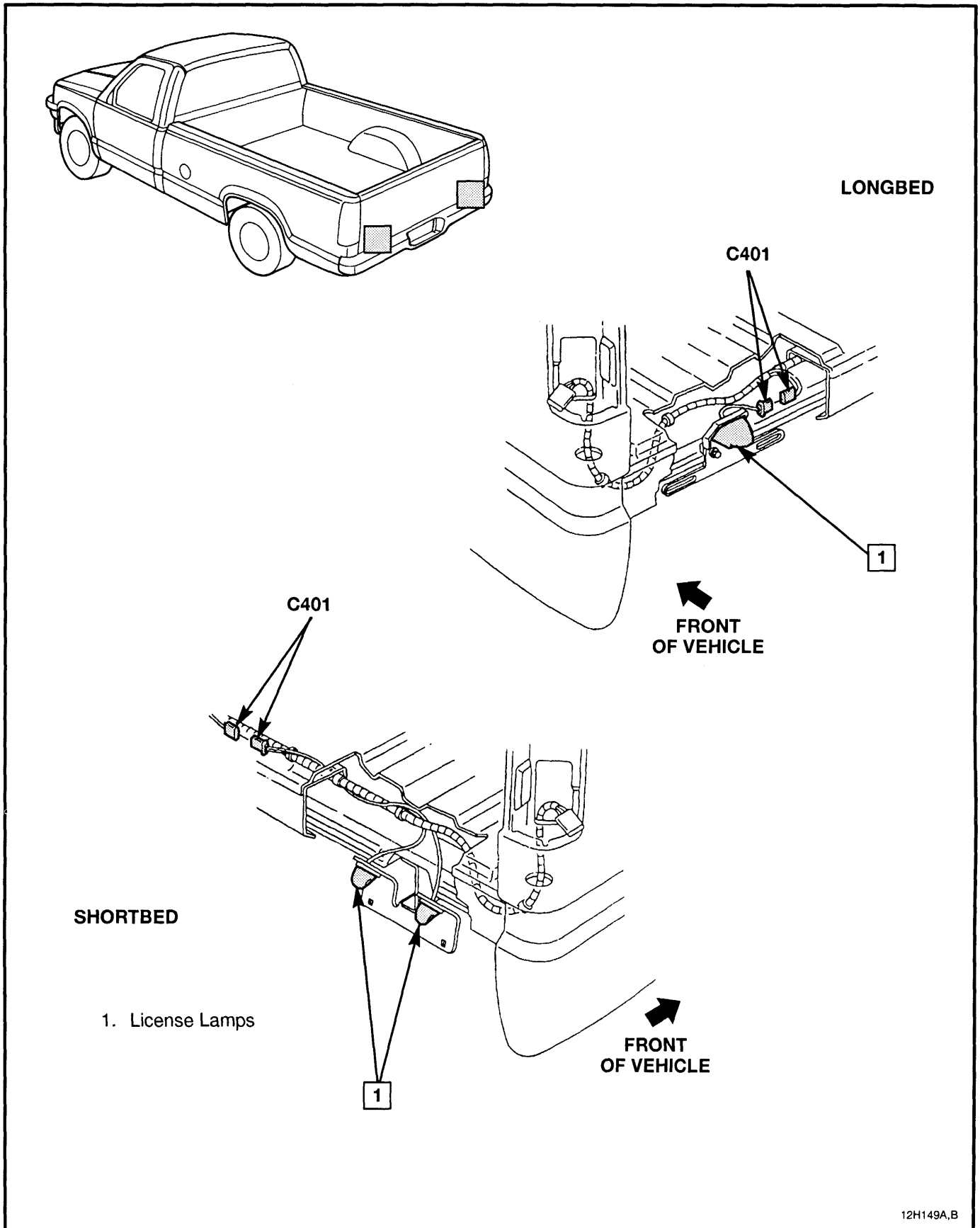


Figure 14 — Endgate Lamp Wiring



12H149A,B

Figure 15 — License Lamps Without Bumper



## 8A-110-30 EXTERIOR LAMPS

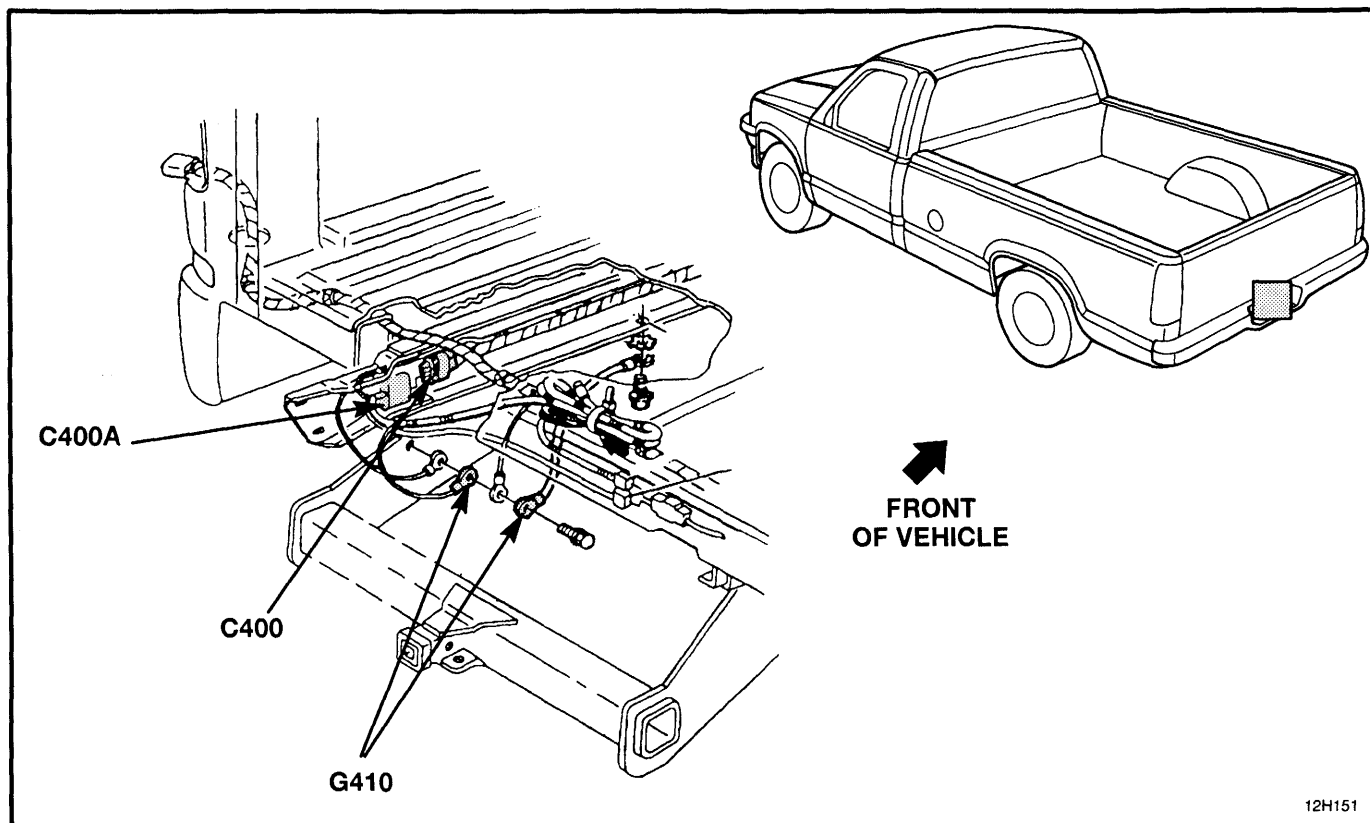


Figure 16 — Trailer Wiring W/Platform Hitch, 2-Door and Extended Cab Pickup

## **CIRCUIT OPERATION**

### **BACKUP LAMPS**

With the Ignition Switch in RUN or START, voltage is supplied through the TURN-B/U Fuse to the Backup Lamp Switch. Whenever the gear selector lever is shifted to REVERSE the Backup Lamp Switch closes and voltage is supplied to the Backup Lamps and the Lamps turn on.

### **COMPONENT LOCATION**

#### **Page — Figure**

|                                                                                       |           |   |
|---------------------------------------------------------------------------------------|-----------|---|
| Backup Lamp Switch (Auto Trans) . . . Top of steering column . . . . .                | 112-6     | 3 |
| Backup Lamp Switch (Man Trans) . . . LH top of transmission . . . . .                 | 112-5     | 2 |
| Tail, Stop, Turn Signal and Backup<br>Lamp, LH . . . . . LH rear of vehicle . . . . . | 112-8     | 5 |
| Tail, Stop, Turn Signal and Backup<br>Lamp, RH . . . . . RH rear of vehicle . . . . . | Not Shown |   |

### **CONNECTORS:**

|                                                                                         |       |   |
|-----------------------------------------------------------------------------------------|-------|---|
| C100 . . . . . At bulkhead connector . . . . .                                          | 112-5 | 1 |
| C101 . . . . . At bulkhead connector . . . . .                                          | 112-5 | 1 |
| C400 (Chassis Cab) . . . . . At rear crossmember, LH side . . . . .                     | 112-8 | 5 |
| C400 (Pickup, Utility and<br>Suburban) . . . . . At rear crossmember, LH side . . . . . | 112-7 | 4 |

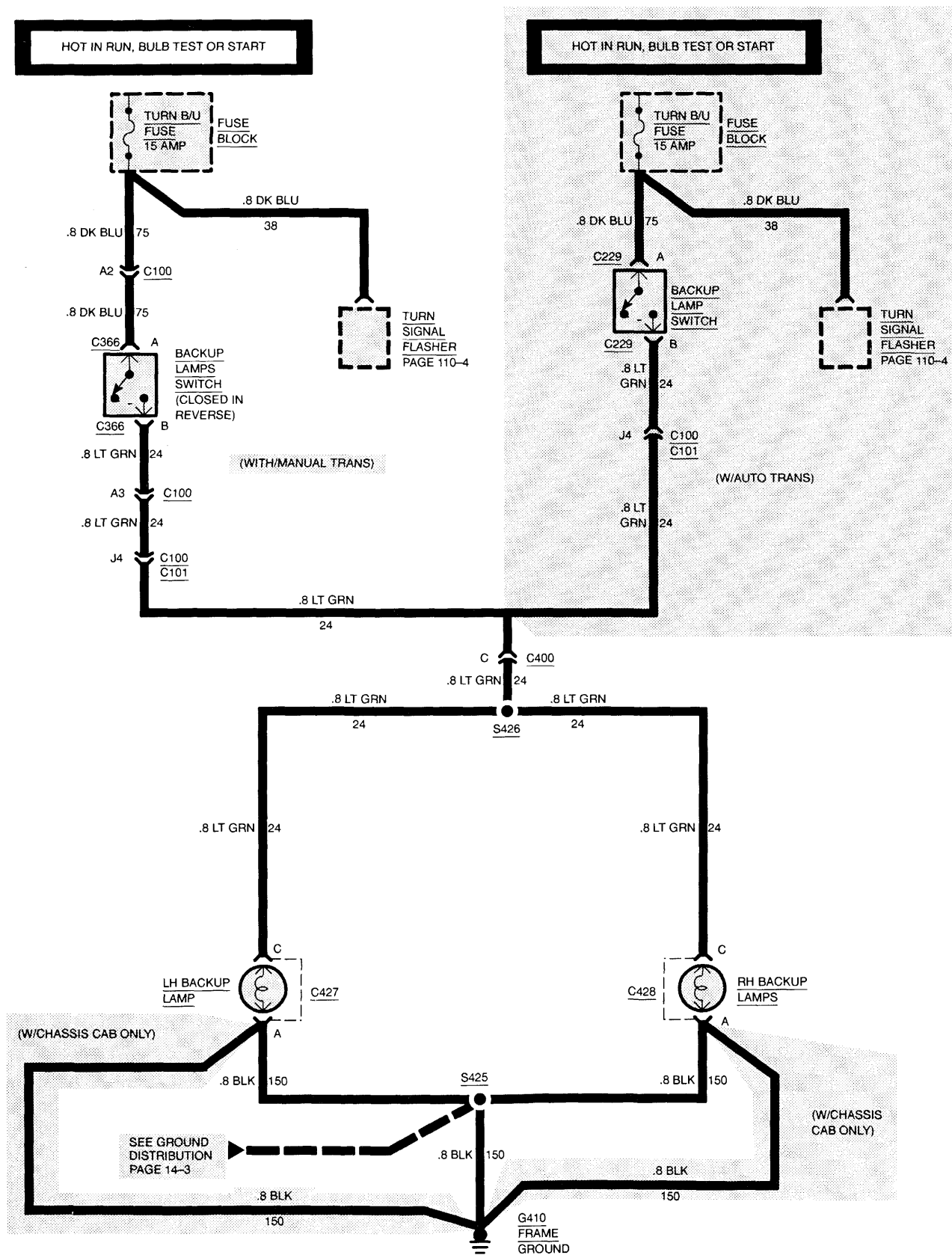
### **GROUND:**

|                                                                                  |       |   |
|----------------------------------------------------------------------------------|-------|---|
| G410 (Chassis Cab) . . . . . At LH side of platform hitch . . . . .              | 112-8 | 5 |
| G410 (Pickup, Utility and<br>Suburban) . . . . . Rear of LH frame rail . . . . . | 112-7 | 4 |

### **SPLICES:**

|                                                                                       |       |   |
|---------------------------------------------------------------------------------------|-------|---|
| S425 (Chassis Cab) . . . . . Rear lamp harness, LH side at rear crossmember . . . . . | 112-8 | 5 |
| S425 (Pickup, Utility and<br>Suburban) . . . . . At rear of LH frame rail . . . . .   | 112-7 | 4 |
| S426 (Chassis Cab) . . . . . Rear lamp harness, LH side at rear crossmember . . . . . | 112-8 | 5 |
| S426 (Pickup, Utility and<br>Suburban) . . . . . At rear of LH frame rail . . . . .   | 112-7 | 4 |

## 8A-112-2 BACKUP LAMPS



## DIAGNOSIS — BACKUP LAMPS

### PRELIMINARY CHECKS:

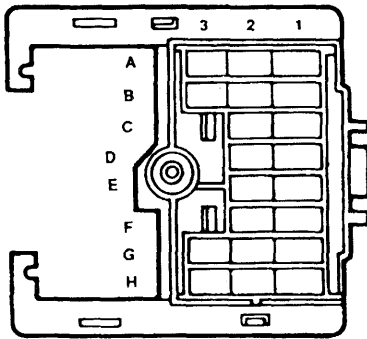
1. Check condition of STOP, PARK LP, TURN-B/U Fuse(s). If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).

### BACKUP LAMPS DO NOT OPERATE

| TEST                                                                                                                                                   | RESULT                    | ACTION                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place transmission in REVERSE. Connect test lamp from LT GRN (24) wire at backup lamp connector C404 and C405 to ground.                            | Test lamp lights.         | GO to step 2.                                                                                                                                       |
|                                                                                                                                                        | Test lamp does not light. | GO to step 3.                                                                                                                                       |
| 2. Connect test lamp from LT GRN (24) wire to BLK (150) wire at backup lamp connector C427, C428 (all except chassis cab) or C429, C430 (chassis cab). | Test lamp lights.         | REPLACE bulb.                                                                                                                                       |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from backup lamp connector C427, C428 (all except chassis cab) or C429, C430 (chassis cab) to ground G410. |
| 3. Connect test lamp from DK BLU (75) wire at backup lamp switch connector C366 (man) or C229 (auto) to ground.                                        | Test lamp lights.         | GO to step 4.                                                                                                                                       |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in DK BLU (75) wire from backup lamp switch to fuse block.                                                                   |
| 4. Connect test lamp from LT GRN (24) wire at backup lamp switch connector C366 (man) or C229 (auto) to ground.                                        | Test lamp lights.         | GO to step 5.                                                                                                                                       |
|                                                                                                                                                        | Test lamp does not light. | Adjust backup lamp switch. If backup lamp switch will not adjust properly, REPLACE backup lamp switch.                                              |
| 5. Connect test lamp from LT GRN (24) wire at connector C100 to ground.                                                                                | Test lamp lights.         | GO to step 6.                                                                                                                                       |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in LT GRN (24) wire between backup lamp switch connector C366 (man) or C229 (auto) and connector C100.                       |
| 6. Connect test lamp from LT GRN (24) wire at connector C400 to ground.                                                                                | Test lamp lights.         | LOCATE and REPAIR open in LT GRN (24) wire between connector C400 and splice S426.                                                                  |
|                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in LT GRN (24) wire between connector C101 and connector C400.                                                               |

## 8A-112-4 BACKUP LAMPS

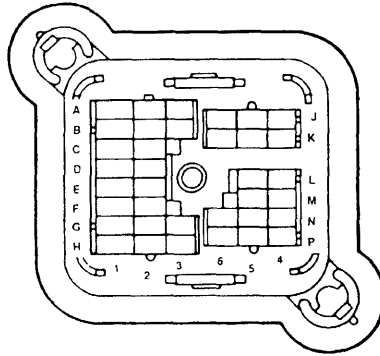
12020183



GRAY  
Metri-Pack

**C100**  
Bulkhead Connector – Eng

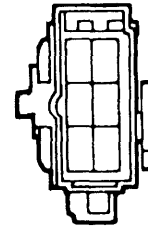
12020184



GRAY  
Metri-Pack

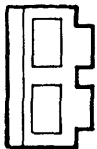
**C100**  
Bulkhead Connector – I/P

12020099



**C101**  
Bulkhead – Rear Lamps

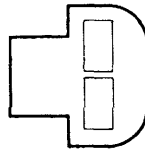
02973407



BLACK  
56 Series

**C229**  
Backup Lamp Switch (Auto)

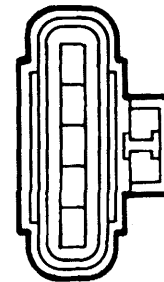
12103584



BROWN

**C366**  
Backup Lamp Switch (Man)

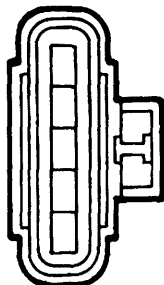
12065862



BLACK  
Metri-Pack 280

**C427**  
LH Rear Lamp Assembly

12065862



BLACK  
Metri-Pack 280

**C428**  
RH Rear Lamp Assembly

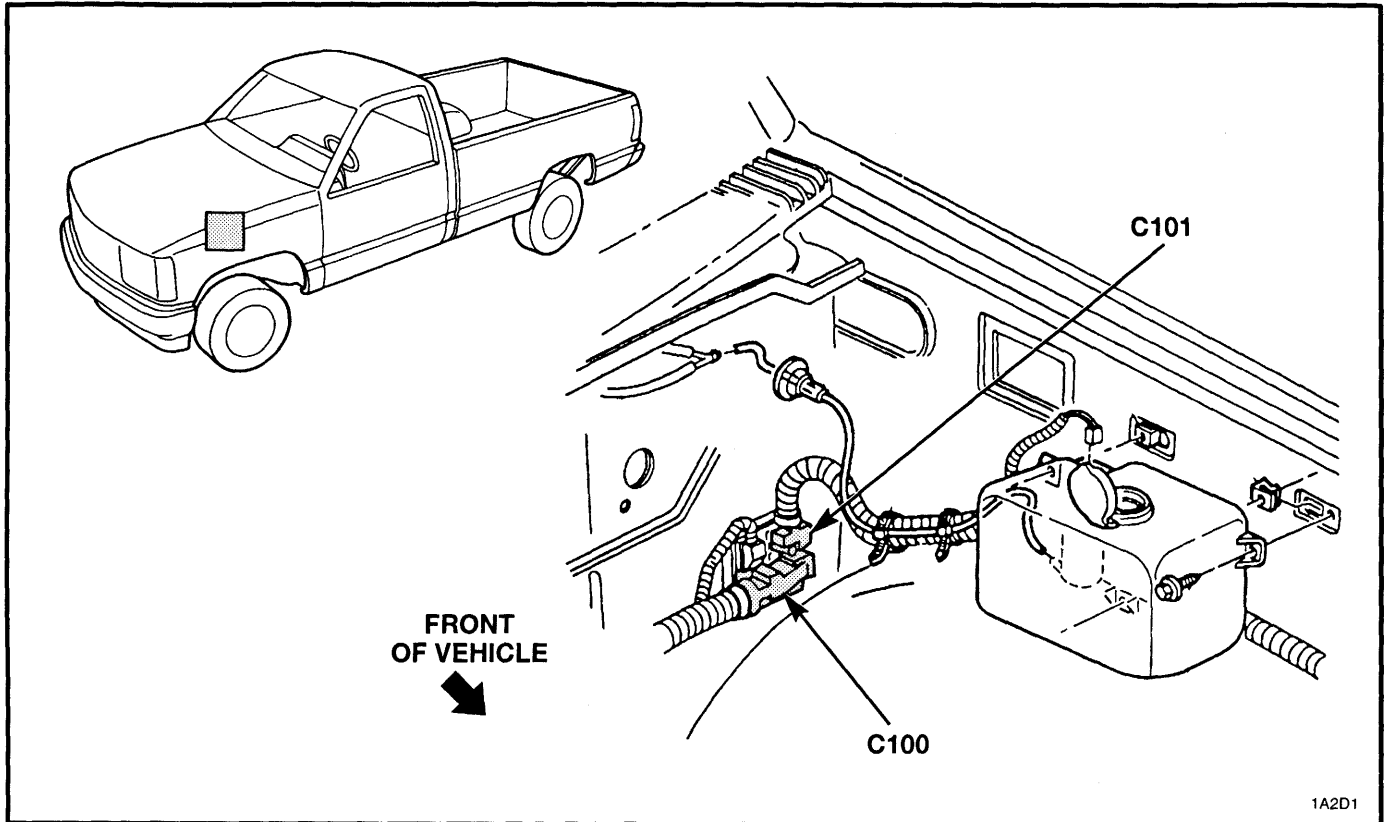


Figure 1 — Cowl Wiring — Except Suburban and Utility

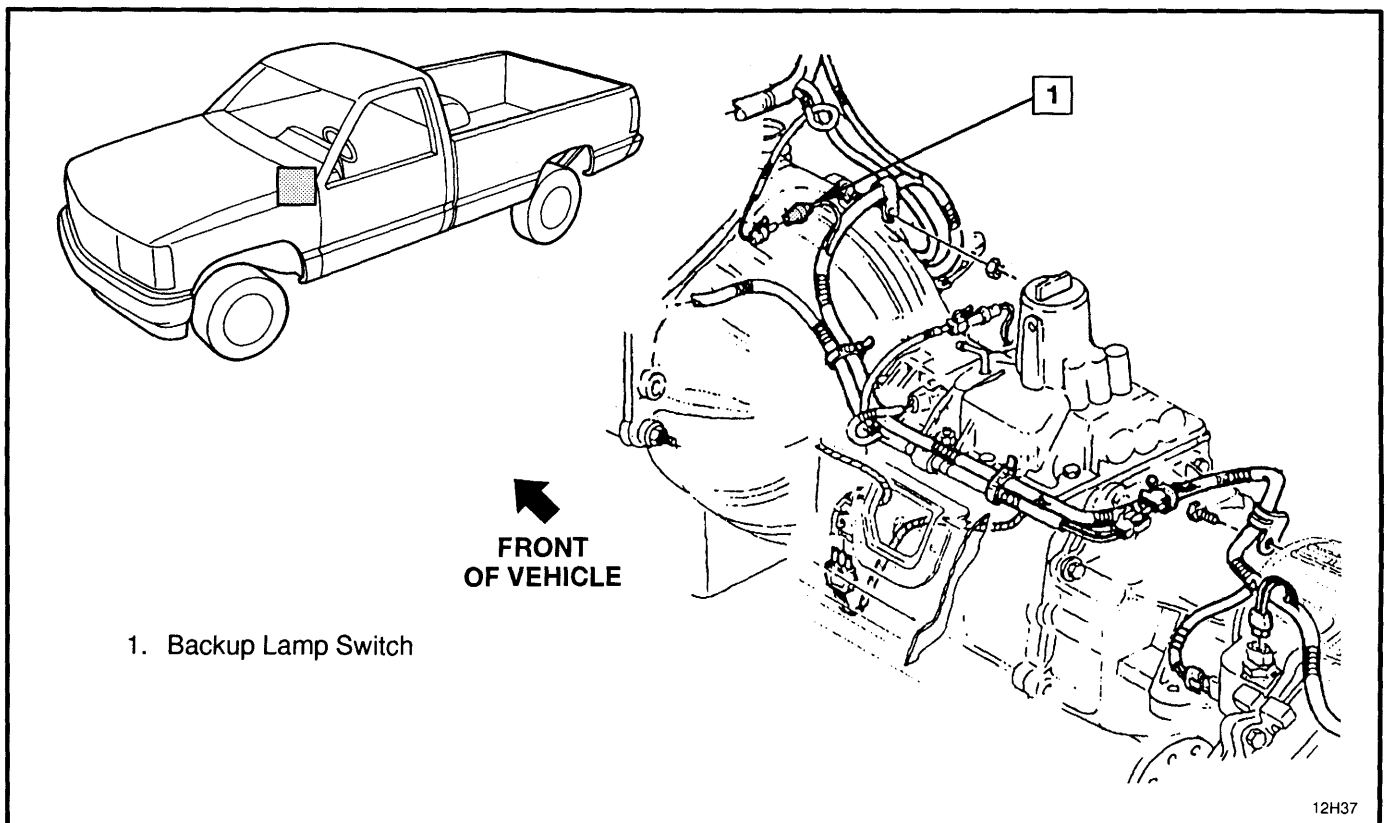


Figure 2 — Backup Lamp Switch Wiring

## 8A-112-6 BACKUP LAMPS

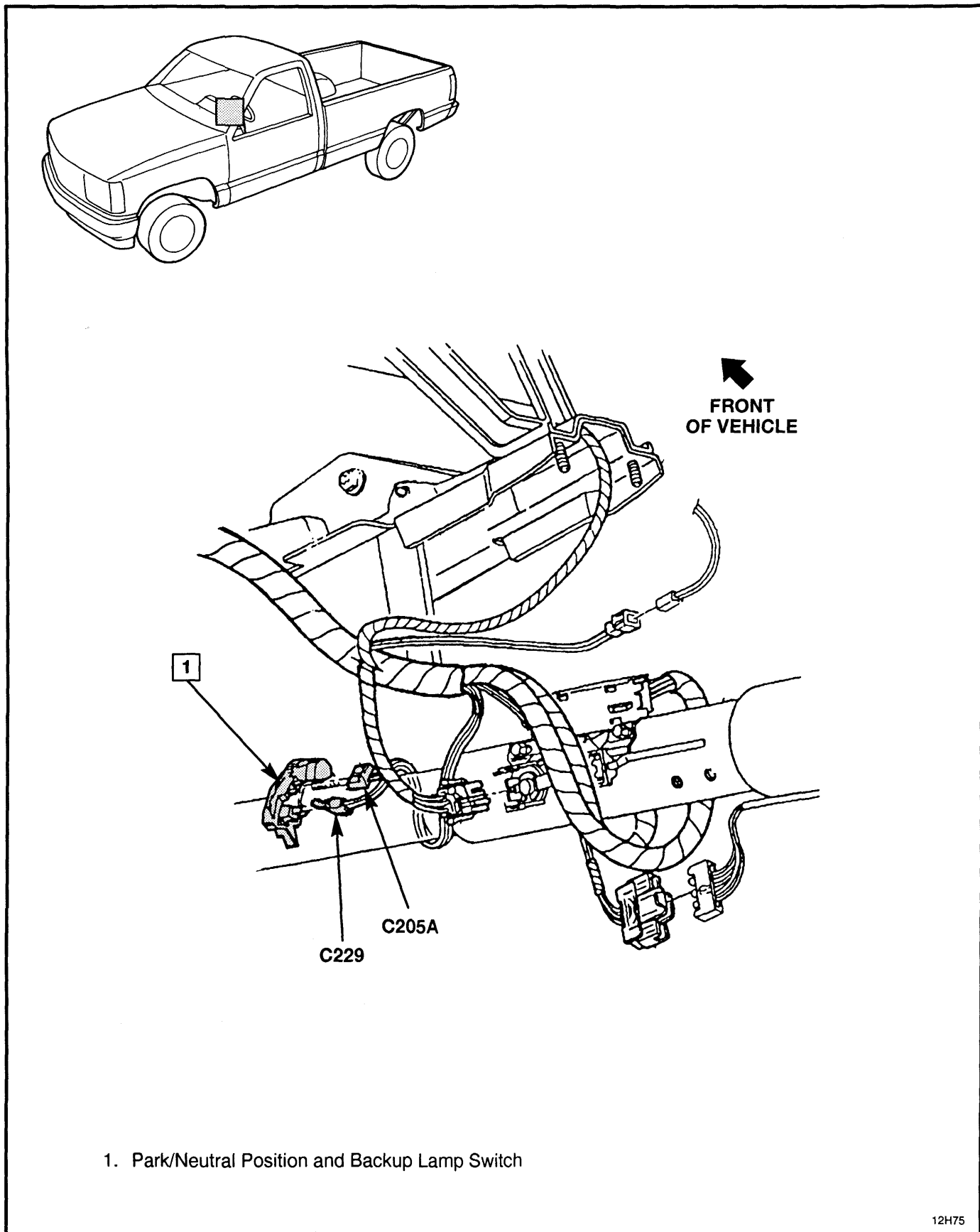
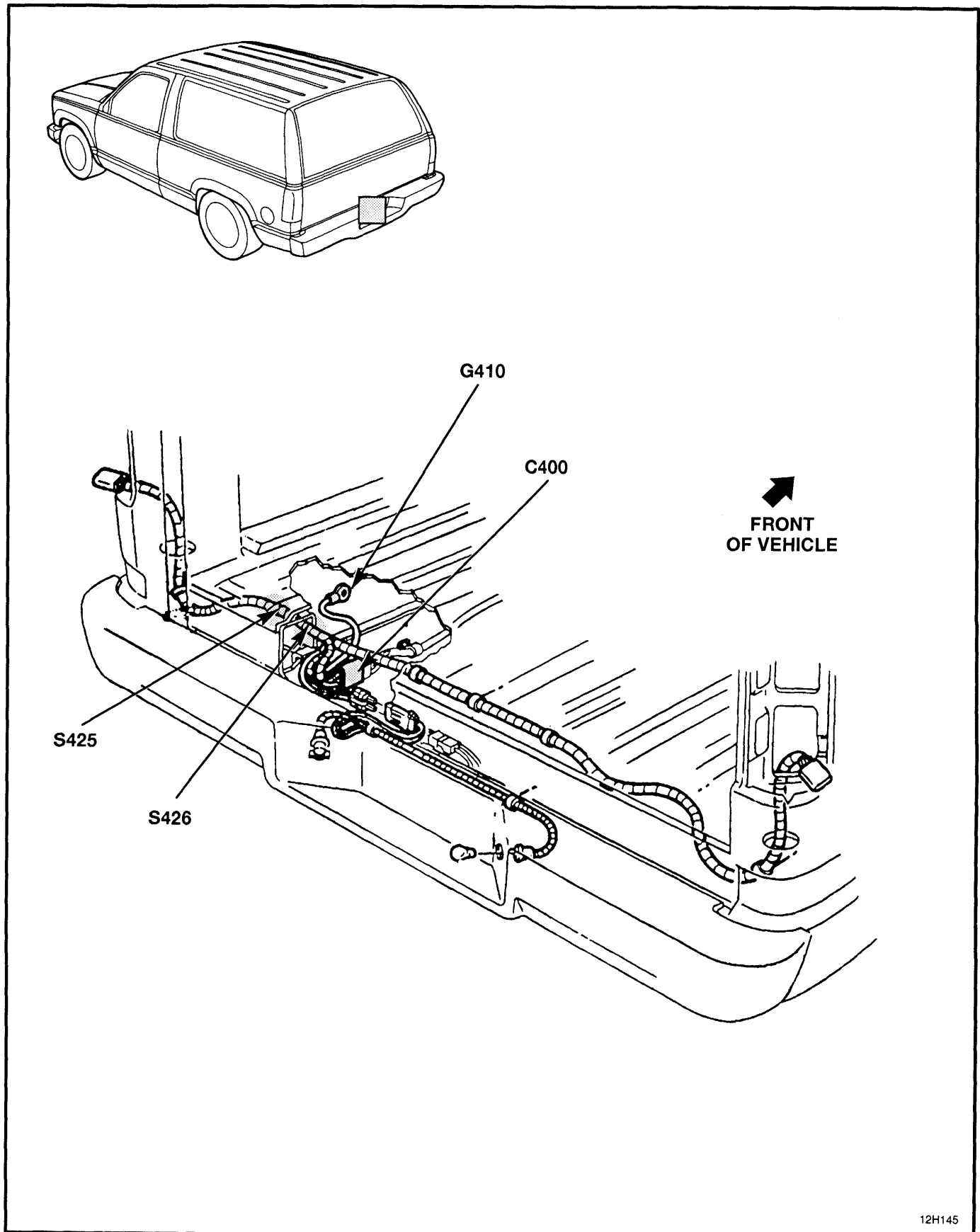


Figure 3 — LH Side of Steering Column Wiring



12H145

Figure 4 — Tail and Stoplamp Harness Wiring, Pickup, Utility and Suburban



## 8A-112-8 BACKUP LAMPS

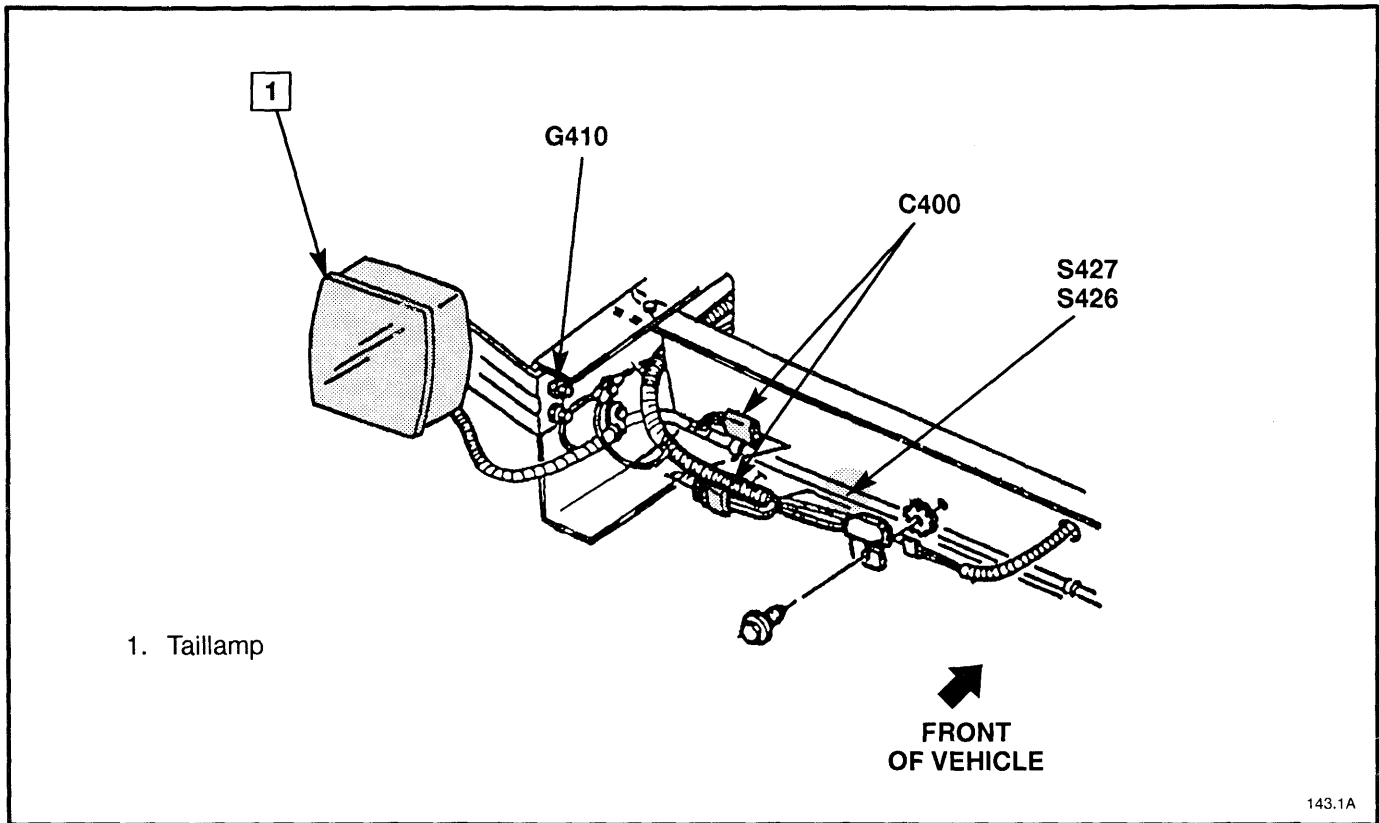


Figure 5 — Rear Lamp Wiring — Chassis Cab

## CIRCUIT OPERATION

### COURTESY, DOME AND I/P COMPARTMENT BOX LAMPS

Voltage is supplied at all times from the CTSY Fuse to the Courtesy Lamp, Dome Lamp and I/P Compartment Box Lamp. The Courtesy and Dome Lamps turn on when a

ground path is provided by the Panel Dimmer Switch or one of the Door Jamb Switches.

The I/P Compartment Box and Vanity Lamps have their own switches that provide ground paths when their switches close.

### COMPONENT LOCATION

### Page — Figure

|                                                  |                                  |           |    |
|--------------------------------------------------|----------------------------------|-----------|----|
| Ashtay Lamp .....                                | Behind I/P, at ashtay .....      | 114-16    | 2  |
| Cigarette Lighter .....                          | Center of I/P at ashtay .....    | 114-17    | 3  |
| Convenience Center .....                         | Under LH side of I/P .....       | 114-16    | 2  |
| Courtesy Lamp, LH .....                          | Under LH side of I/P .....       | 114-16    | 2  |
| Courtesy Lamp, RH .....                          | Below RH side of I/P .....       | 114-16    | 2  |
| Dome/Reading Lamp, Front .....                   | Inside on roof .....             | 114-19    | 6  |
| Dome/Reading Lamp, Rear .....                    | Inside on roof .....             | 114-22    | 10 |
| Dome Lamp Override Switch .....                  | On center of I/P .....           | Not Shown |    |
| Door Jamb Switch, LH Front .....                 | At LH end of I/P .....           | 114-16    | 2  |
| Door Jamb Switch, RH Front .....                 | At RH end of I/P .....           | 114-16    | 2  |
| Endgate Jamb Switch (Utility/<br>Suburban) ..... | RH D-pillar .....                | Not Shown |    |
| I/P Compartment Box Lamp .....                   | In I/P compartment box .....     | 114-16    | 2  |
| Light Switch .....                               | Upper LH side of I/P .....       | 114-15    | 1  |
| Overhead Console Lamps .....                     | In roof console .....            | Not Shown |    |
| Panel Dimmer Switch .....                        | LH end of I/P .....              | 114-15    | 1  |
| Rear Door Jamb Switch<br>(Suburban) .....        | RH rear body opening frame ..... | 114-22    | 9  |
| Side Door Jamb Switch, LH Rear ...               | At LH B-pillar .....             | 114-21    | 8  |
| Side Door Jamb Switch, RH Rear ..                | At RH B-pillar .....             | Not Shown |    |

### CONNECTORS:

|             |                                                     |           |    |
|-------------|-----------------------------------------------------|-----------|----|
| C224 .....  | At convenience center .....                         | 114-16    | 2  |
| C227 .....  | At convenience center .....                         | 114-18    | 4  |
| C237 .....  | At LH body hinge pillar .....                       | 114-18    | 4  |
| C269 .....  | At convenience center .....                         | 114-16    | 2  |
| C297 .....  | Behind LH side of I/P .....                         | Not Shown |    |
| C299 .....  | Under LH side of I/P, near convenience center ..... | 114-15    | 1  |
| C299A ..... | Near convenience center .....                       | Not Shown |    |
| C300 .....  | LH side, at roof, near front dome lamp .....        | 114-19    | 6  |
| C300A ..... | Near front dome lamp .....                          | Not Shown |    |
| C301 .....  | Behind roof console at front .....                  | 114-19    | 6  |
| C459 .....  | At RH rear body opening .....                       | Not Shown |    |
| C464 .....  | LH rear body upper, near rear dome lamp .....       | 114-22    | 10 |
| C464A ..... | Near rear dome lamp .....                           | Not Shown |    |

### GROUNDINGS:

|                       |                            |           |   |
|-----------------------|----------------------------|-----------|---|
| G202 .....            | At DLC connector .....     | Not Shown |   |
| G300 .....            | Near front dome lamp ..... | 114-18    | 5 |
| G380 .....            | Near front dome lamp ..... | Not Shown |   |
| G400 (Pickup) .....   | Rear frame rail .....      | Not Shown |   |
| G400 (Suburban) ..... | Rear D-pillar .....        | Not Shown |   |
| G400 (Utility) .....  | Rear C-pillar .....        | Not Shown |   |
| G480 .....            | Near rear dome lamp .....  | Not Shown |   |

## 8A-114-2 INTERIOR LAMPS

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### COMPONENT LOCATION (CONTINUED)

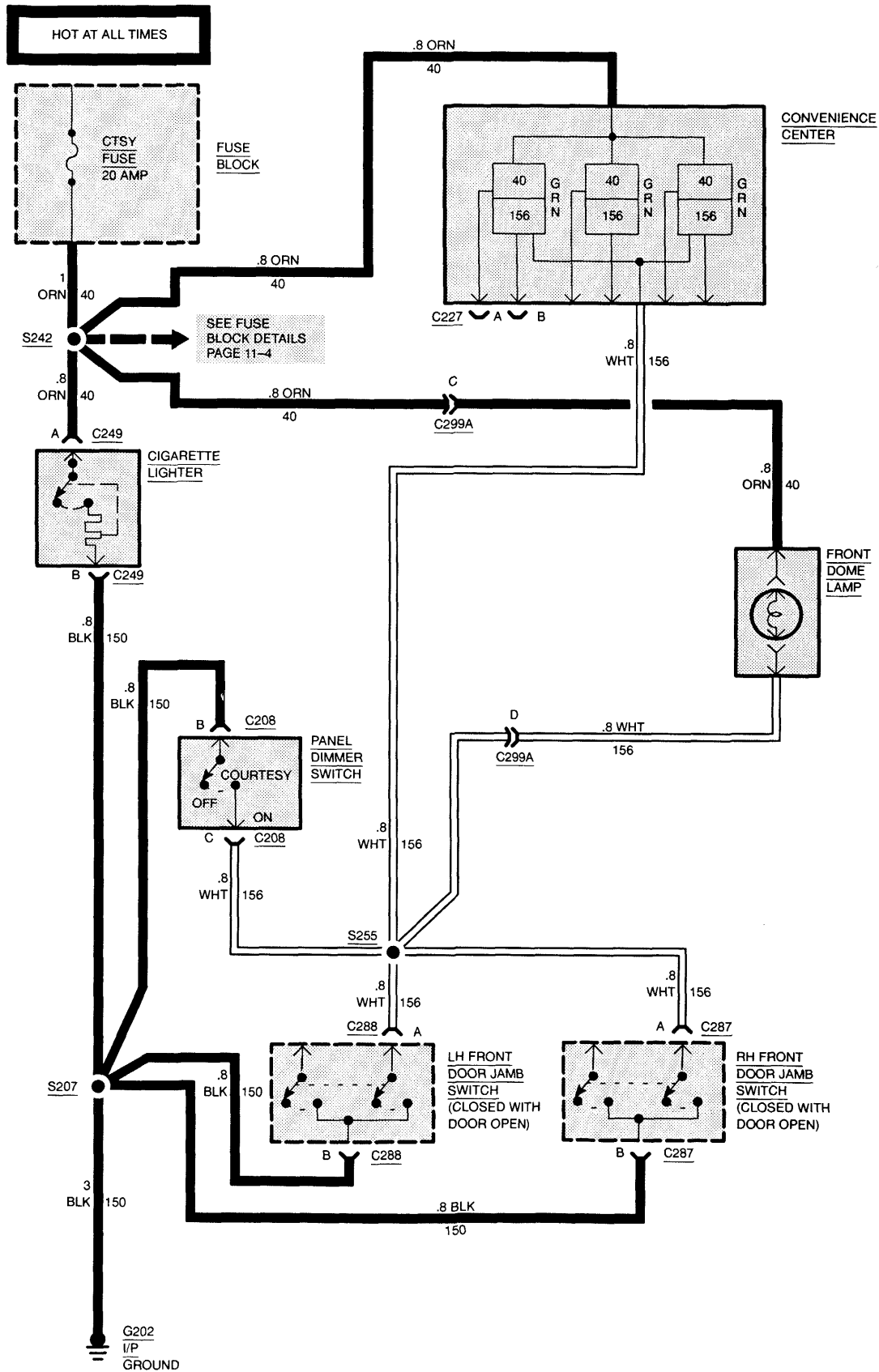
Page — Figure

#### SPLICES:

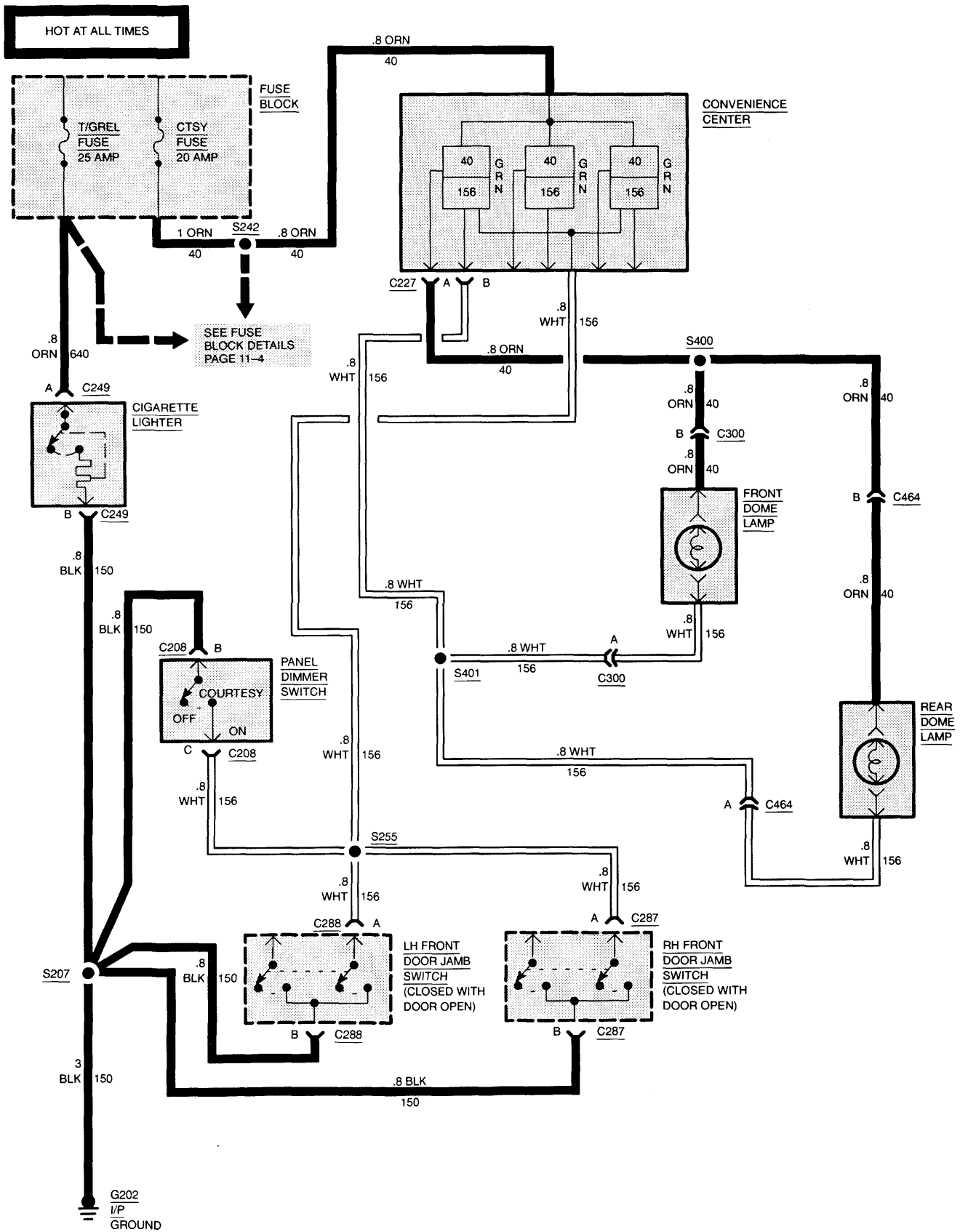
|       |                                                           |           |    |
|-------|-----------------------------------------------------------|-----------|----|
| S207  | Under LH side of I/P                                      | 114-15    | 1  |
| S208  | Under LH side of I/P                                      | 114-15    | 1  |
| S210  | Under LH side of I/P                                      | 114-15    | 1  |
| S211  | Courtesy lamp harness, near I/P compartment lamp lead     | 114-16    | 2  |
| S212  | Courtesy lamp harness, near ashtray lamp lead             | 114-16    | 2  |
| S214  | Courtesy lamp harness, near ashtray compartment lamp lead | 114-16    | 2  |
| S242  | Under LH side of I/P                                      | 114-15    | 1  |
| S255  | Under LH side of I/P                                      | 114-15    | 1  |
| S255A | Near panel dimmer switch                                  | Not Shown |    |
| S275  | Under LH side of I/P                                      | 114-15    | 1  |
| S305  | In roof console harness, near C300 lead                   | Not Shown |    |
| S315  | Inside overhead console                                   | Not Shown |    |
| S316  | Inside overhead console                                   | Not Shown |    |
| S400  | In dome lamp harness, at center pillar                    | 114-20    | 7  |
| S402  | Above rear liftgate glass opening                         | 114-23    | 11 |
| S410  | In dome lamp harness, at bottom of center pillar          | 114-20    | 7  |

# INTERIOR LAMPS 8A-114-3

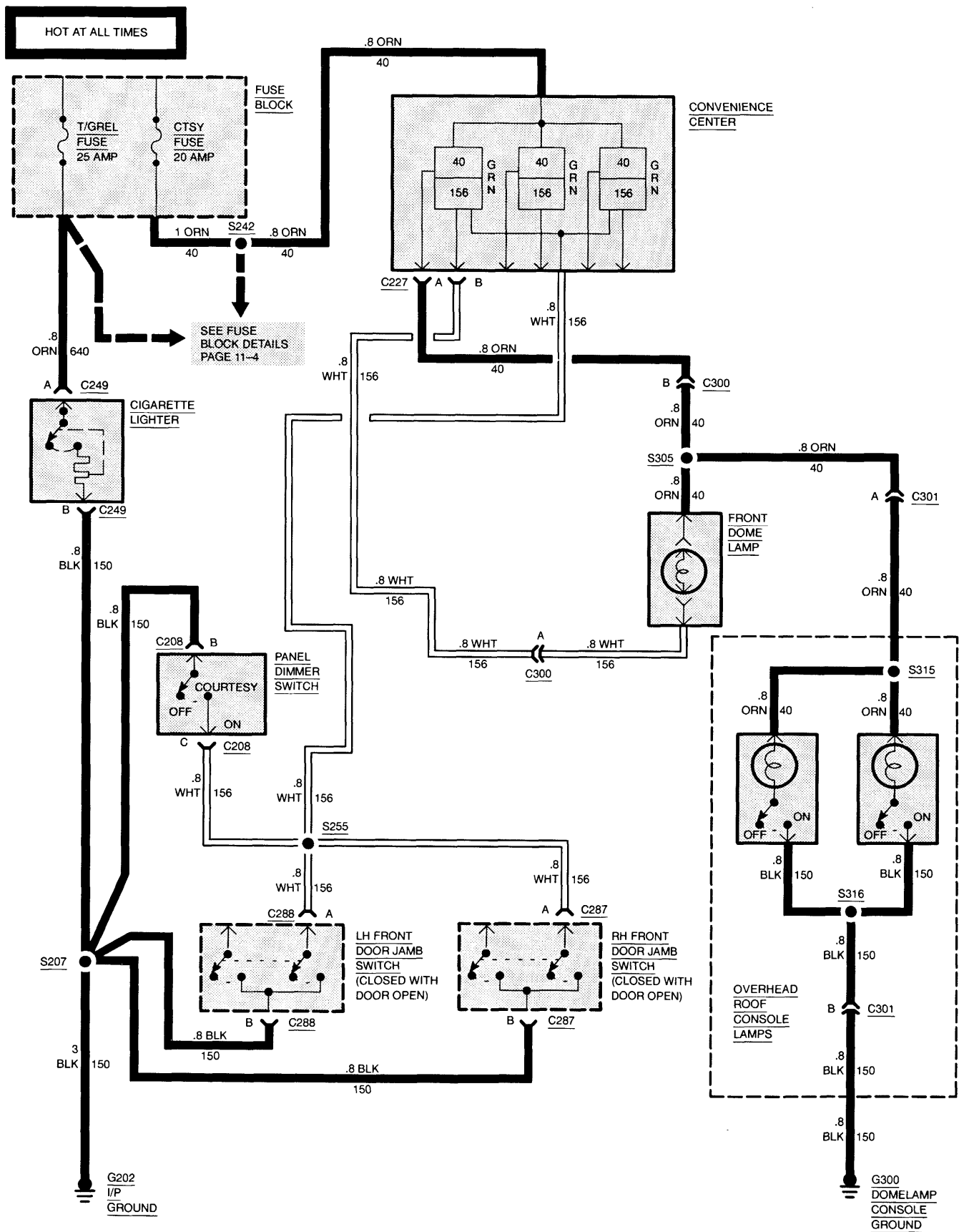
## PICKUP BASE



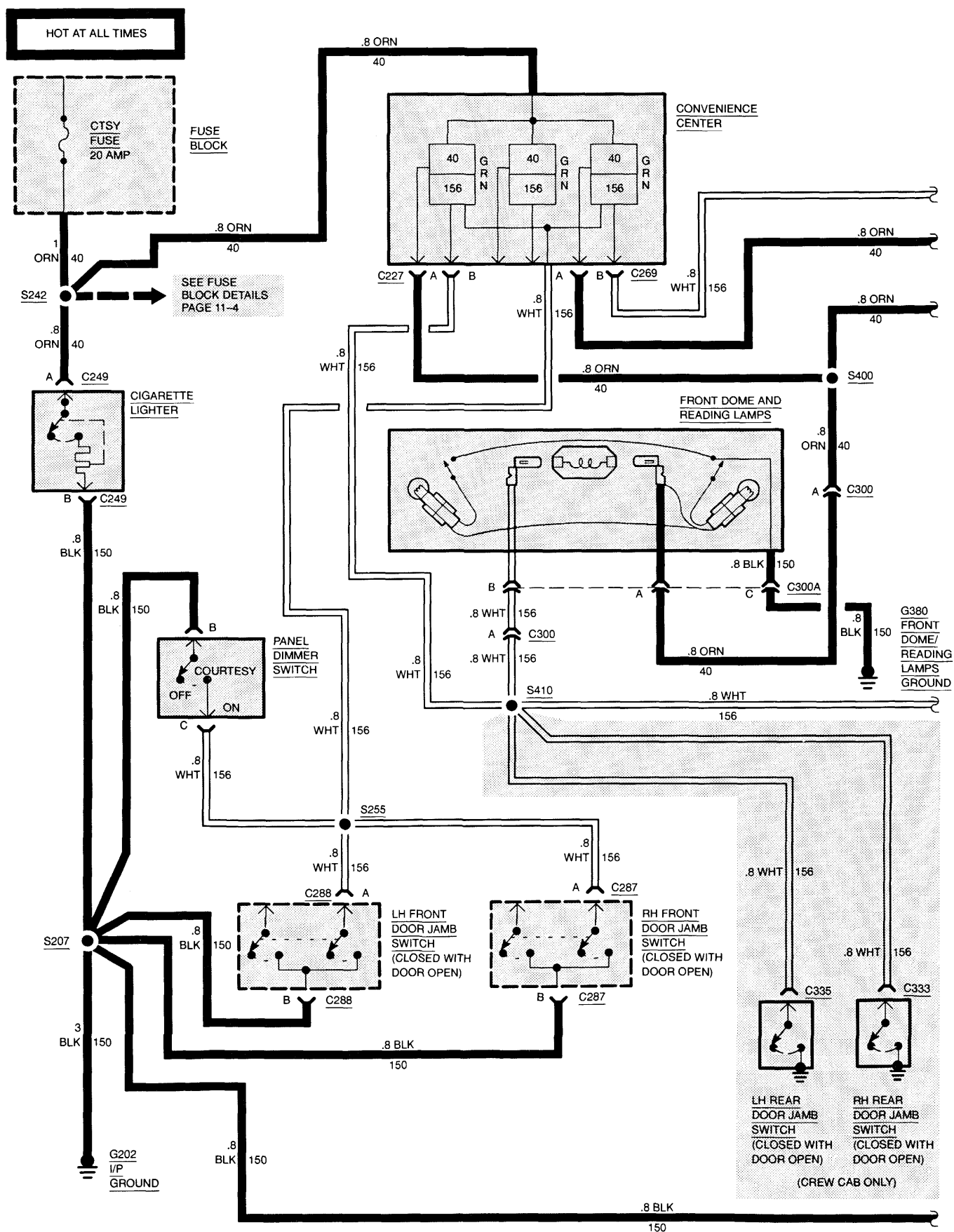
# 8A-114-4 INTERIOR LAMPS SUBURBAN-YUKON BASE



## CREW CAB, SUBURBAN, UTILITY W/OVERHEAD ROOF CONSOLE



**CREW CAB W/AUXILIARY LIGHTING**

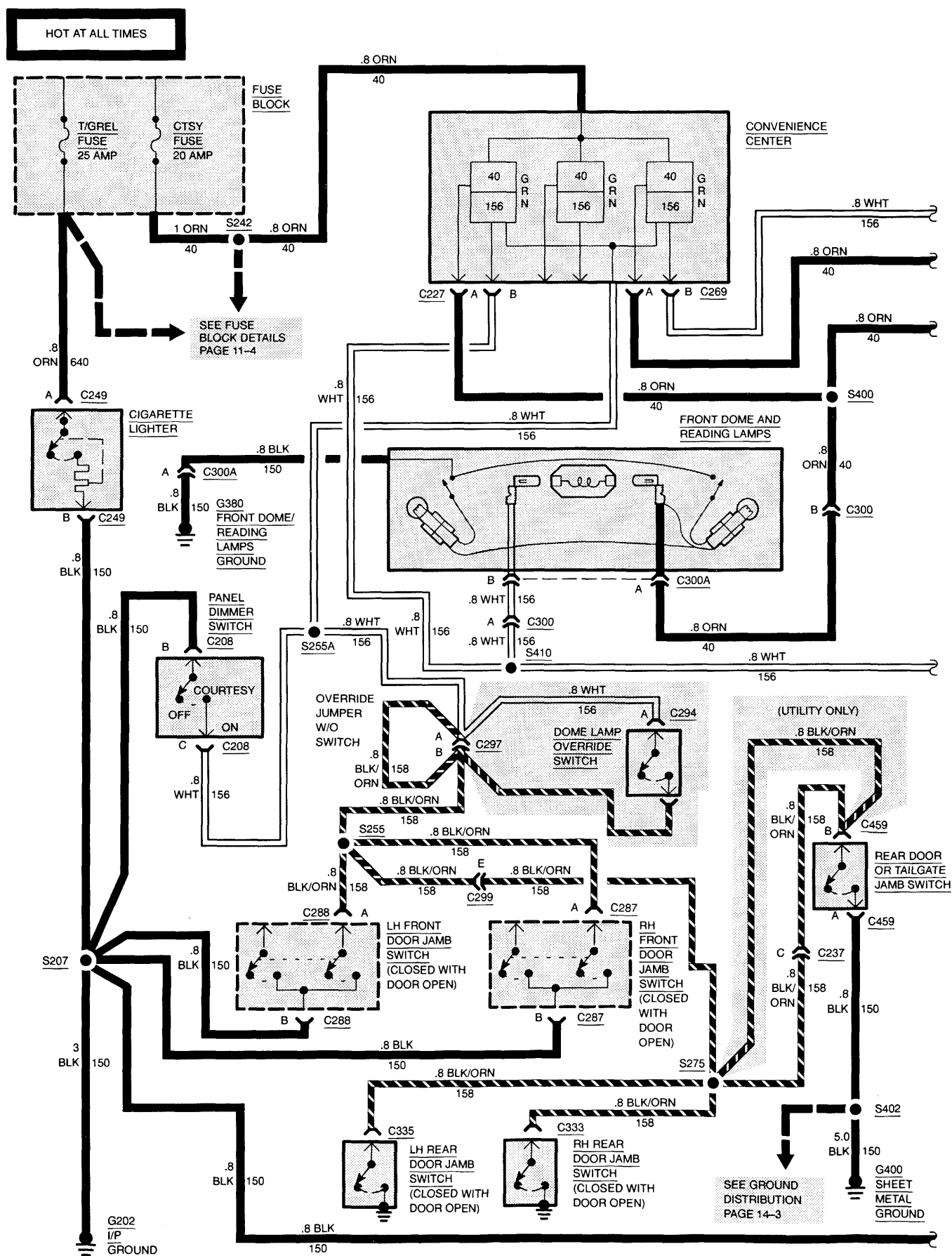


## CREW CAB W/AUXILIARY LIGHTING





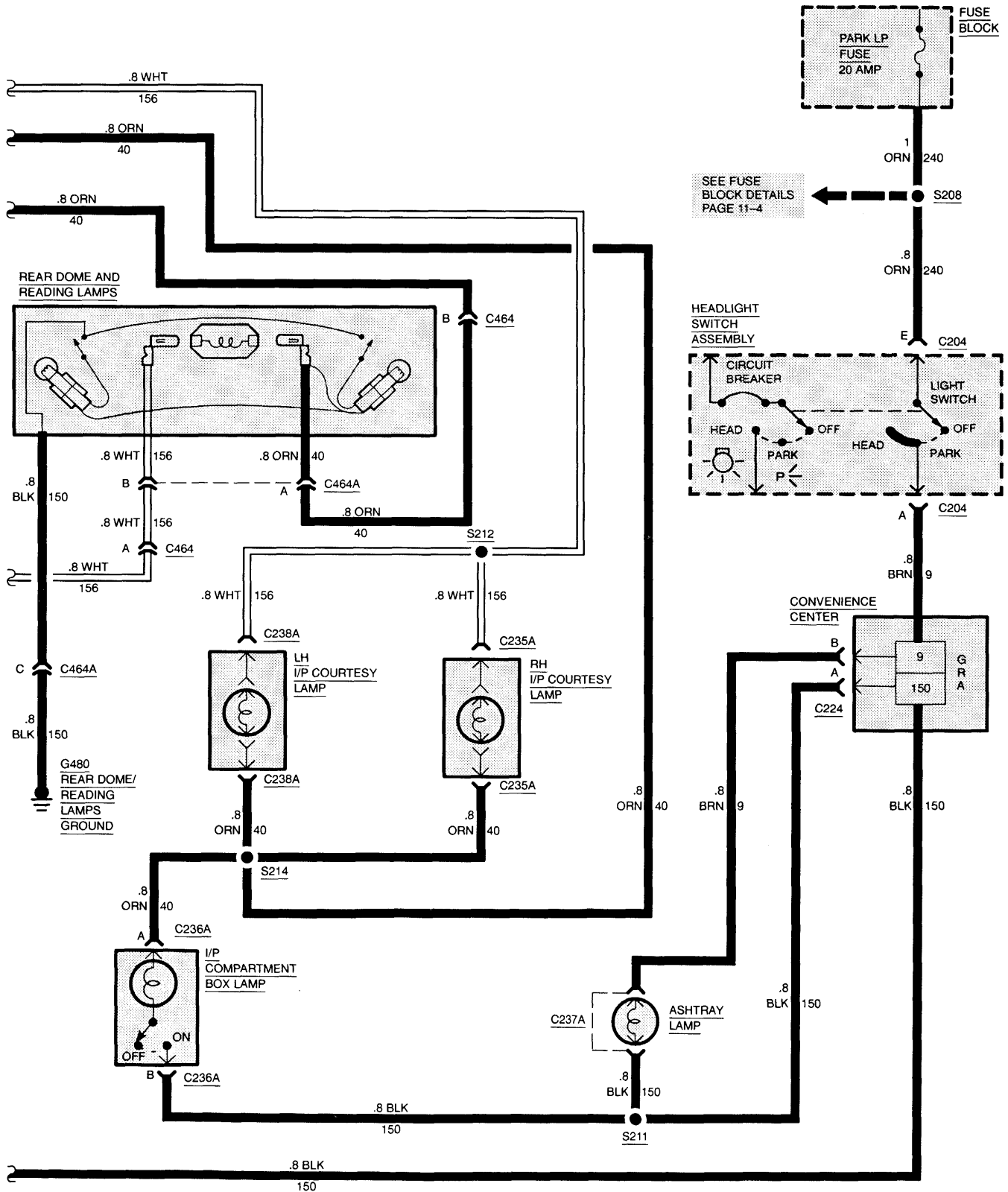
### SUBURBAN/UTILITY W/AUXILIARY LIGHTING



# INTERIOR LAMPS 8A-114-9

## SUBURBAN/UTILITY W/AUXILIARY LIGHTING

HOT AT ALL TIMES



## 8A-114-10 INTERIOR LAMPS

### DIAGNOSIS — INTERIOR LAMPS

#### PRELIMINARY CHECKS:

1. Check condition of CTSY, PARK LP, and T/GREL Fuse(s). If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).

#### COURTESY LAMPS DO NOT OPERATE

| TEST                                                                                                                                                                                                                                                                                                | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect a test lamp from ORN (40) wire at courtesy lamp connectors C235/C238 to ground. Check at each courtesy lamp.                                                                                                                                                                             | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in ORN (40) wire from inoperative courtesy lamp connector(s) C235A/C238A to splice S214 or from splice S214 to convenience center connector C269.                                                                                                                                                                                                                                                                                                                           |
| 2. Open all doors. Connect test lamp from ORN (40) wire to WHT (156) wire at courtesy lamp connectors C235/C238.                                                                                                                                                                                    | Test lamp lights.         | REPLACE bulb if lamp did not work. If lamp stayed ON all the time, GO to step 3.                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                     | Test lamp does not light. | GO to step 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3. Disconnect door jamb switch connectors. Connect ohmmeter from WHT (156) terminal at door jamb switch to ground. Take reading with door open and reading with door closed. With door open, reading must be 0 ohms and with door closed, infinite ohms.                                            | Correct readings.         | GO to step 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                     | Incorrect readings.       | REPLACE door jamb switch(es) that have incorrect reading.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4. Disconnect panel control switch connector C208. Connect ohmmeter from WHT (156) terminal to BLK (150) terminal at panel lamp switch. Turn panel lamp switch to ON and then OFF and take a reading in each position. When ON, reading must be 0 ohms and when OFF, reading must be infinite ohms. | Correct readings.         | LOCATE and REPAIR open in WHT (156) wire between panel lamps control switch connector C208 and splice S255 or between splice S255 and door jamb switch connectors or between splice S255 and convenience center C225. Also check WHT (156) wire from courtesy lamp connectors C235A and C238A to splice S212 or from splice S212 to convenience center connector C269. Also check BLK (150) wire from panel lamps control switch connector C208 to splice S207 or from splice S207 to ground G202. |
|                                                                                                                                                                                                                                                                                                     | Incorrect readings.       | REPLACE panel lamps control switch.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

**DOME LAMP DOES NOT WORK OR STAYS ON ALL THE TIME**

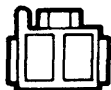
| TEST                                                                                                                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (40) wire at inoperative dome lamp to ground.                                                                                                                                                                                                       | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in ORN (40) wire between inoperative dome lamp and splice S900 or between splice S400 and convenience center connector C227.                                                                                                                                                                     |
| 2. Open all doors and turn panel lamp switch to ON. Connect test lamp from ORN (40) wire to WHT (156) wire at inoperative dome lamp.                                                                                                                                              | Test lamp lights.         | REPLACE bulb if dome lamp did not work. If dome lamp stayed ON all the time, GO to step 3.                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                                                   | Test lamp does not light. | GO to step 3.                                                                                                                                                                                                                                                                                                           |
| 3. Disconnect door jamb switch connectors. Connect ohmmeter from WHT (156) terminal to BLK (150) terminal at door jamb switch. Take reading with door open and reading with door closed. With door open, reading must be 0 ohms and with door closed, infinite ohms.              | Correct readings.         | GO to step 4.                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                   | Incorrect readings.       | REPLACE door jamb switch(es) that have incorrect reading.                                                                                                                                                                                                                                                               |
| 4. Disconnect light switch connector C208. Connect ohmmeter from WHT (156) terminal to BLK (150) terminal at light switch. Turn light switch to ON and then OFF and take a reading in each position. When ON, reading must be 0 ohms and when OFF, reading must be infinite ohms. | Correct readings.         | LOCATE and REPAIR open or short in WHT (156) wire from panel lamps control switch connector C208 to splice S255 or from splice S255 to convenience center C225. Also LOCATE and REPAIR open in BLK (150) wire between panel lamps control switch connector C208 and splice S207 or between splice S207 and ground G202. |
|                                                                                                                                                                                                                                                                                   | Incorrect readings.       | REPLACE panel lamp control switch.                                                                                                                                                                                                                                                                                      |

**I/P COMPARTMENT BOX LAMP DOES NOT WORK**

| TEST                                                                                                                      | RESULT                    | ACTION                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Open I/P compartment box door. Connect test lamp from ORN (40) wire I/P compartment box lamp connector C236 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                     |
|                                                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in ORN (40) wire between I/P compartment box connector C236A and splice S214 or between splice S214 and convenience center connector C269. |
| 2. Connect test lamp from ORN (40) wire to BLK (150) wire at I/P compartment box lamp connector C236A.                    | Test lamp lights.         | REPLACE I/P compartment box lamp assembly.                                                                                                                        |
|                                                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from I/P compartment box lamp connector C236A to ground terminal G202.                                                   |

# 8A-114-12 INTERIOR LAMPS

12033700



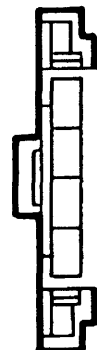
**C227**  
Convenience Center Tap

12033700



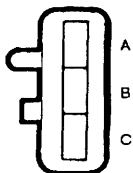
**C269**  
Convenience Center Tap

12034060



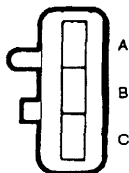
**NATURAL**  
Metri-Pack 480  
**C208**  
Panel Dimmer Switch

12047781



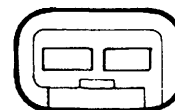
**BLACK**  
Metri-Pack 150  
**C287**  
RH Front Door Jamb Switch

12047781



**BLACK**  
Metri-Pack 150  
**C288**  
LH Front Door Jamb Switch

12047663



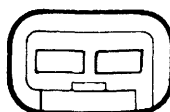
**BLACK**  
Metri-Pack 150  
**C300**  
Convenience Center to Dome  
Lamp

12047662



**BLACK**  
Metri-Pack 150  
**C300**  
Dome Lamp to Convenience  
Center

12047663



**BLACK**  
Metri-Pack 150  
**C301**  
In-Line Overhead Roof Console

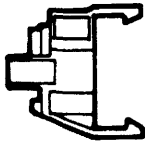
12047662



**BLACK**  
Metri-Pack 150  
**C301**  
In-Line Overhead Roof Console

# INTERIOR LAMPS 8A-114-13

12047699



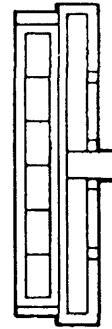
**C249**  
Cigarette Lighter

12047662



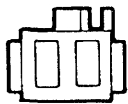
**BLACK**  
Metri-Pack 150  
**C464**  
Rear Dome Lamp to  
Convenience Center

12034061



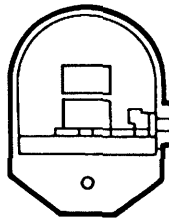
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

12033701



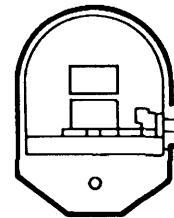
**C224**  
Convenience Center Tap

12124219



**C235A**  
Courtesy Lamp

12124219



**C238A**  
Courtesy Lamp

12089063



**BLACK**  
**C237A**  
Ashtray Lamp

06288872



188 Series  
**C333**  
Rear Door Jamb Switch

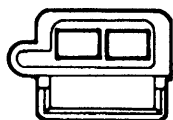
06288872



188 Series  
**C335**  
Rear Door Jamb Switch

## 8A-114-14 INTERIOR LAMPS

12064870



**C297**  
In-Line Convenience Center to  
Override Switch

12020556



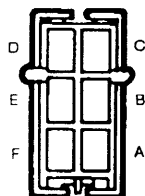
**BLACK**  
Metri-Pack 480  
**C294**  
Dome Lamp Override Switch

12059251



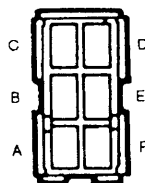
**C459**  
Tailgate Jamb Switch

12034482



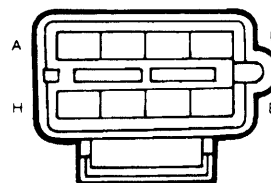
**GRAY**  
Metri-Pack 280  
**C299**  
Convenience Center to Rear  
Jamb Switches In-Line

12034481

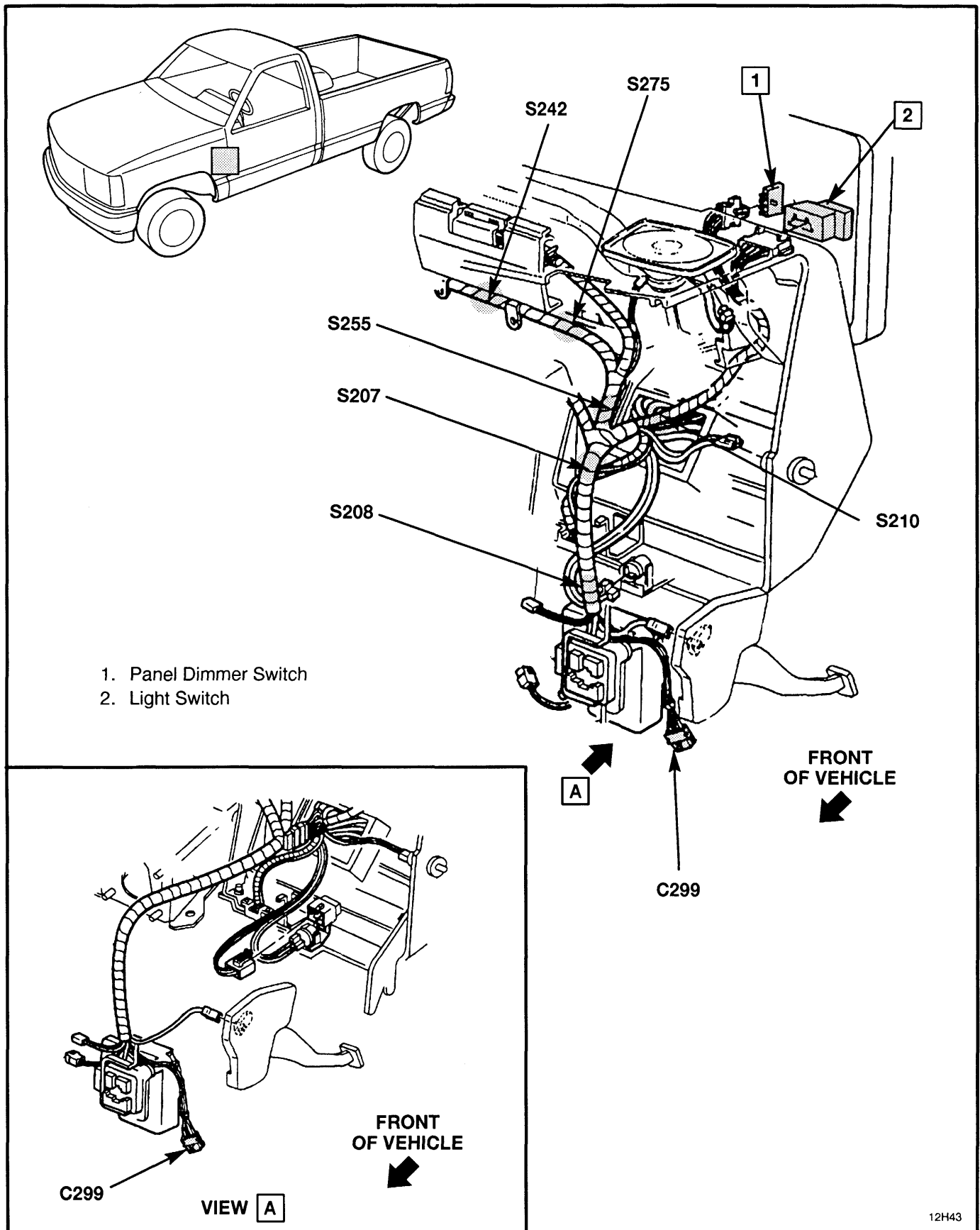


**GRAY**  
Metri-Pack 280  
**C299**  
Rear Jamb Switches to  
Convenience Center In-Line

12066195



**BLACK**  
Metri-Pack 280  
**C237**  
Rear Tailgate Jamb Switch





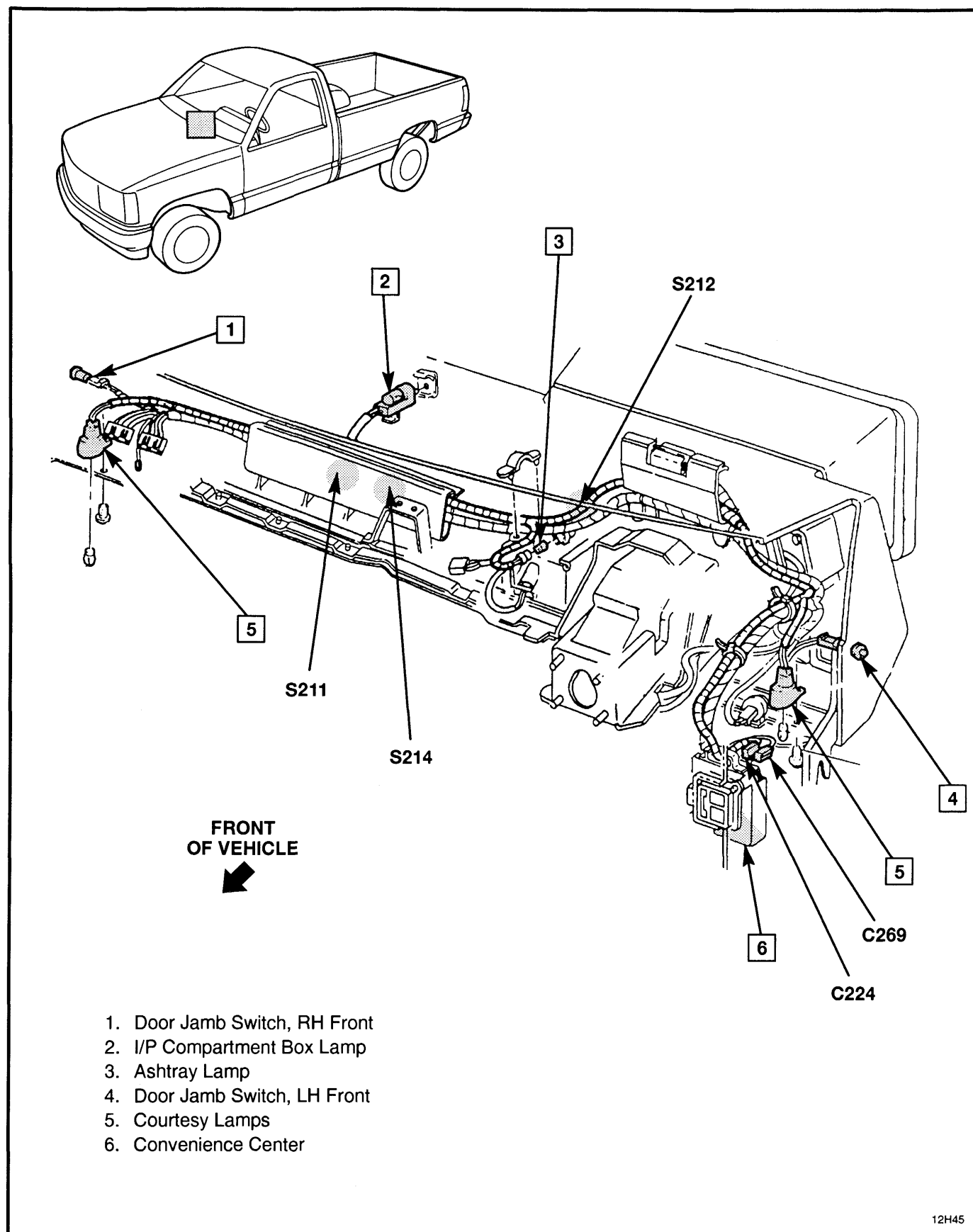
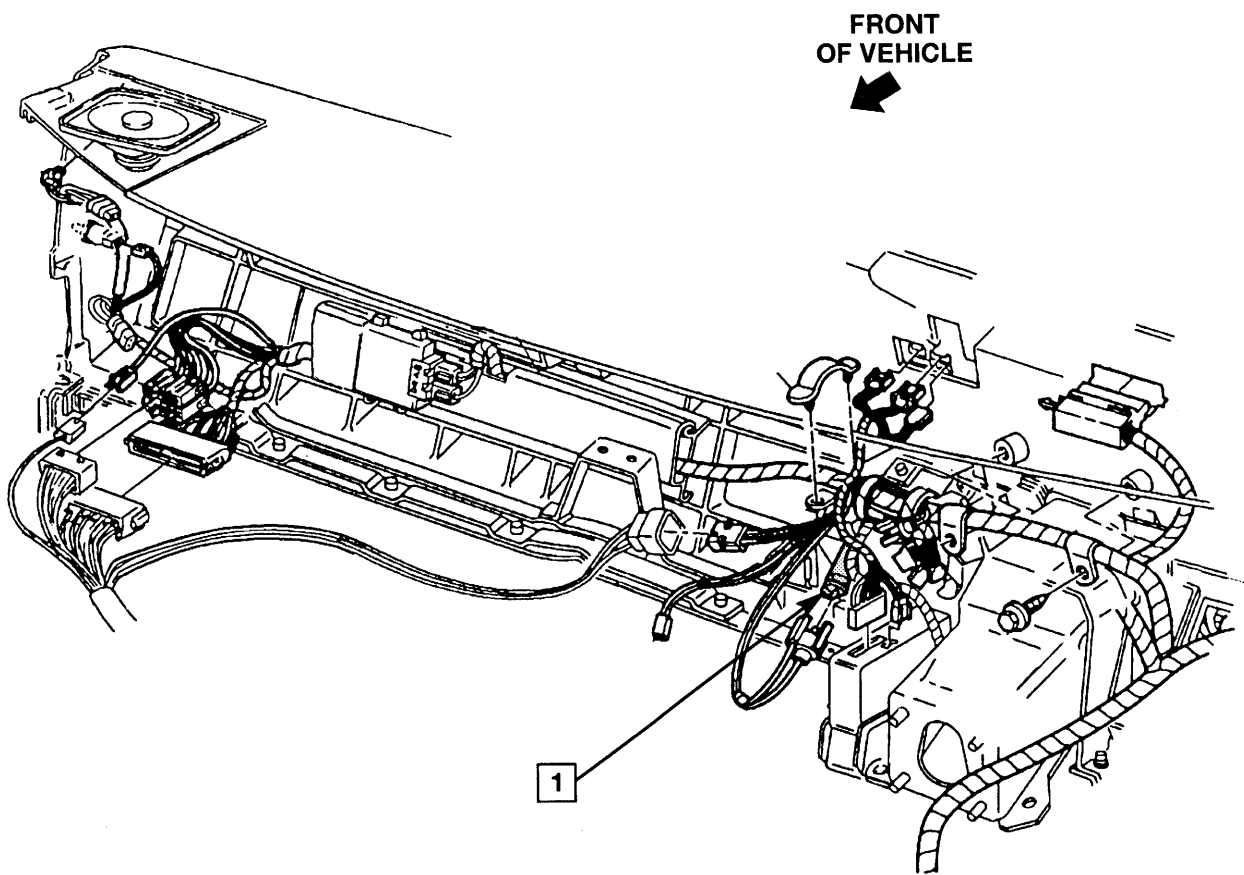
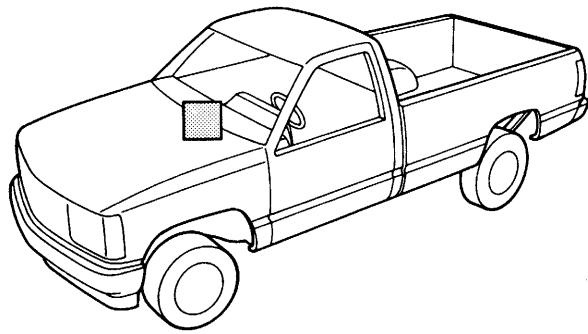


Figure 2 — Interior Lighting



1. Cigarette Lighter

Figure 3 — Instrument Panel Wiring – RH Side

## 8A-114-18 INTERIOR LAMPS

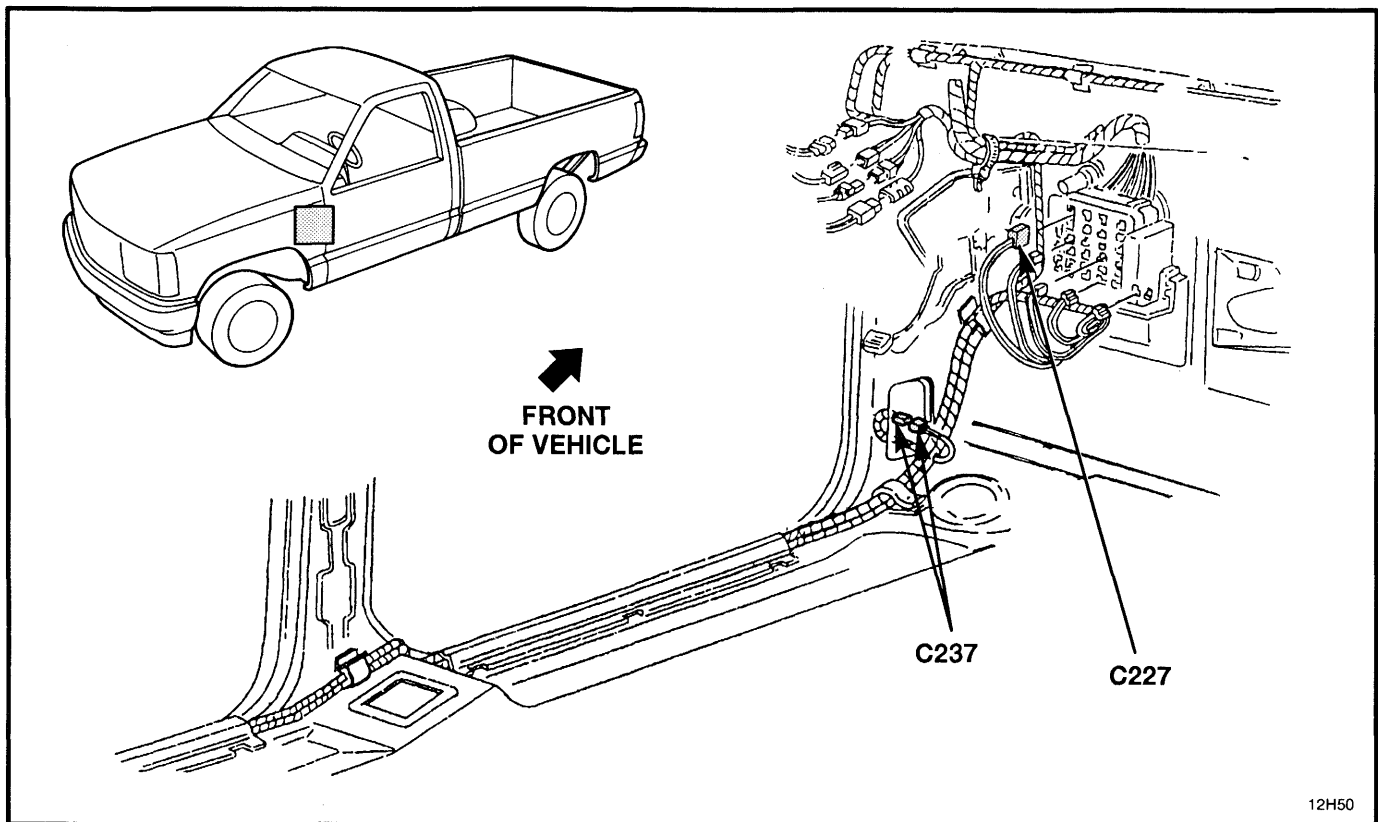


Figure 4 — Body Wiring Harness, Front

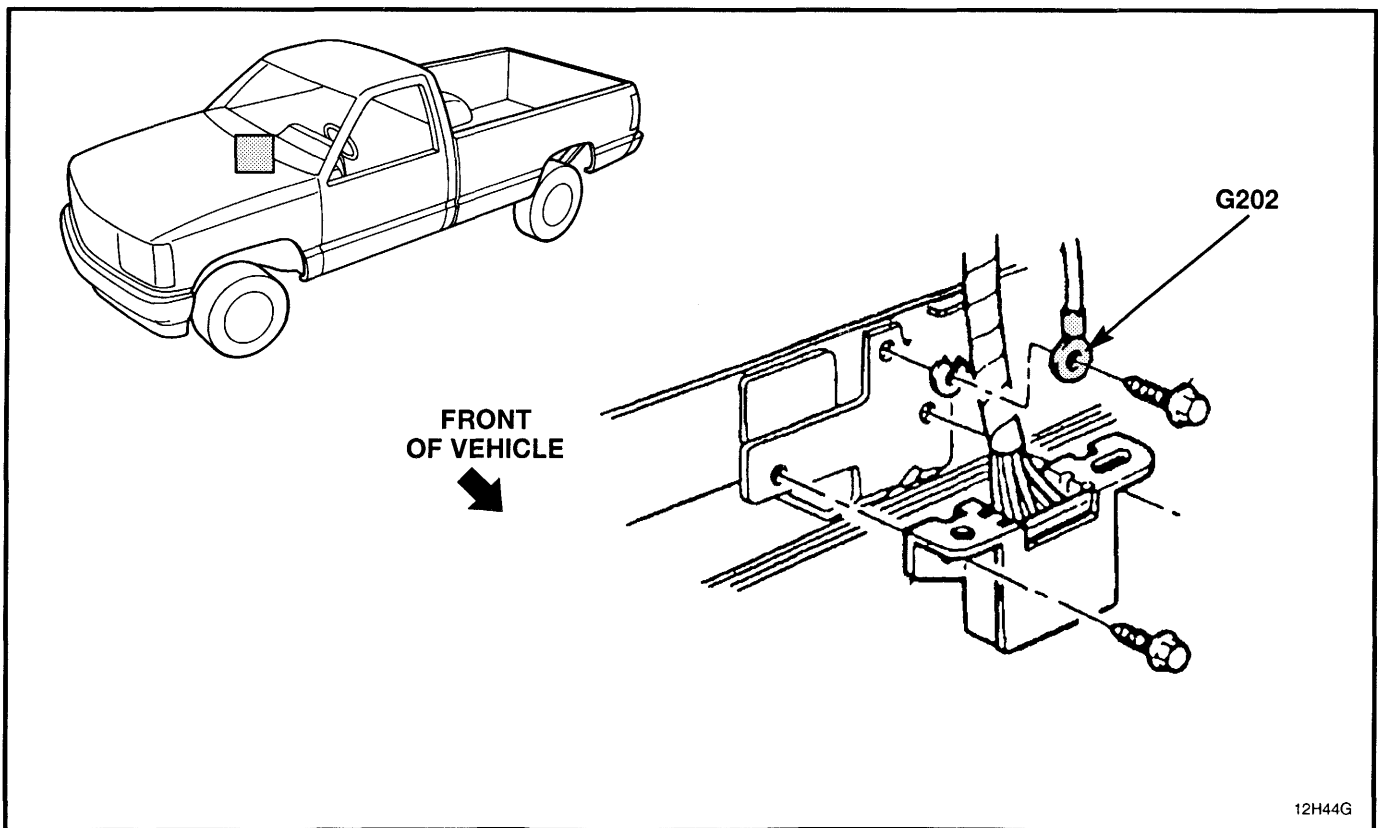
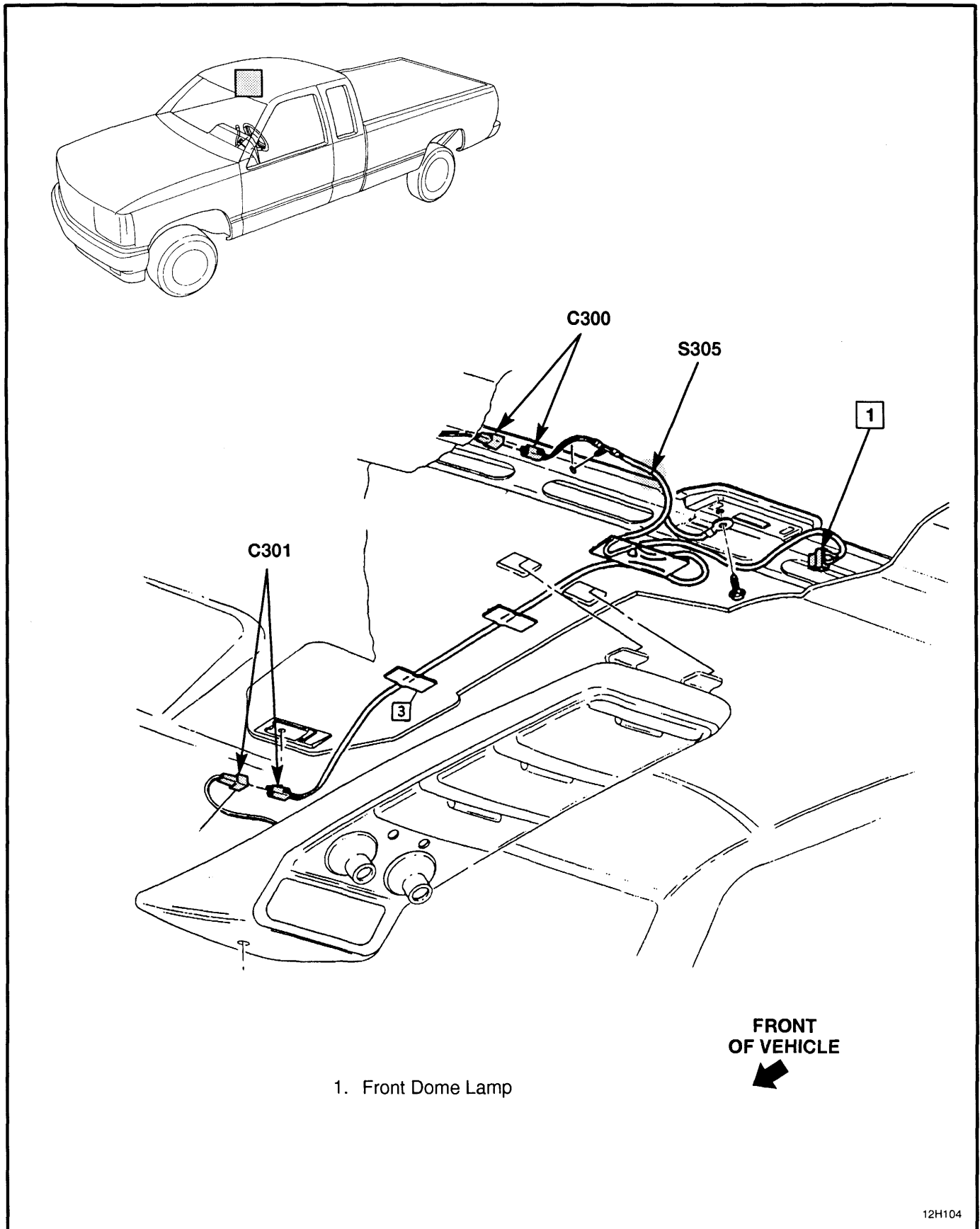


Figure 5 — I/P Ground



12H104

Figure 6 — Roof Console and Dome Lamp Wiring – Suburban, Utility and 4-Door Pickup

## 8A-114-20 INTERIOR LAMPS

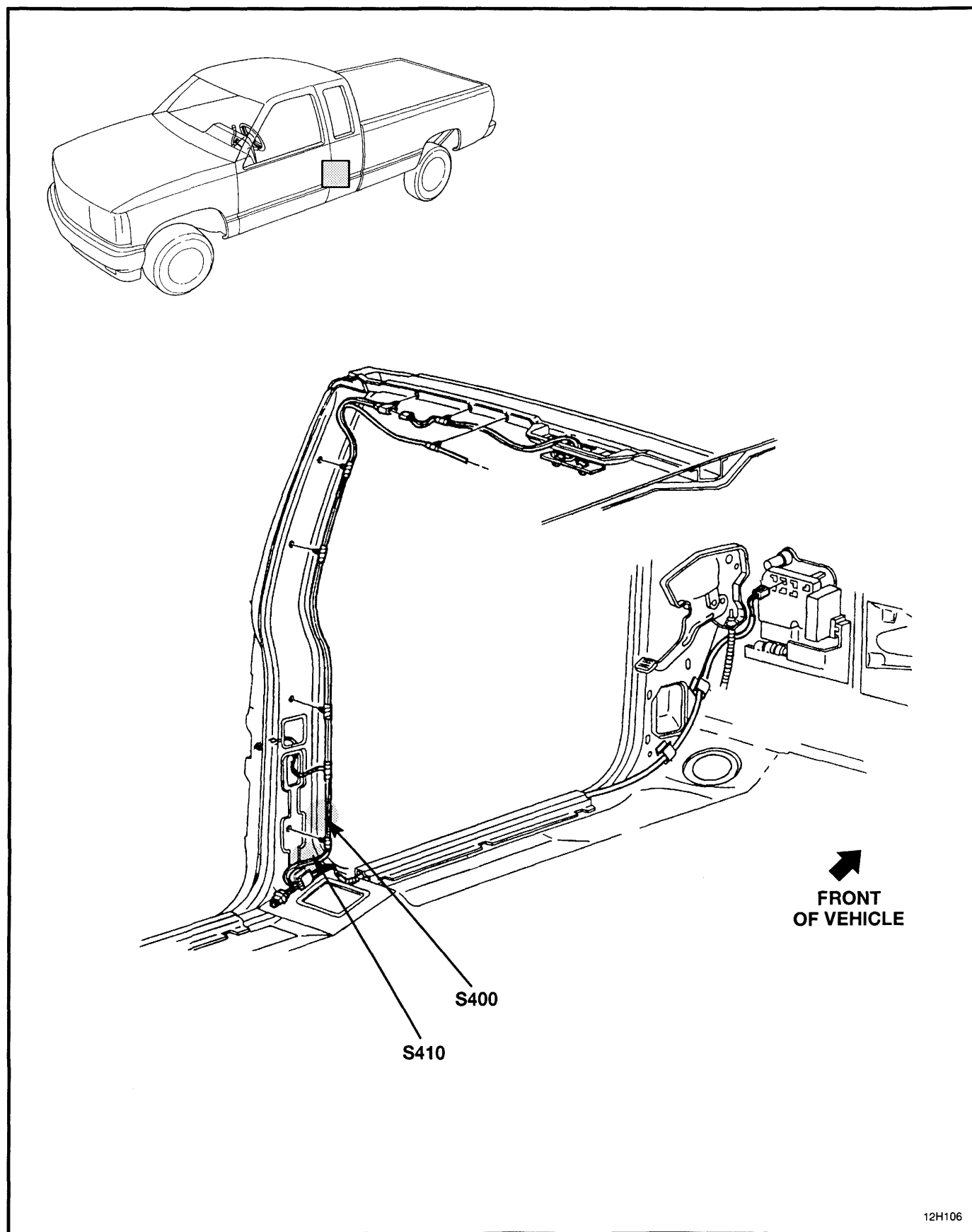
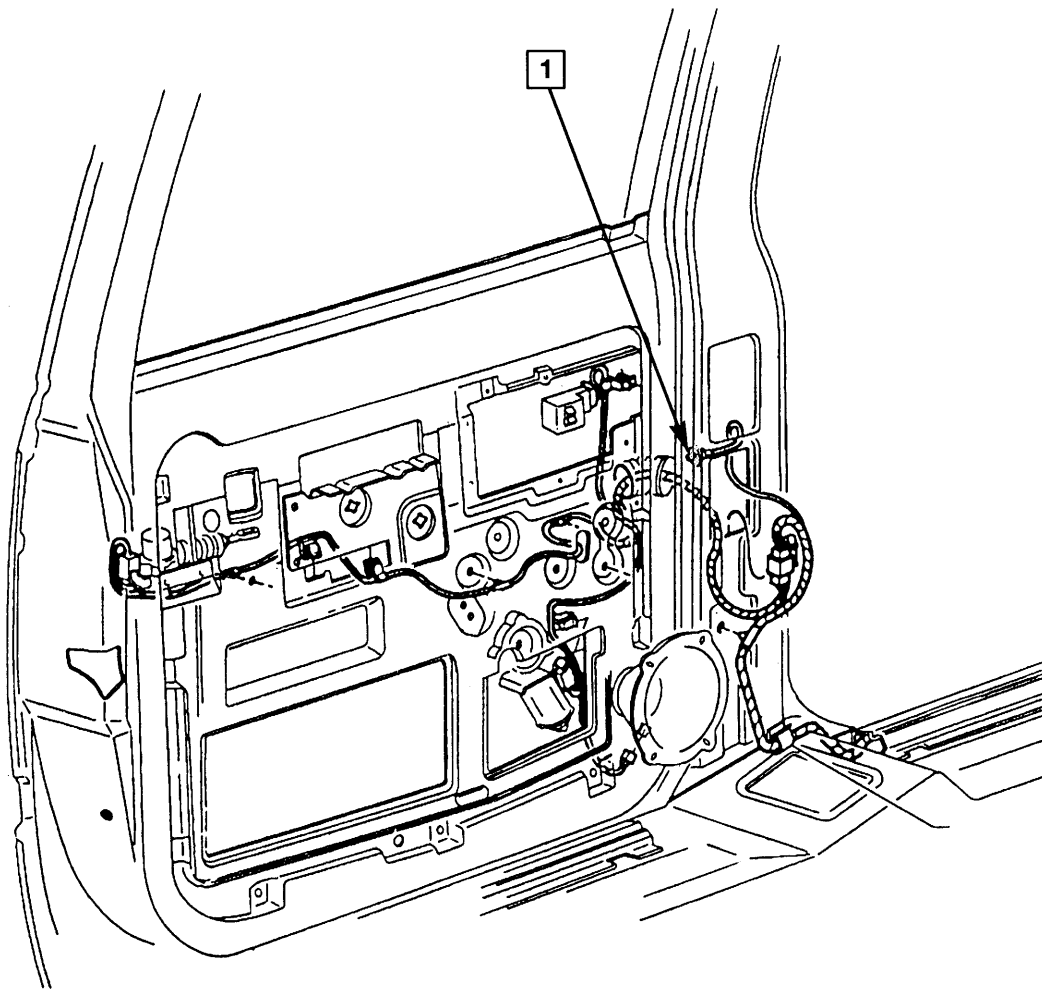
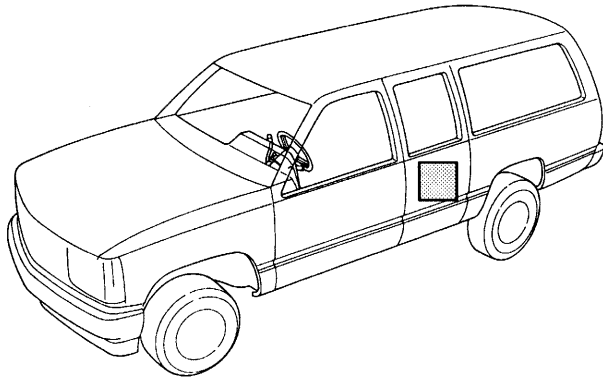


Figure 7 — Front Dome Lamp Harness — Crew W/Convenience Package



1. Rear Side Door Jamb Switch

FRONT  
OF VEHICLE

12H89

Figure 8 — Rear Side Door Wiring – Suburban and 4-Door

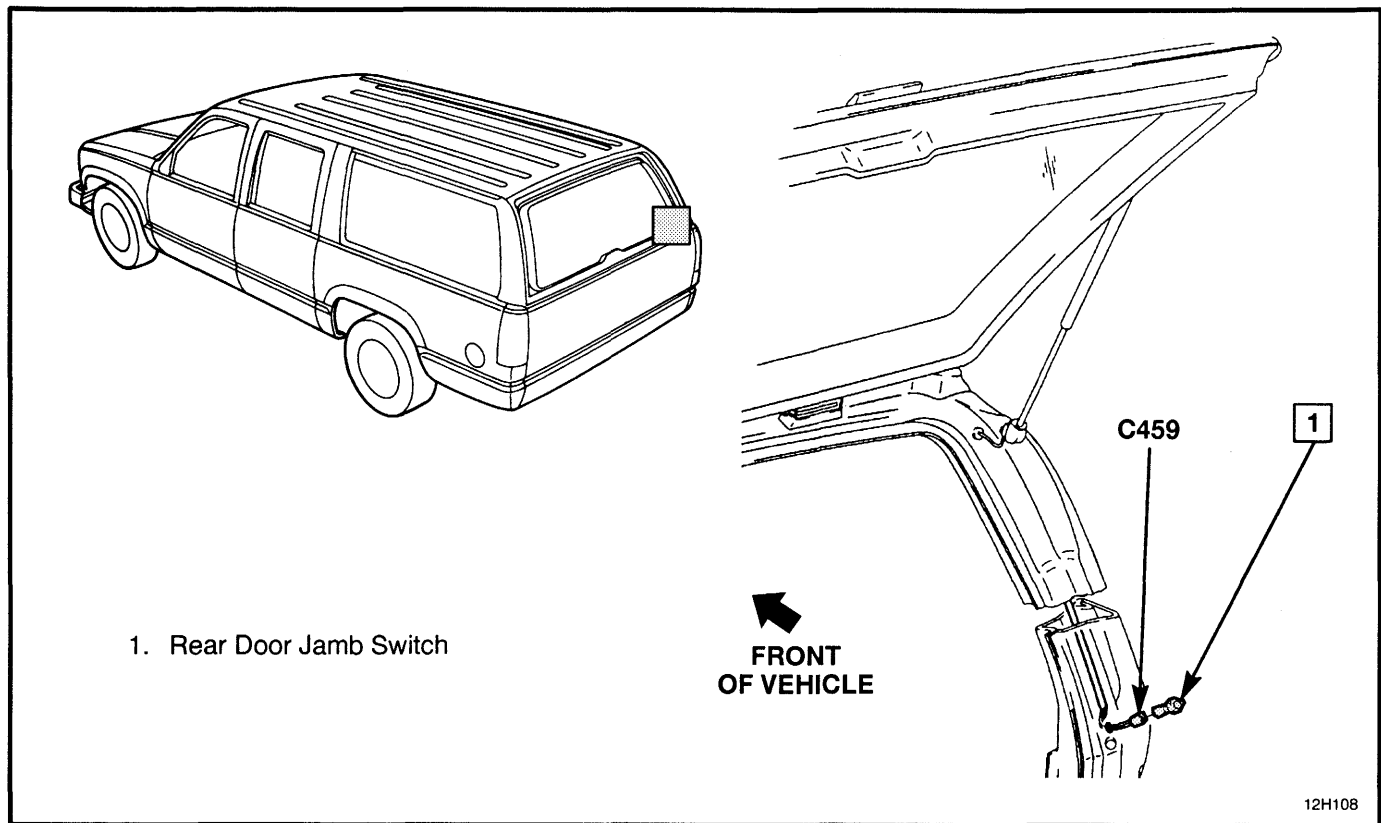


Figure 9 — Rear Door Jamb Switch Wiring, Suburban W/Endgate

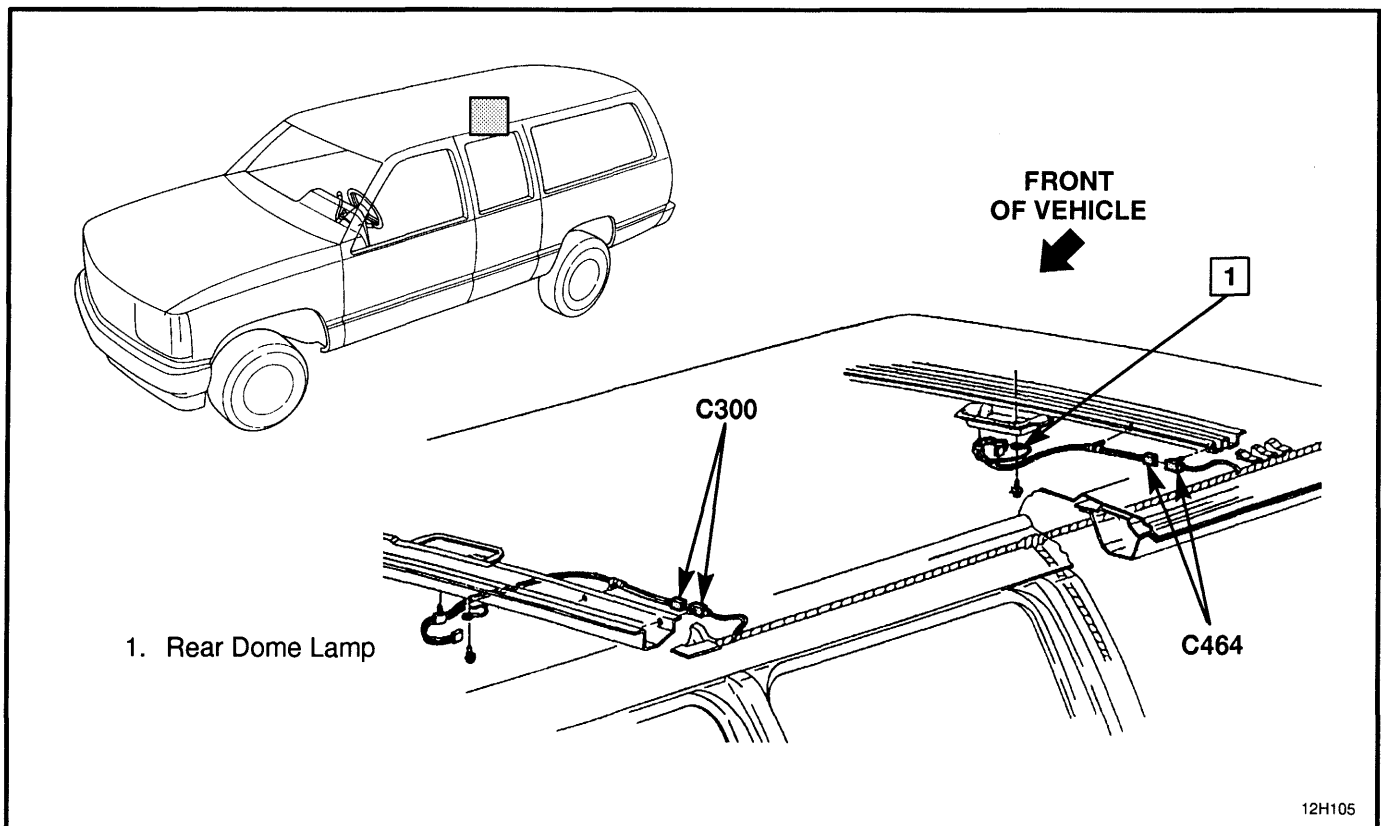


Figure 10 — Front and Rear Dome Lamp Wiring, Suburban and Utility W/O Console

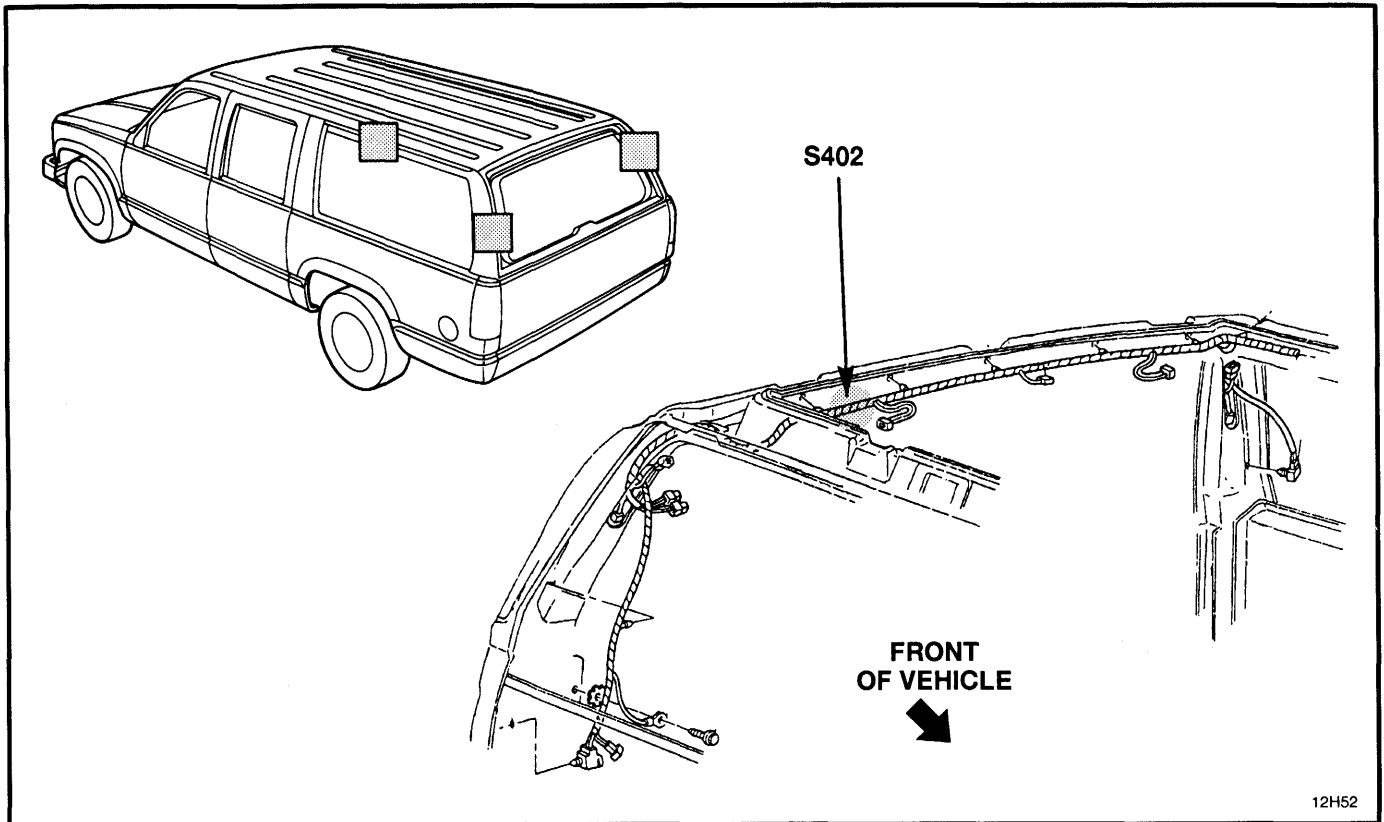


Figure 11 — Body Wiring, Rear – Suburban



**BLANK**

## **CIRCUIT OPERATION**

### **CARGO LAMP**

Voltage is supplied at all times through the CTSY Fuse to the Cargo Lamp Switch. When the Cargo Lamp Switch is turned on, voltage flows through the switch to the Lamp.

### **COMPONENT LOCATION**

|                                  |                                             | <b>Page — Figure</b> |   |
|----------------------------------|---------------------------------------------|----------------------|---|
| Convenience Center .....         | Under LH side of I/P .....                  | 116-7                | 4 |
| Cargo Lamp .....                 | Rear center of cab, above rear window ..... | 116-7                | 5 |
| Cargo Lamp Switch .....          | LH side of I/P .....                        | 116-6                | 2 |
| Door Jamb Switch, LH Front ..... | At LH end of I/P .....                      | 116-5                | 1 |
| Door Jamb Switch, RH Front ..... | At RH end of I/P .....                      | Not Shown            |   |
| Fuse Block .....                 | Below LH side of I/P .....                  | 116-5                | 1 |
| Panel Dimmer Switch .....        | LH end of I/P .....                         | 116-5                | 1 |

### **CONNECTORS:**

|             |                                                      |       |   |
|-------------|------------------------------------------------------|-------|---|
| C239A ..... | At convenience center .....                          | 116-7 | 4 |
| C293 .....  | Behind LH side of I/P, near convenience center ..... | 116-7 | 4 |

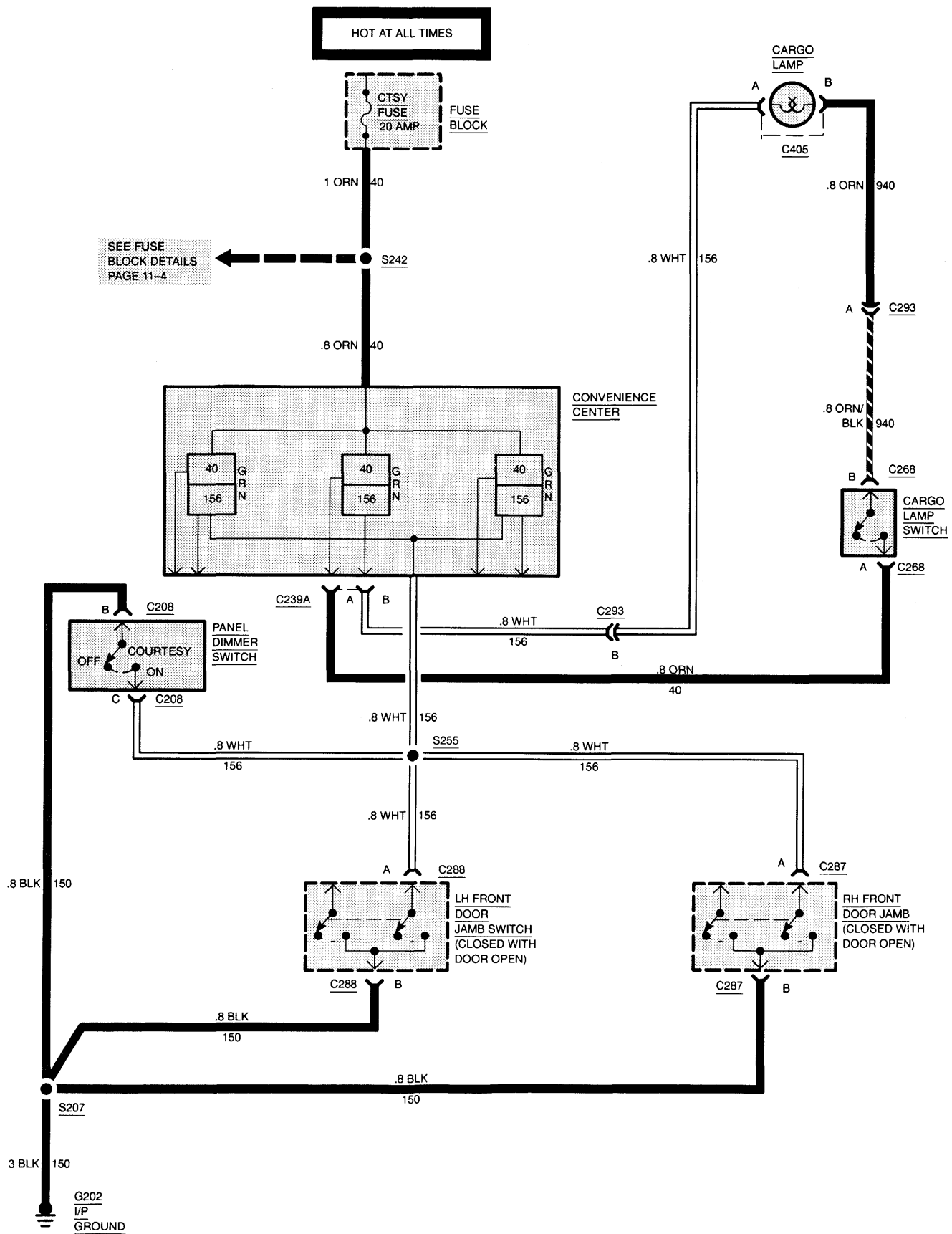
### **GROUND:**

|            |                        |       |   |
|------------|------------------------|-------|---|
| G202 ..... | At DLC connector ..... | 116-6 | 3 |
|------------|------------------------|-------|---|

### **SPLICES:**

|            |                            |       |   |
|------------|----------------------------|-------|---|
| S207 ..... | Under LH side of I/P ..... | 116-5 | 1 |
| S242 ..... | Under LH side of I/P ..... | 116-5 | 1 |
| S255 ..... | Under LH side of I/P ..... | 116-5 | 1 |

# 8A-116-2 CARGO LAMP



## DIAGNOSIS — CARGO LAMP

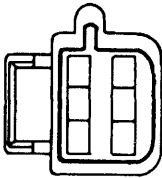
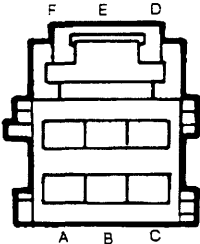
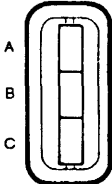
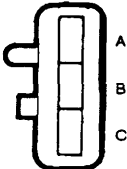
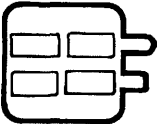
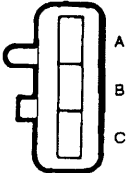
### PRELIMINARY CHECKS:

1. Check condition of CTSY Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.
2. Check operation of dome and courtesy lamps, if inoperative, repair before proceeding with cargo lamp diagnosis.

### CARGO LAMP DOES NOT OPERATE

| TEST                                                                                                       | RESULT                    | ACTION                                                                                                             |
|------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1. Place cargo switch to ON. Connect test lamp from ORN (940) wire at cargo lamp connector C405 to ground. | Test lamp lights.         | GO to step 2.                                                                                                      |
|                                                                                                            | Test lamp does not light. | GO to step 3.                                                                                                      |
| 2. Connect test lamp from ORN (940) wire to WHT (156) wire at cargo lamp connector C405.                   | Test lamp lights.         | REPLACE bulb.                                                                                                      |
|                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in WHT (156) wire from cargo lamp to convenience center connector C227.                     |
| 3. Connect test lamp from ORN (40) wire at cargo lamp switch connector C268 to ground.                     | Test lamp lights.         | GO to step 4.                                                                                                      |
|                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in ORN (40) wire between cargo switch connector C268 and convenience center connector C227. |
| 4. Connect test lamp from ORN/BLK (940) wire at cargo lamp switch connector C268 to ground.                | Test lamp lights.         | LOCATE and REPAIR open in ORN/BLK (940) wire from cargo lamp switch connector C268 to cargo lamp connector C405.   |
|                                                                                                            | Test lamp does not light. | REPLACE cargo lamp switch.                                                                                         |

8A-116-4 CARGO LAMP

|                                                                                                                                                                                                                |                                                                                                                                                                                               |                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>12033700</div> <div></div> <div>C239A<br/>Cargo Lamp to Convenience<br/>Center</div>                                     | <div>12034060</div> <div></div> <div>NATURAL<br/>Metri-Pack 480<br/>C208<br/>Panel Dimmer Switch</div>       | <div>12064763</div> <div></div> <div>GRAY<br/>Metri-Pack 150<br/>C293<br/>In-Line Convenience Center to<br/>Cargo Lamp</div> |
| <div>12064762</div> <div></div> <div>GRAY<br/>Metri-Pack 150<br/>C293<br/>In-Line Cargo Lamp to<br/>Convenience Center</div> | <div>12047782</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C268<br/>Cargo Lamp Switch</div>          | <div>12047781</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C288<br/>LH Front Door Jamb Switch</div>                  |
| <div>12047785</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C405<br/>Cargo Lamp</div>                                 | <div>12047781</div> <div></div> <div>BLACK<br/>Metri-Pack 150<br/>C287<br/>RH Front Door Jamb Switch</div> |                                                                                                                                                                                                                 |

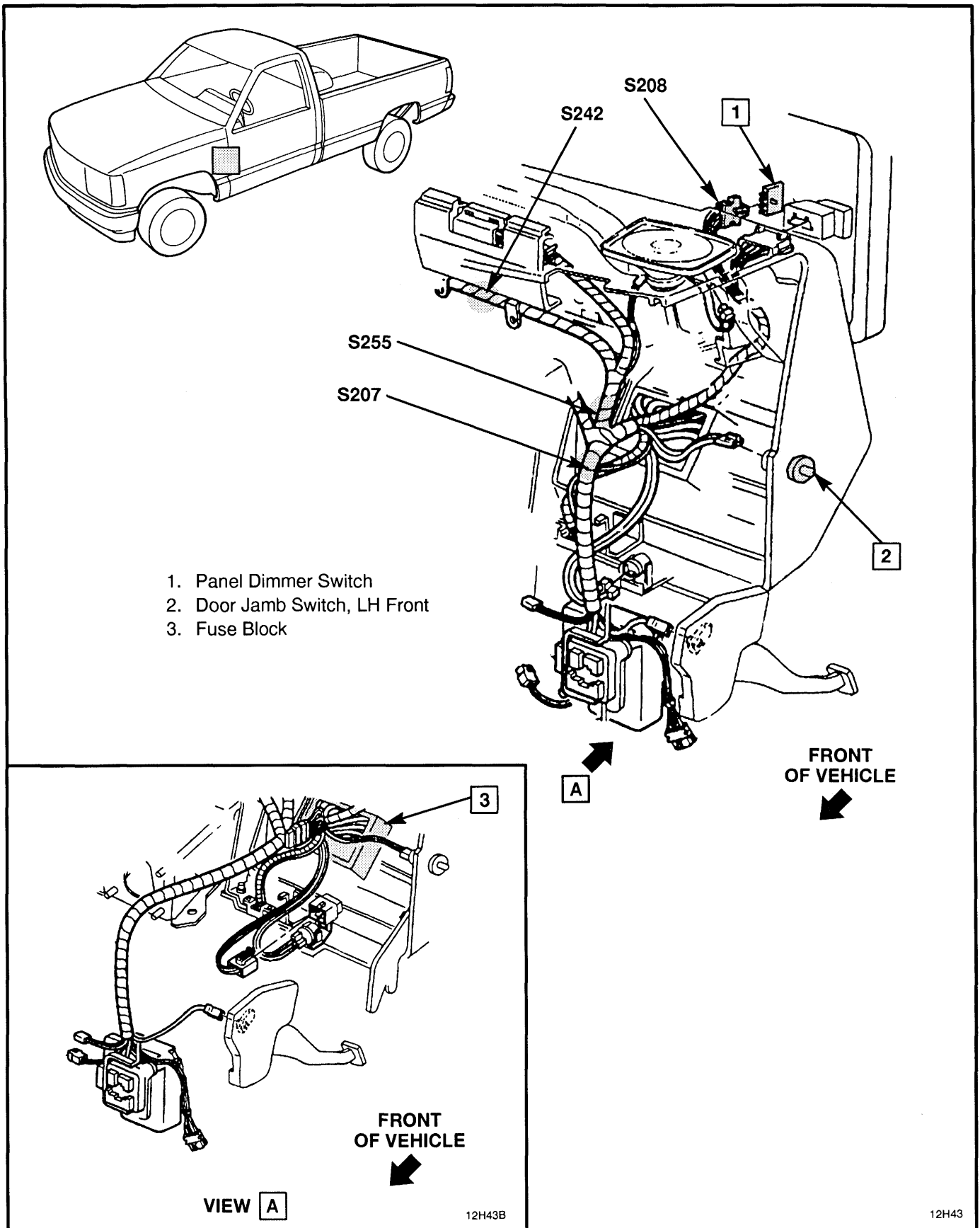


Figure 1 — LH Side of Instrument Panel

## 8A-116-6 CARGO LAMP

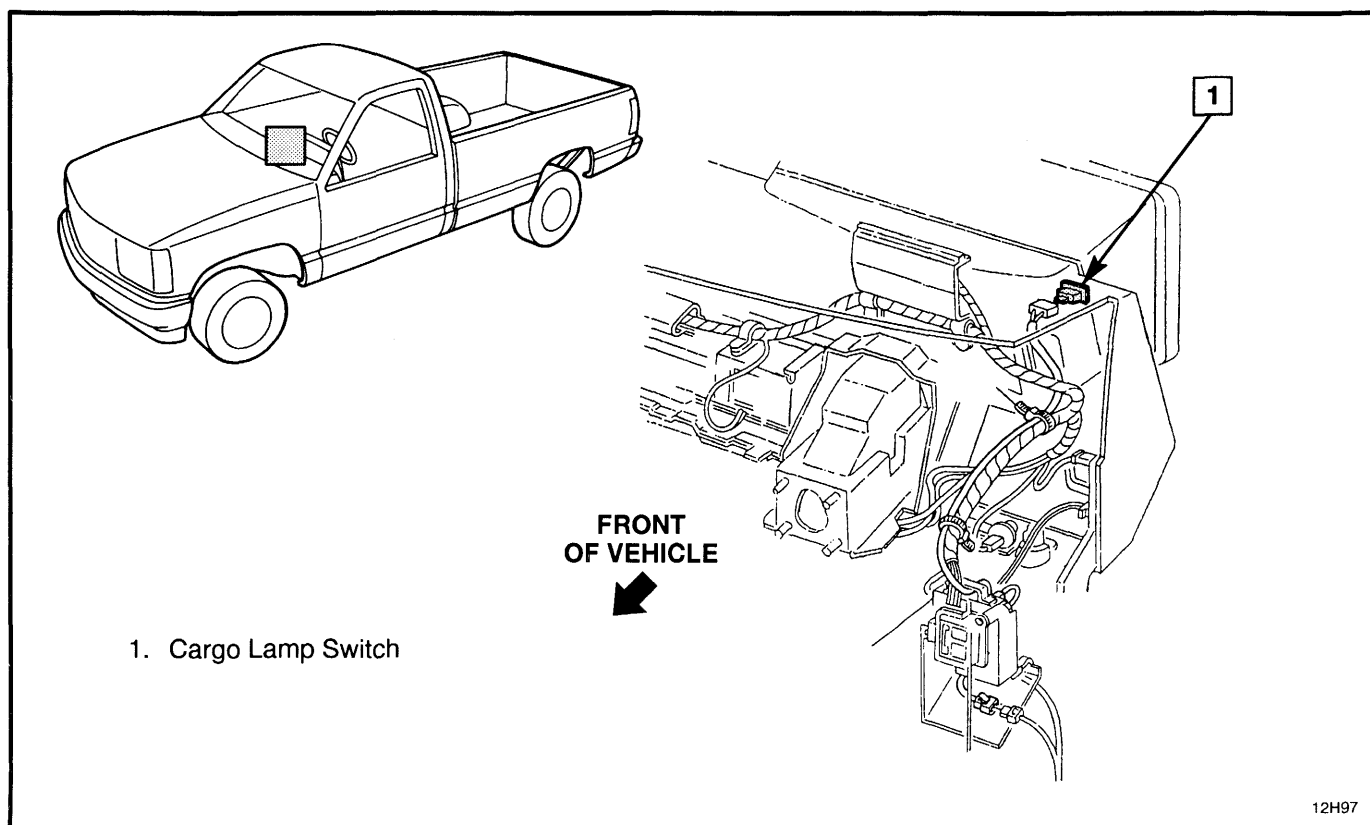


Figure 2 — Cargo Lamp Switch Wiring

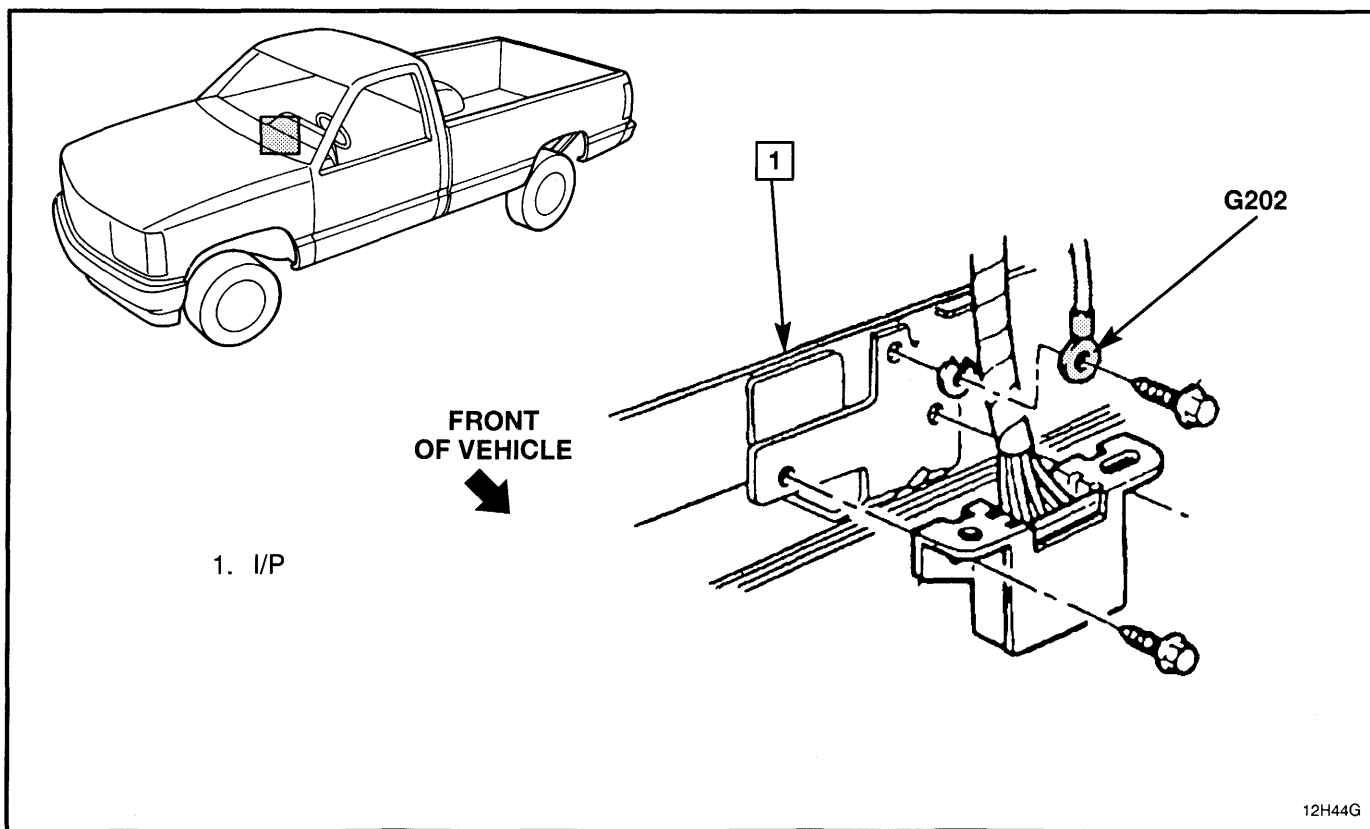


Figure 3 — I/P Ground

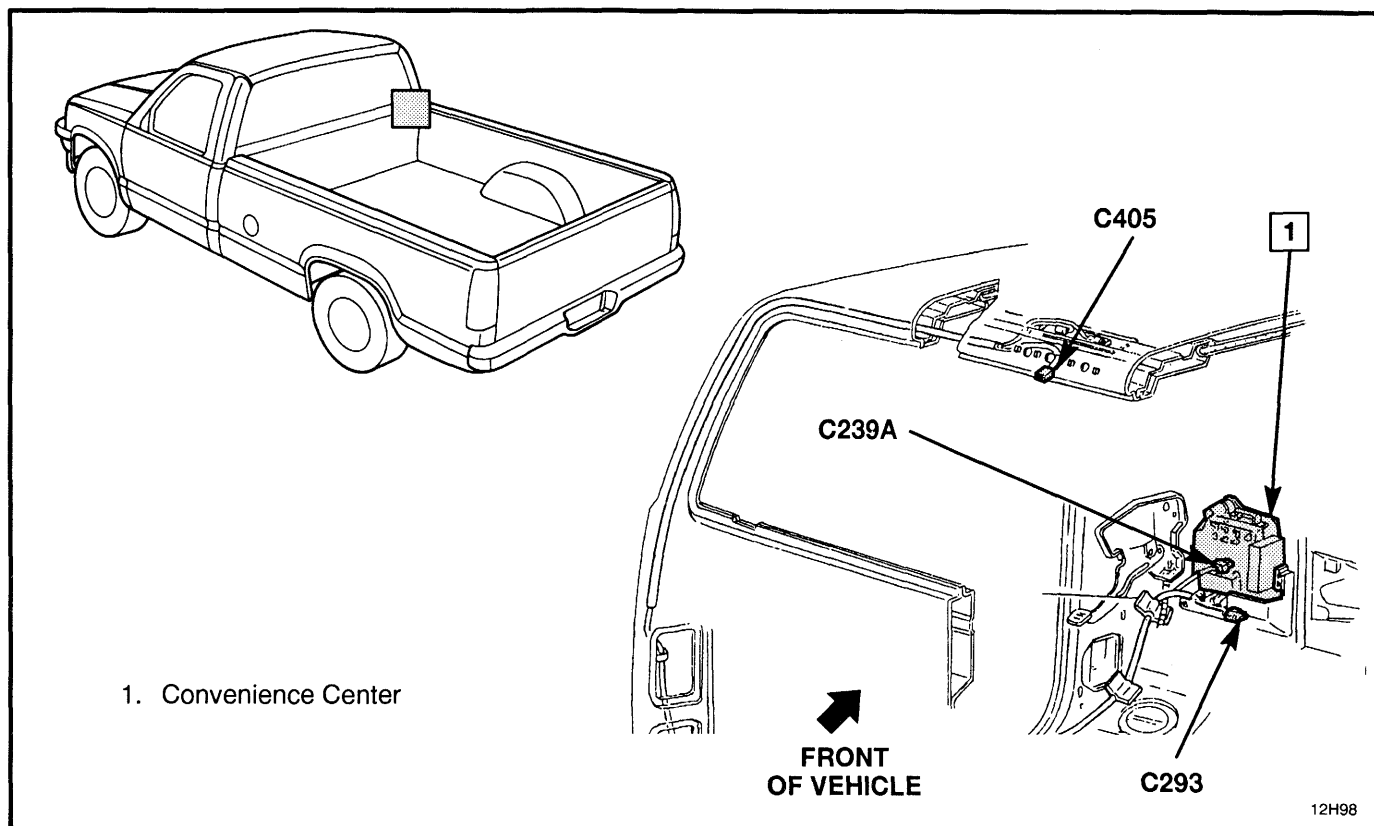


Figure 4 — Cargo CHMSL and Dome Lamp Wiring

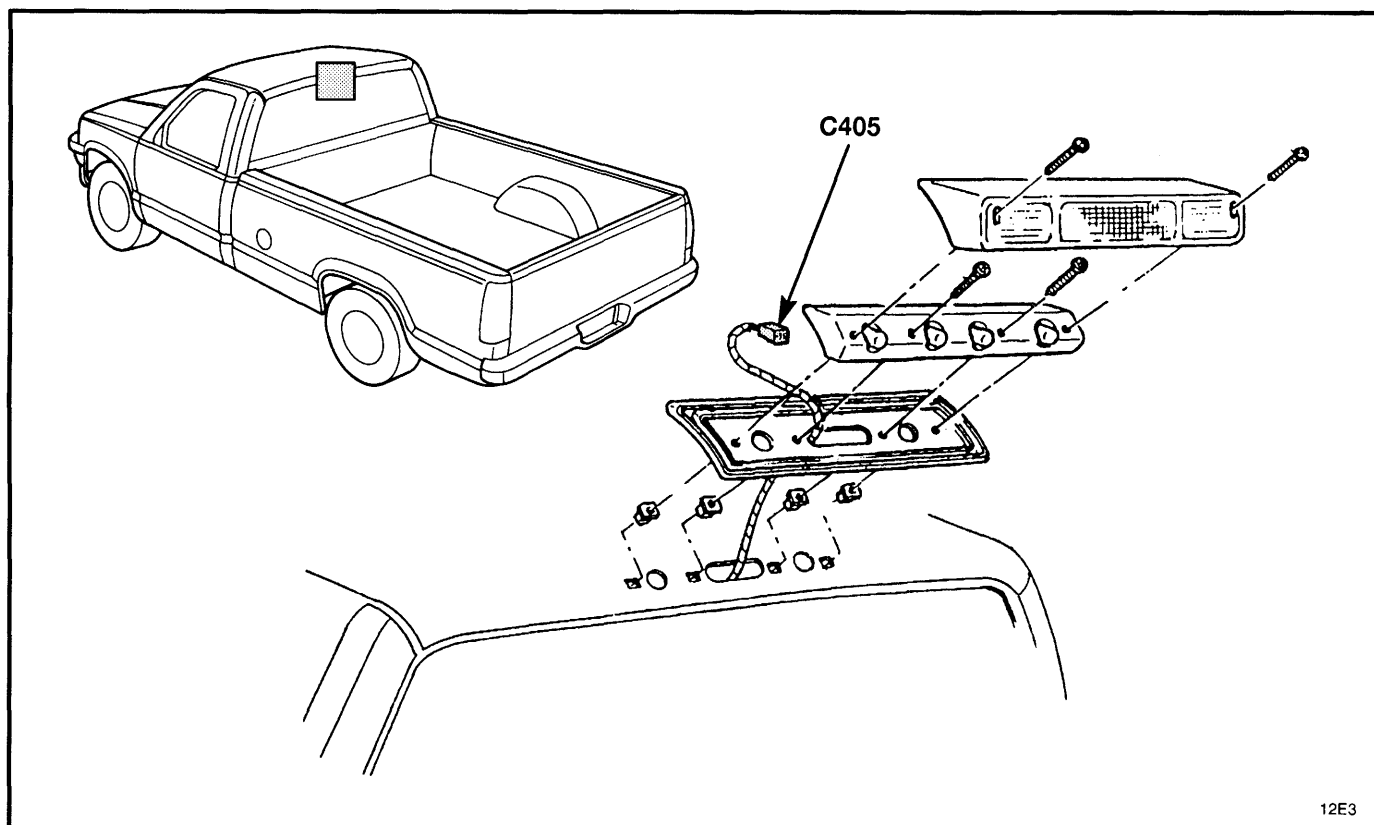


Figure 5 — Cargo and CHMSL Lamp Rear Wiring



**BLANK**

## **CIRCUIT OPERATION**

### **INTERIOR LAMPS DIMMING**

With the Headlight Switch in PARK or HEAD, voltage is supplied to Panel Dimmer Switch assembly. This voltage goes through the PNL LPS 5 Amp Fuse to the I/P Cluster Lamps, Radio, Heater — A/C Control Assembly, Auxiliary Heater-A/C Control Assemblies, Rear Defogger and Four Wheel Drive Indicator Lamps.

### **COMPONENT LOCATION**

**Page — Figure**

|                                             |                                 |           |   |
|---------------------------------------------|---------------------------------|-----------|---|
| Auxiliary Heater and A/C Control Assemblies | Overhead console                | 117-10    | 6 |
| Convenience Center                          | Under LH side of I/P            | 117-11    | 7 |
| Heater and A/C Control                      | Center of I/P at heater control | 117-7     | 3 |
| Heater Control                              | Center of I/P at heater control | Not Shown |   |
| Instrument Cluster                          | LH upper end of I/P             | Not Shown |   |
| Light Switch                                | Upper LH side of I/P            | 117-8     | 4 |
| Panel Dimmer Switch                         | RH side of I/P                  | 117-8     | 4 |
| Radio                                       | LH side of I/P                  | 117-9     | 5 |
| Rear Defogger Switch                        | LH side of I/P                  | 117-12    | 8 |
| Four-Wheel Drive Indicator                  | Center floor console            | 117-11    | 7 |

### **CONNECTORS:**

|       |                                         |        |   |
|-------|-----------------------------------------|--------|---|
| C215A | At convenience center                   | 117-11 | 7 |
| C230  | Below center of I/P, near heater outlet | 117-7  | 3 |
| C258  | At convenience center                   | 117-12 | 8 |
| C382  | Under driver's seat                     | 117-10 | 6 |

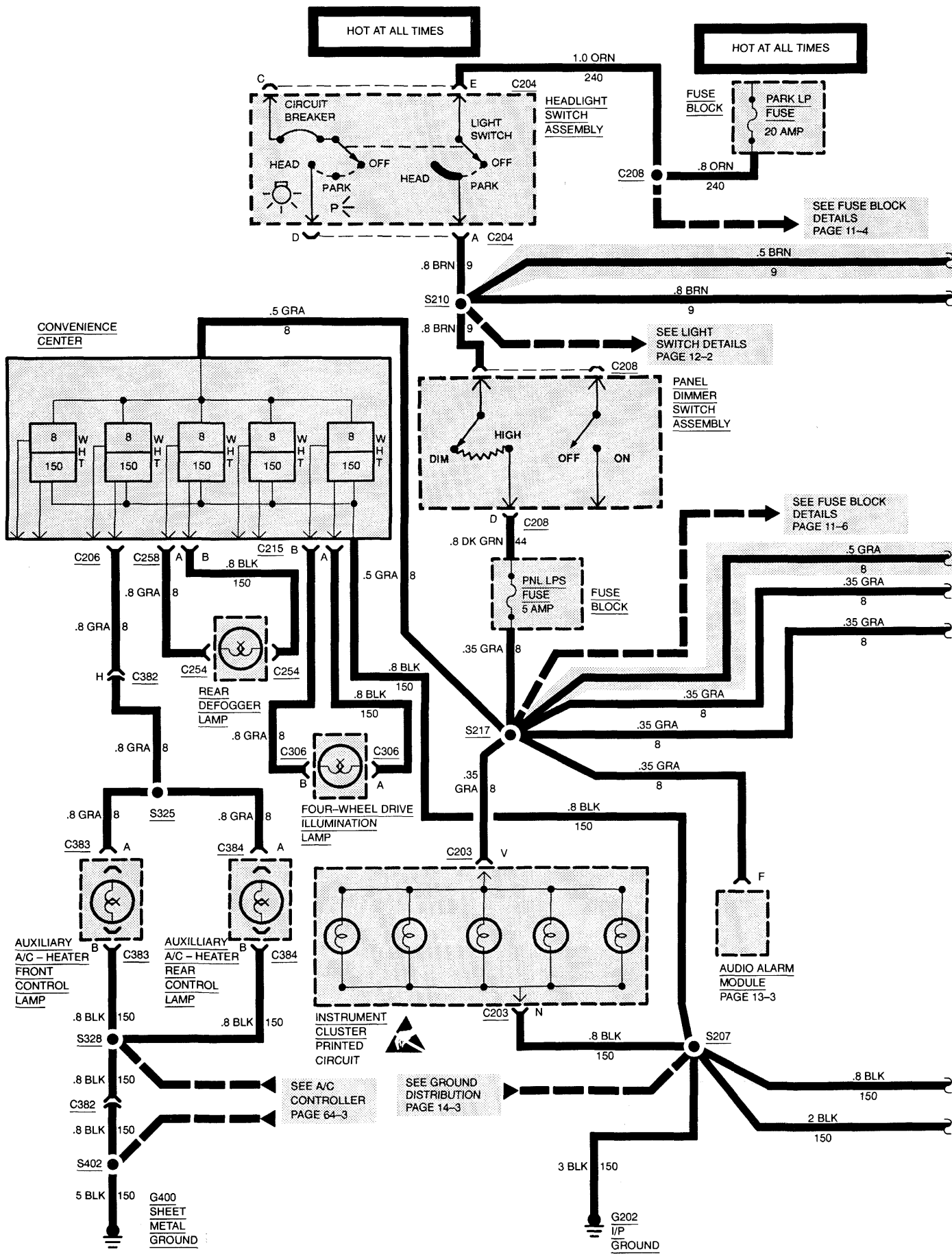
### **GROUND:**

|                 |                  |           |   |
|-----------------|------------------|-----------|---|
| G202            | At DLC connector | 117-6     | 2 |
| G400 (Utility)  | At RH D-pillar   | Not Shown |   |
| G400 (Suburban) | At RH C-pillar   | Not Shown |   |

### **SPLICES:**

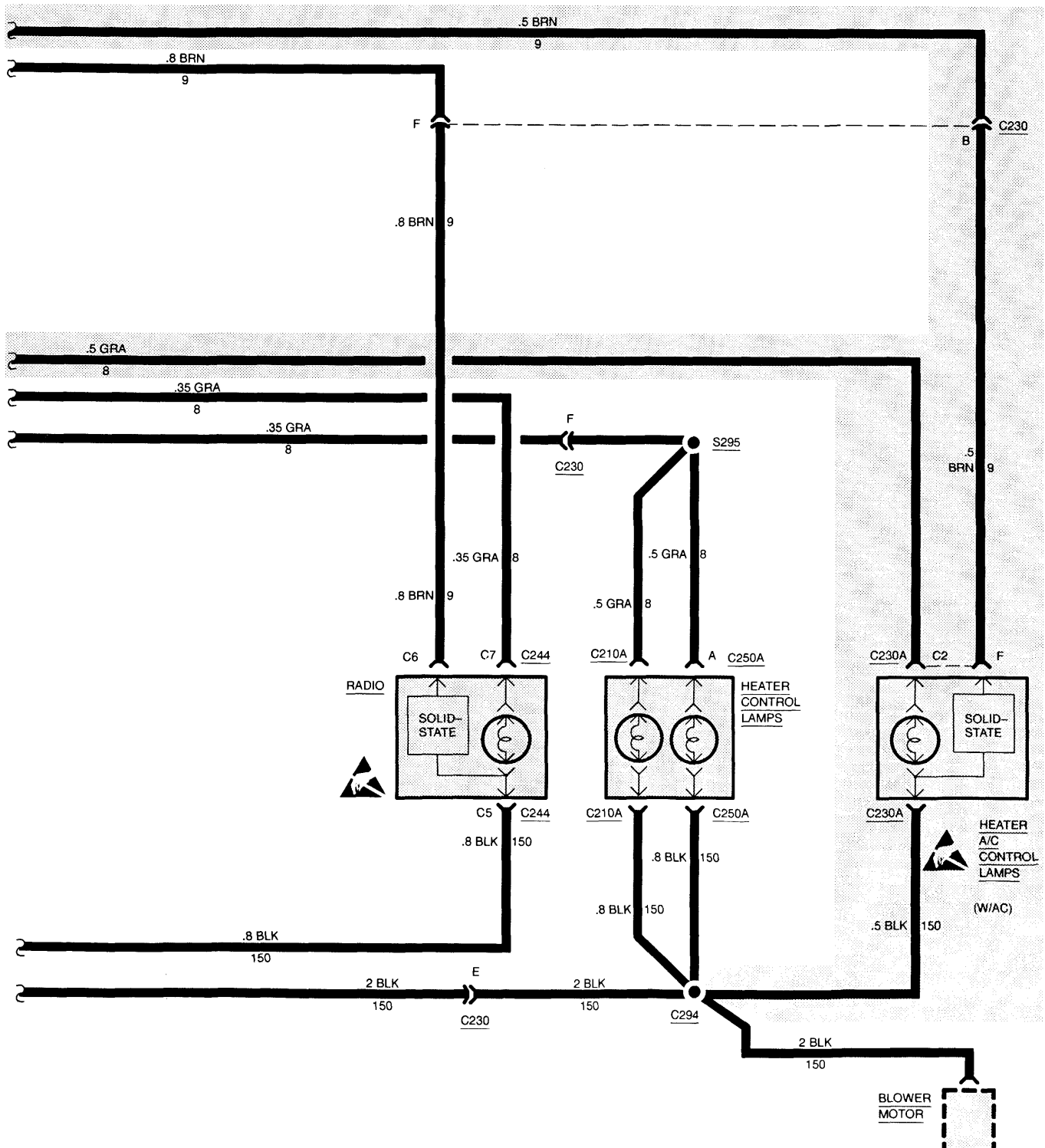
|      |                                       |        |   |
|------|---------------------------------------|--------|---|
| S207 | Under LH side of I/P                  | 117-8  | 4 |
| S208 | Under LH side of I/P                  | 117-8  | 4 |
| S210 | Under LH side of I/P                  | 117-8  | 4 |
| S217 | Under LH side of I/P                  | 117-8  | 4 |
| S294 | Heater harness, near I/P harness lead | 117-12 | 9 |
| S295 | Heater harness, near I/P harness lead | 117-12 | 9 |
| S325 | At overhead console                   | 117-10 | 6 |
| S328 | At overhead console                   | 117-10 | 6 |
| S402 | Rear of vehicle                       | 117-6  | 1 |

## 8A-117-2 INSTRUMENT PANEL DIMMING



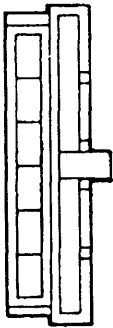
# INSTRUMENT PANEL DIMMING 8A-117-3

SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



## 8A-117-4 INSTRUMENT PANEL DIMMING

12034061



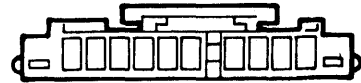
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Metri-Pack 480  
**C204**  
Light Switch

12034060



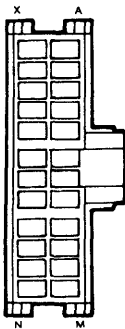
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Metri-Pack 480  
**C208**  
Panel Dimmer Switch

12047531



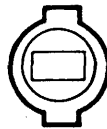
**BLACK**  
Micro-Pack 100  
**C244**  
Radio

12004702



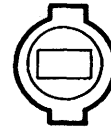
**BLACK**  
**C203A**  
Heater-A/C Control

12015956



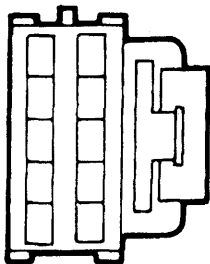
**BLACK**  
**C210A**  
Heater Control

12015956



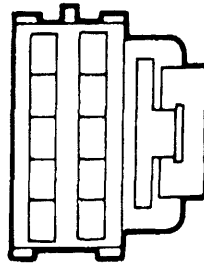
**BLACK**  
**C250A**  
Heater Control

12064871



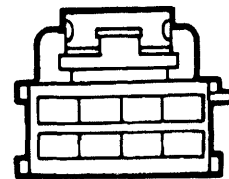
**C383**  
Front Auxiliary Heater-A/C  
Control

12064871



**C384**  
Rear Auxiliary Heater-A/C  
Control

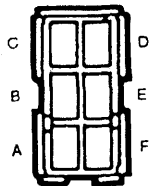
12064766



**BLUE**  
Metri-Pack 150  
**C382**  
In-Line Extension Harness to  
Auxiliary Heater-A/C Controls

INSTRUMENT PANEL DIMMING 8A-117-5

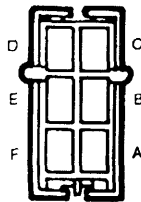
12034481



GRAY  
Metri-Pack 280

C230  
I/P to Heater-A/C Harness

12034482



GRAY  
Metri-Pack 280

C230  
Heater-A/C Harness to I/P

## 8A-117-6 INSTRUMENT PANEL DIMMING

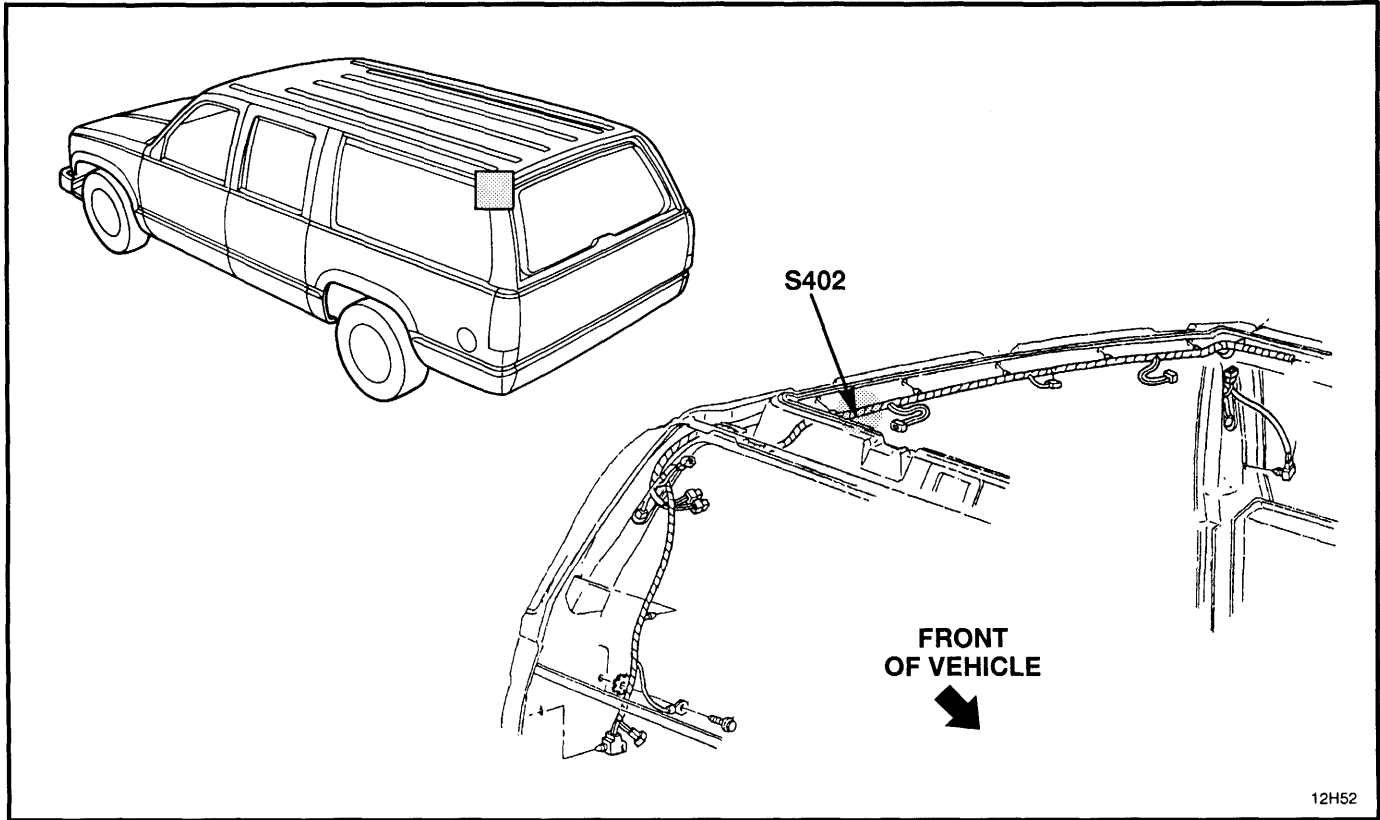


Figure 1 — Body Wiring, Rear — Suburban

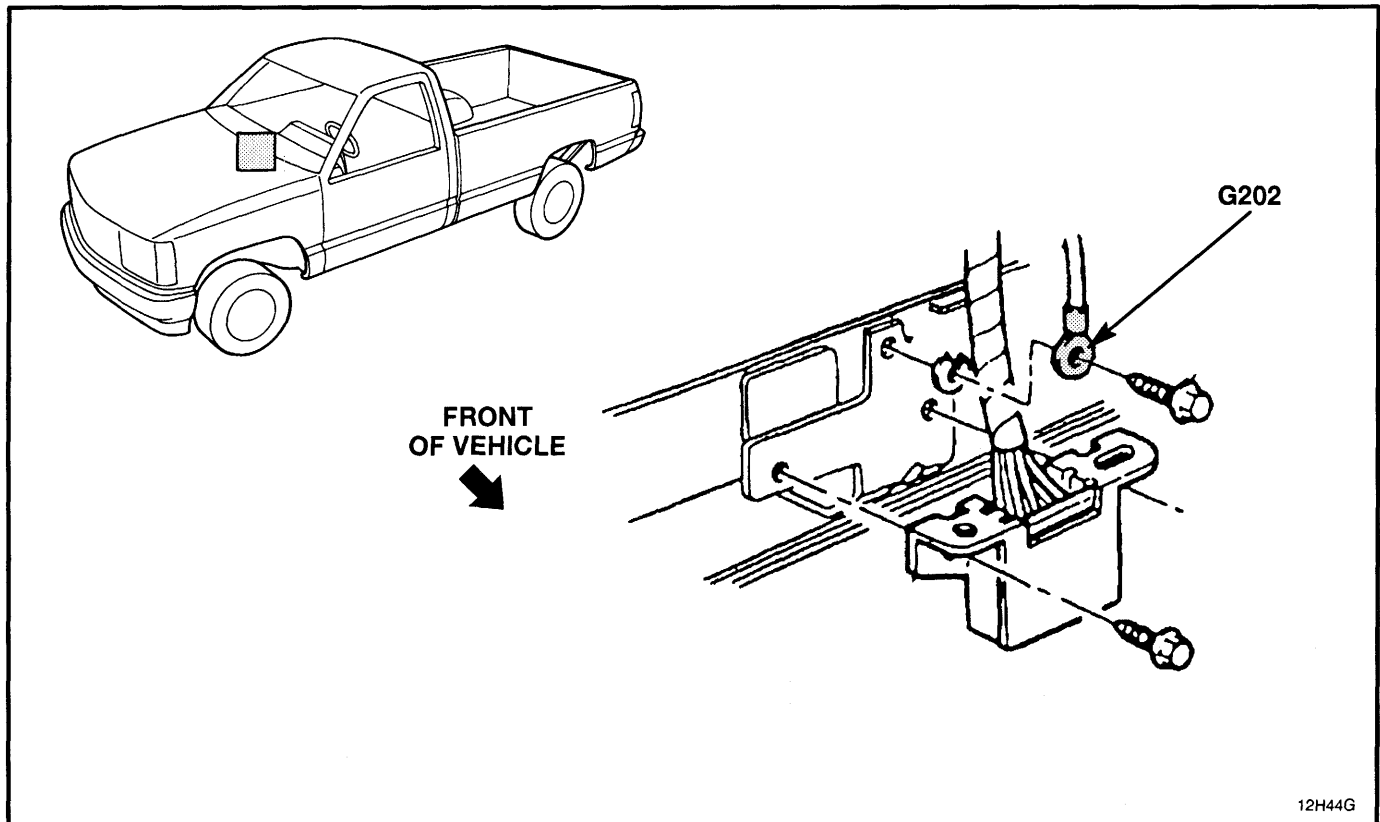


Figure 2 — I/P Ground

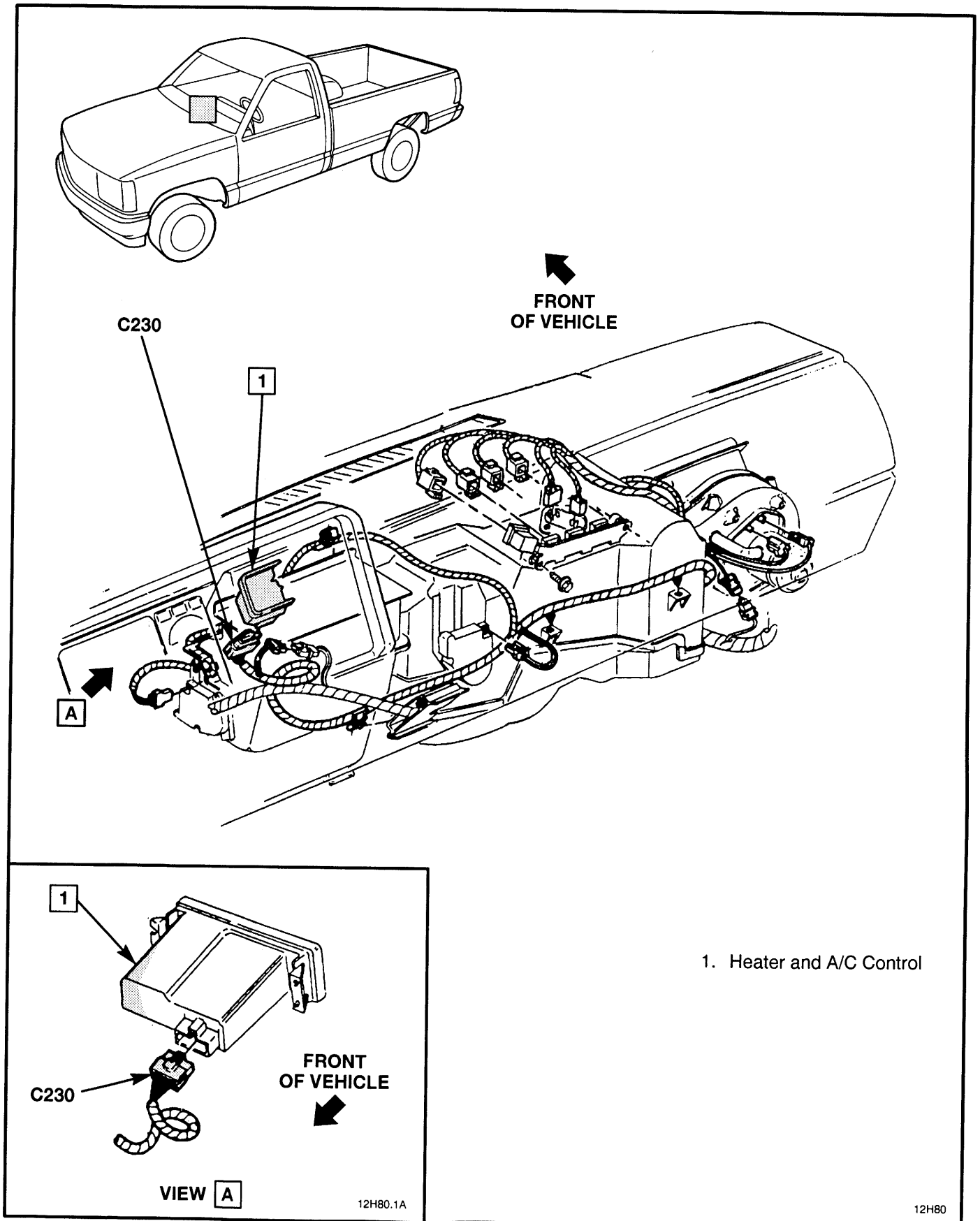


Figure 3 — Heater and A/C Harness Wiring



## 8A-117-8 INSTRUMENT PANEL DIMMING

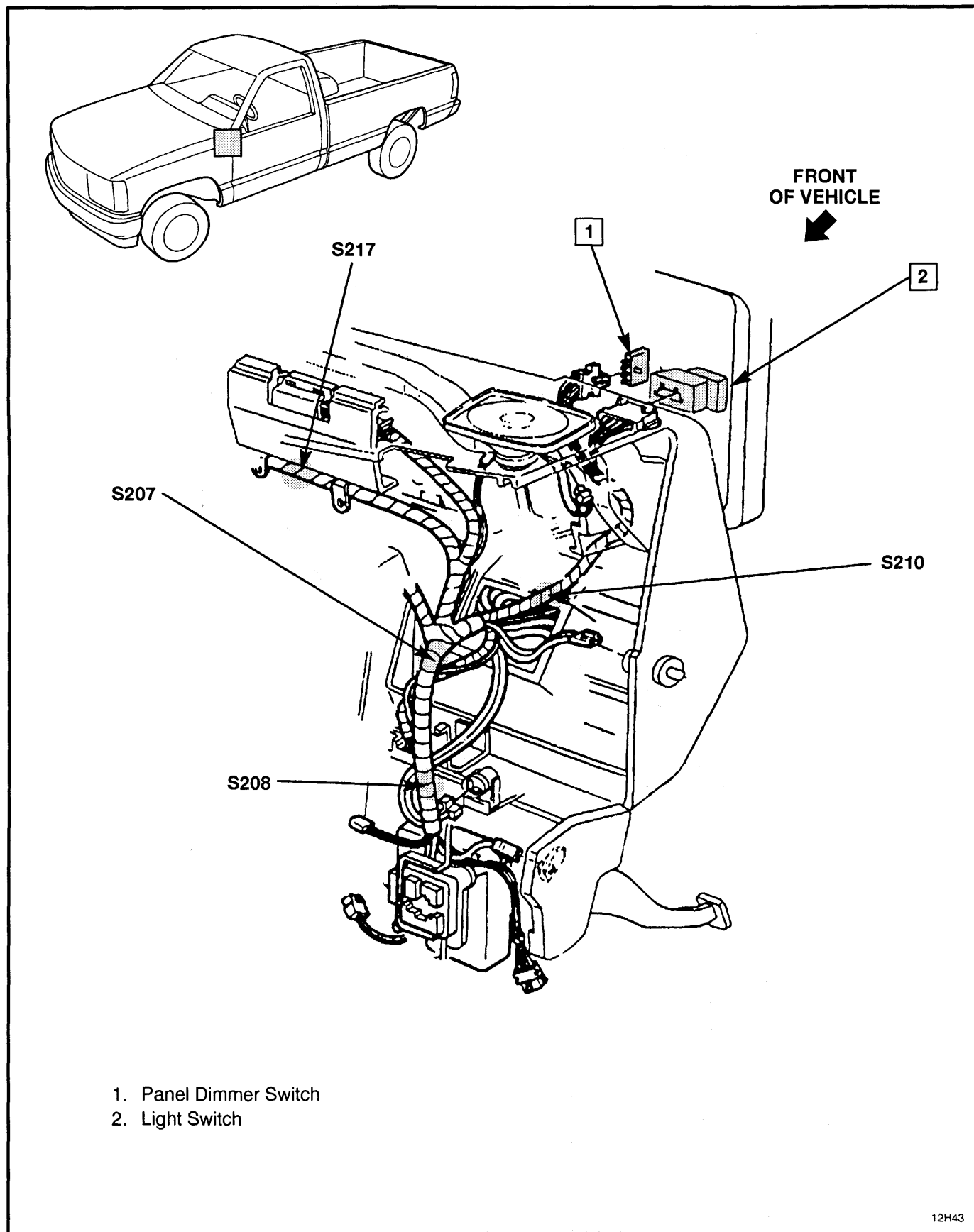


Figure 4 — LH Side of Instrument Panel

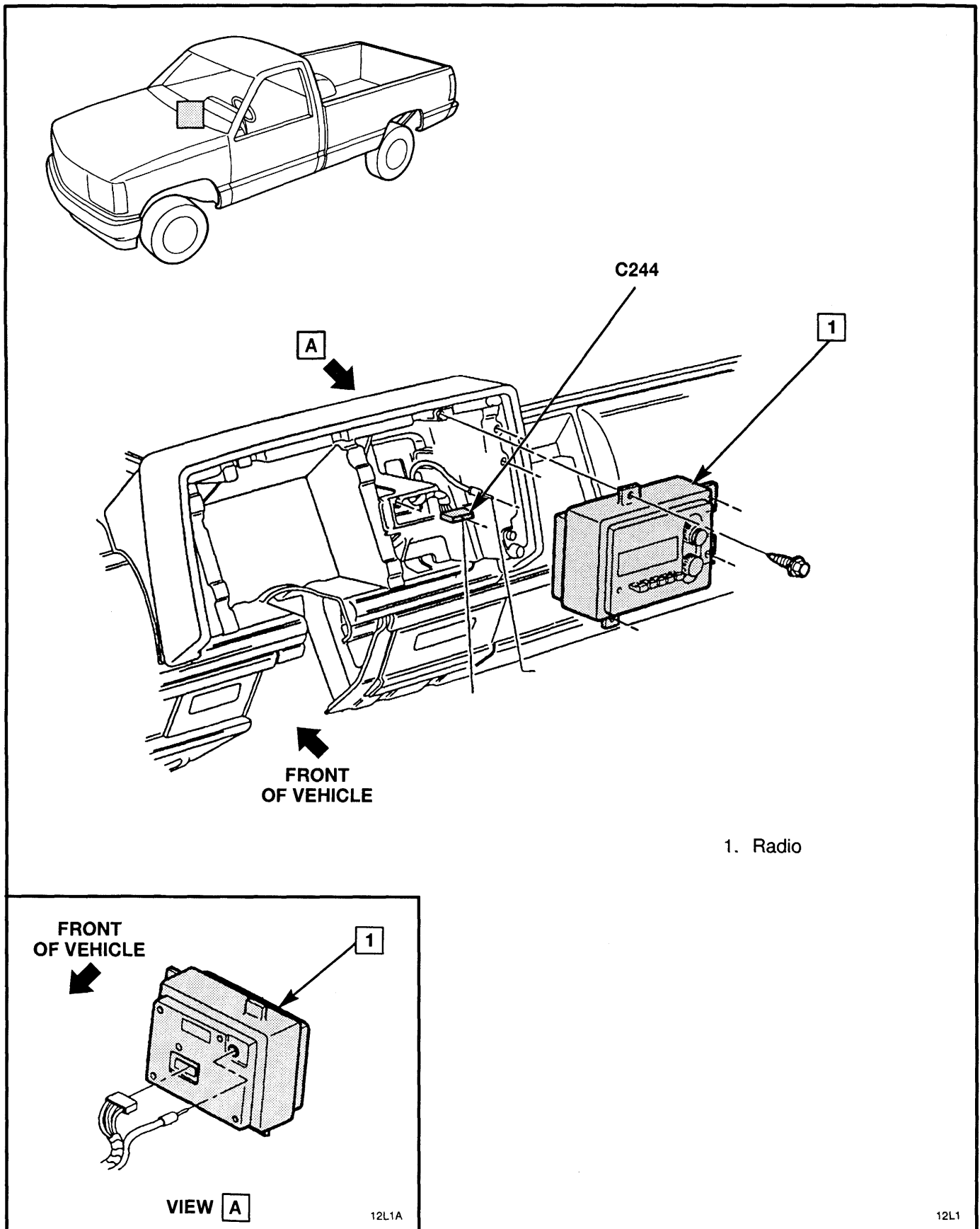
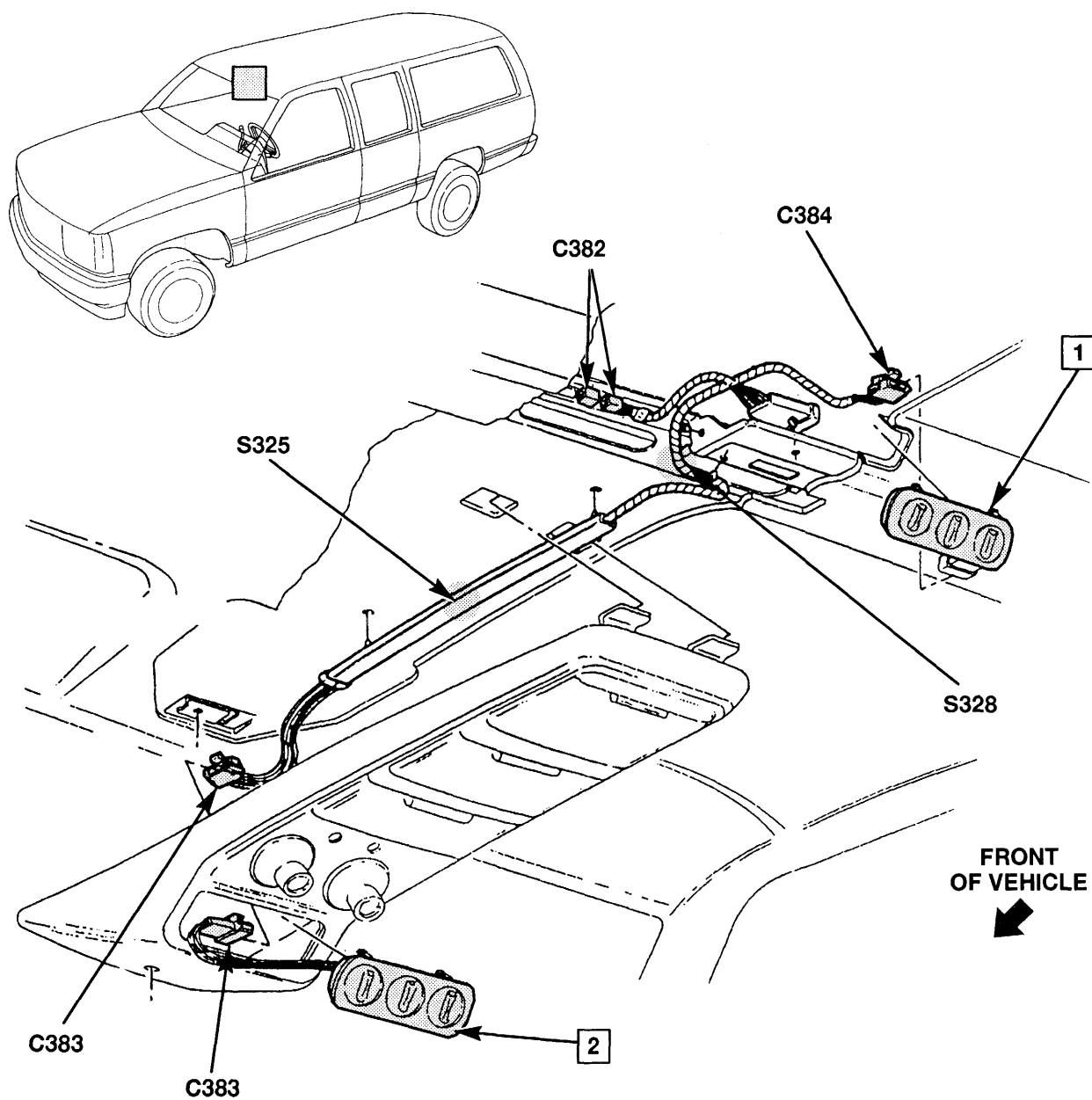


Figure 5 — Radio Wiring

## 8A-117-10 INSTRUMENT PANEL DIMMING



1. Auxiliary Heater and A/C Front Control
2. Auxiliary Heater and A/C Rear Control

Figure 6 — Auxiliary Heater and A/C Controls

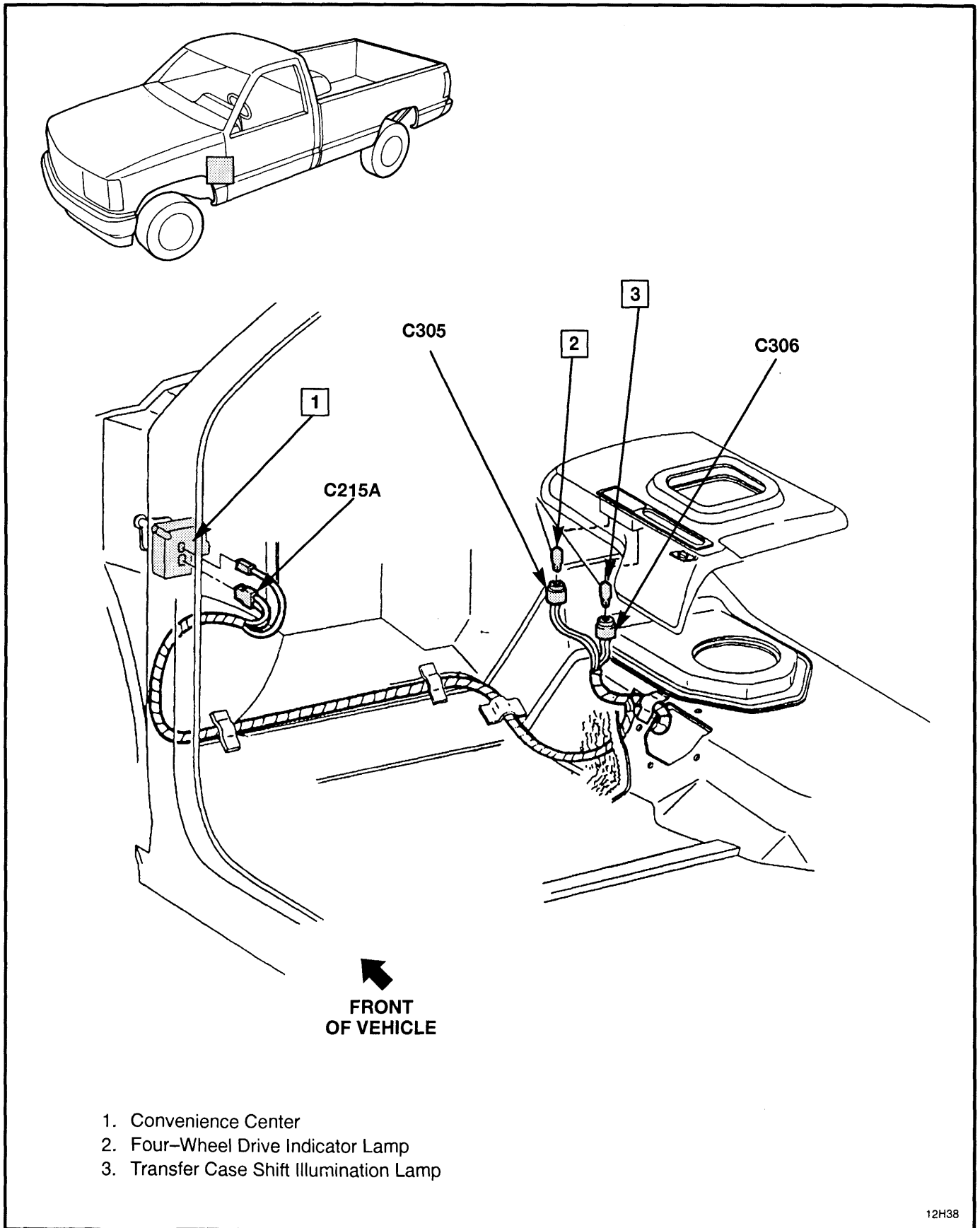


Figure 7 — Four-Wheel Drive Illumination Wiring

## 8A-117-12 INSTRUMENT PANEL DIMMING

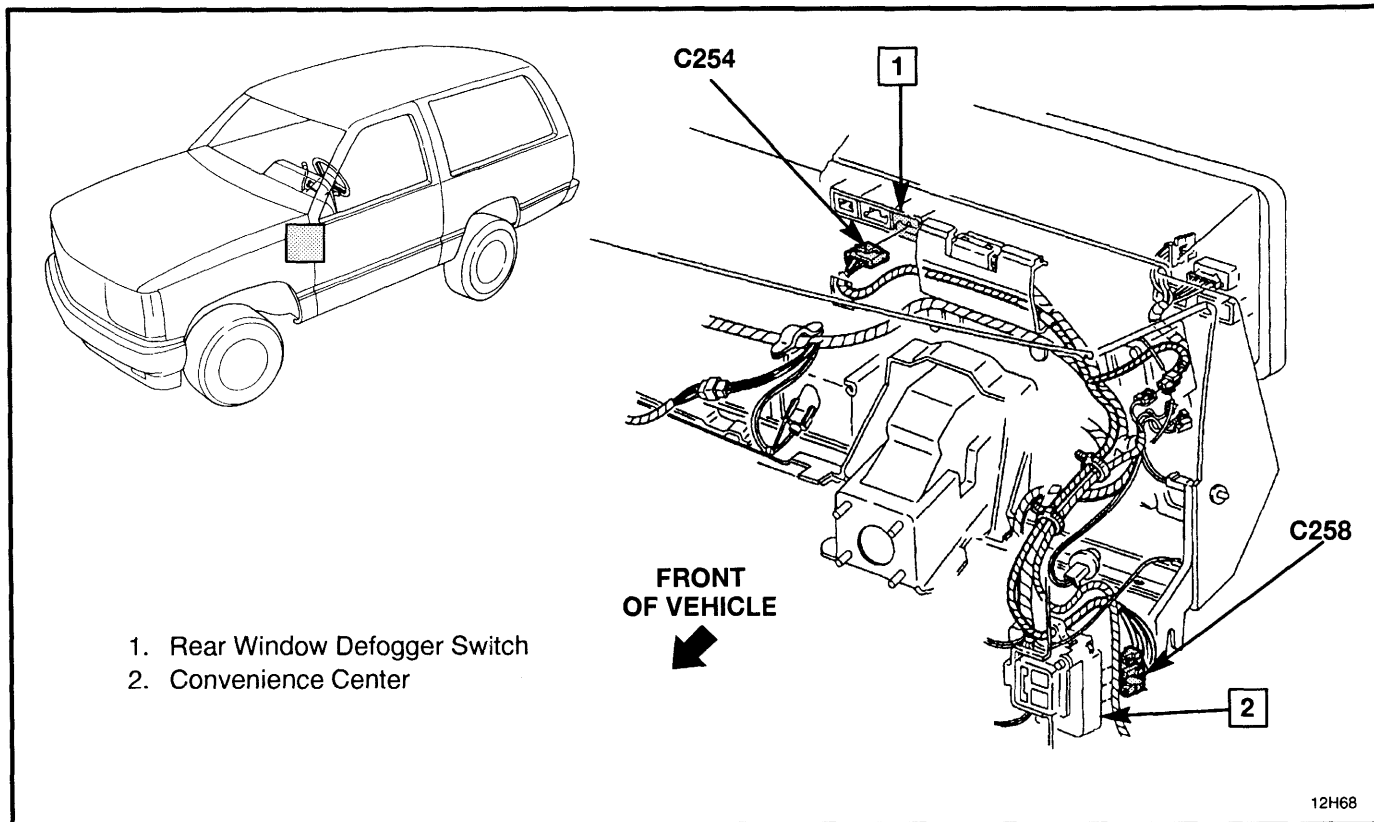


Figure 8 — Rear Window Defogger Front Wiring — Utility and Suburban Shown Extended and 4-Door Cabs Similar

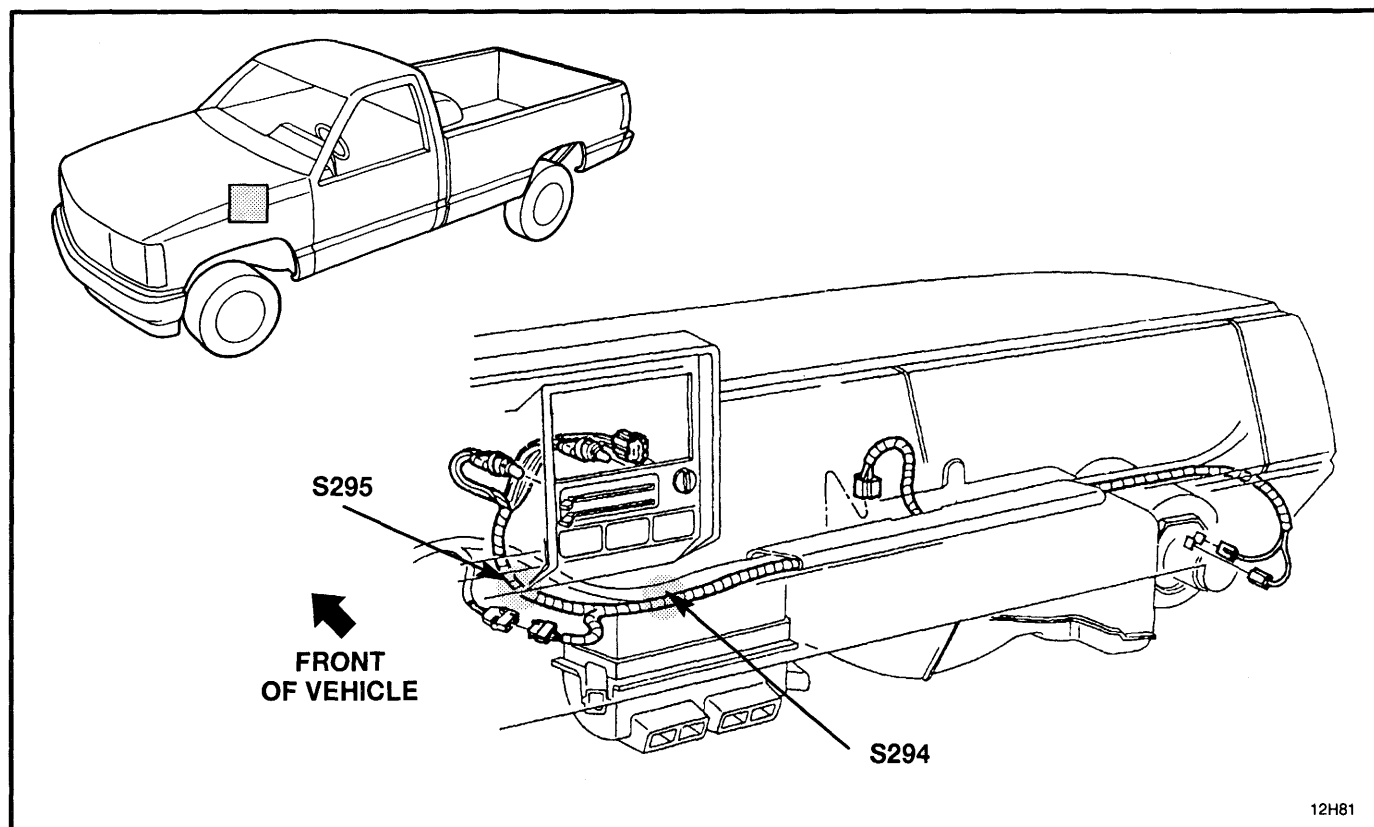


Figure 9 — Heater Wiring

## CIRCUIT OPERATION

### UNDERHOOD REEL LAMP

Voltage is supplied at all times to the Underhood Lamp from the Battery Junction Block through an in-line fuse. When the switch is closed a ground path is provided.

### COMPONENT LOCATION

#### Page — Figure

|                        |                                            |                 |   |
|------------------------|--------------------------------------------|-----------------|---|
| Battery Junction Block | ..... RH rear engine compartment, at cowl  | ..... 118-5     | 1 |
| In-Line Fuse Holder    | ..... On cowl, near battery junction block | ..... Not Shown |   |
| Underhood Reel Lamp    | ..... RH front side of engine compartment  | ..... 118-5     | 1 |

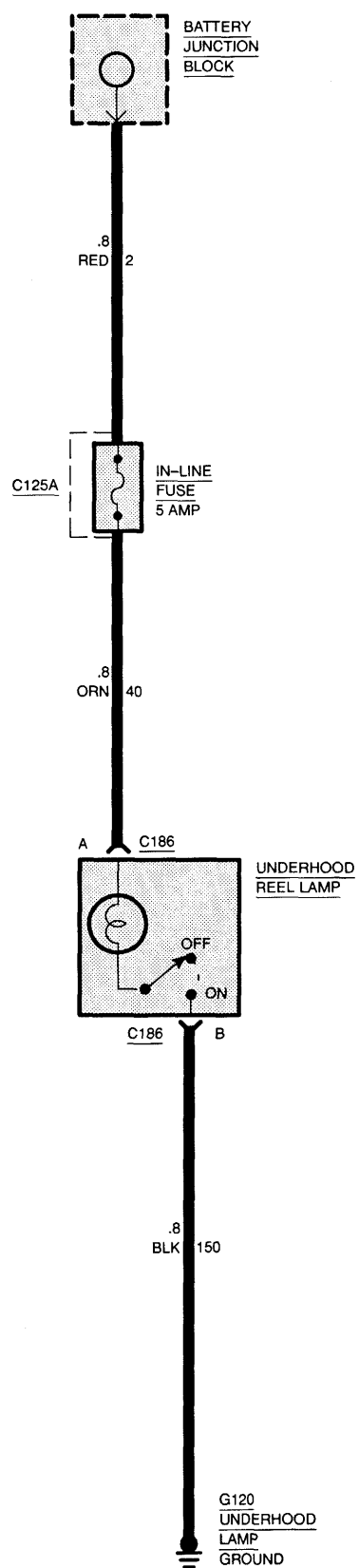
### CONNECTORS:

|       |                                           |                 |
|-------|-------------------------------------------|-----------------|
| C125A | ..... Behind battery junction block cover | ..... Not Shown |
|-------|-------------------------------------------|-----------------|

### GROUNDING:

|      |                         |                 |
|------|-------------------------|-----------------|
| G120 | ..... At underhood lamp | ..... Not Shown |
|------|-------------------------|-----------------|

## 8A-118-2 UNDERHOOD LAMP



## DIAGNOSIS — UNDERHOOD LAMP

### PRELIMINARY CHECKS:

1. Check condition of UNDERHOOD LAMP Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

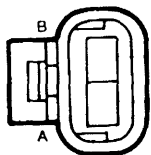
### UNDERHOOD REEL LAMP DOES NOT OPERATE

| TEST                                                                                          | RESULT                    | ACTION                                                                                              |
|-----------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------|
| 1. Connect a test lamp from ORN (40) wire to BLK (150) wire at underhood lamp connector C186. | Test lamp lights.         | REPLACE underhood lamp bulb.                                                                        |
|                                                                                               | Test lamp does not light. | GO to step 2.                                                                                       |
| 2. Connect a test lamp to RED (2) wire at in-line fuse connector C125A to ground.             | Test lamp lights.         | REPLACE in-line fuse.                                                                               |
|                                                                                               | Test lamp does not light. | LOCATE and REPAIR open in RED (2) wire from in-line fuse connector C125A to battery junction block. |



## 8A-118-4 UNDERHOOD LAMP

12078084



**BLACK**  
Metri-Pack 150  
**C186**  
Underhood Lamp

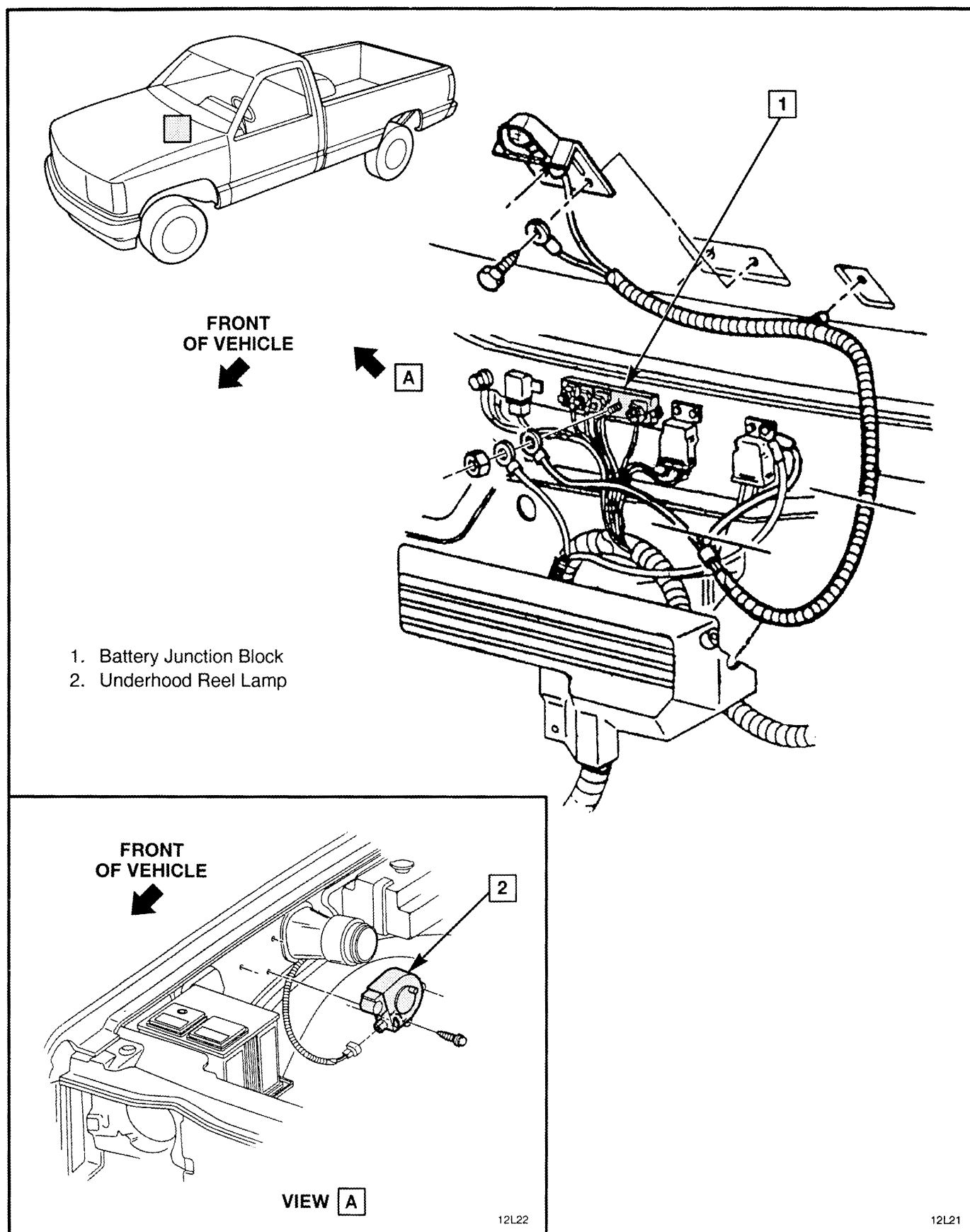


Figure 1 — Underhood Reel Lamp Wiring

**BLANK**

## COMPONENT LOCATION

## Page — Figure

|                                                  |                                           |           |   |
|--------------------------------------------------|-------------------------------------------|-----------|---|
| Backup Lamp Switch (Auto) .....                  | Top of lower steering column .....        | 119-8     | 6 |
| Backup Lamp Switch (Man) .....                   | LH top of transmission .....              | 119-6     | 3 |
| Battery Junction Block .....                     | RH upper cowl .....                       | 119-5     | 2 |
| Brake Switch .....                               | Top of brake pedal support .....          | Not Shown |   |
| Convenience Center .....                         | Under LH side of I/P .....                | 119-6     | 4 |
| Fuse Block .....                                 | Lower LH side of I/P .....                | 119-10    | 9 |
| Hazard Flasher .....                             | Under LH side of I/P .....                | 119-10    | 9 |
| Headlight Switch .....                           | Upper LH side of I/P .....                | 119-10    | 9 |
| High Mount Stoplamp Relay<br>(Pickup Only) ..... | LH side of cowl, near brake booster ..... | Not Shown |   |
| In-Line Fuse .....                               | Near Battery Junction Block .....         | Not Shown |   |
| Turn Signal Switch .....                         | Part of multi-function switch .....       | 119-7     | 5 |

## CONNECTORS:

|             |                                               |       |   |
|-------------|-----------------------------------------------|-------|---|
| C100 .....  | At bulkhead connector .....                   | 119-5 | 1 |
| C101 .....  | At bulkhead connector .....                   | 119-5 | 1 |
| C200 .....  | Under RH side of I/P, near blower motor ..... | 119-8 | 7 |
| C206 .....  | Lower LH side of steering column .....        | 119-7 | 5 |
| C400 .....  | At rear of LH frame rail .....                | 119-9 | 8 |
| C400A ..... | At rear of LH frame rail .....                | 119-9 | 8 |
| C400B ..... | At rear of LH frame rail .....                | 119-9 | 8 |

## GROMMETS:

|            |                     |       |   |
|------------|---------------------|-------|---|
| P101 ..... | Lower RH cowl ..... | 119-8 | 7 |
|------------|---------------------|-------|---|

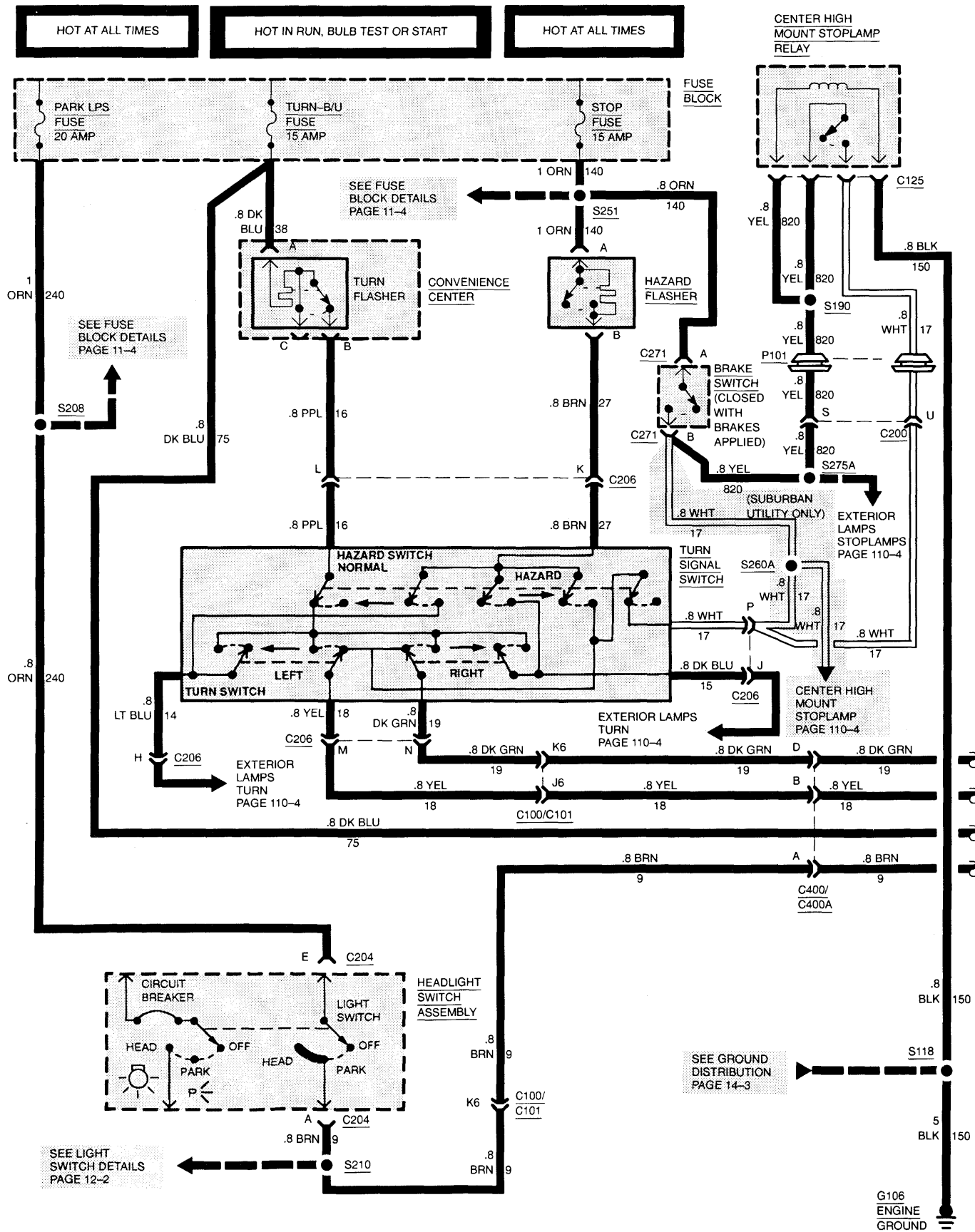
## GROUNDS:

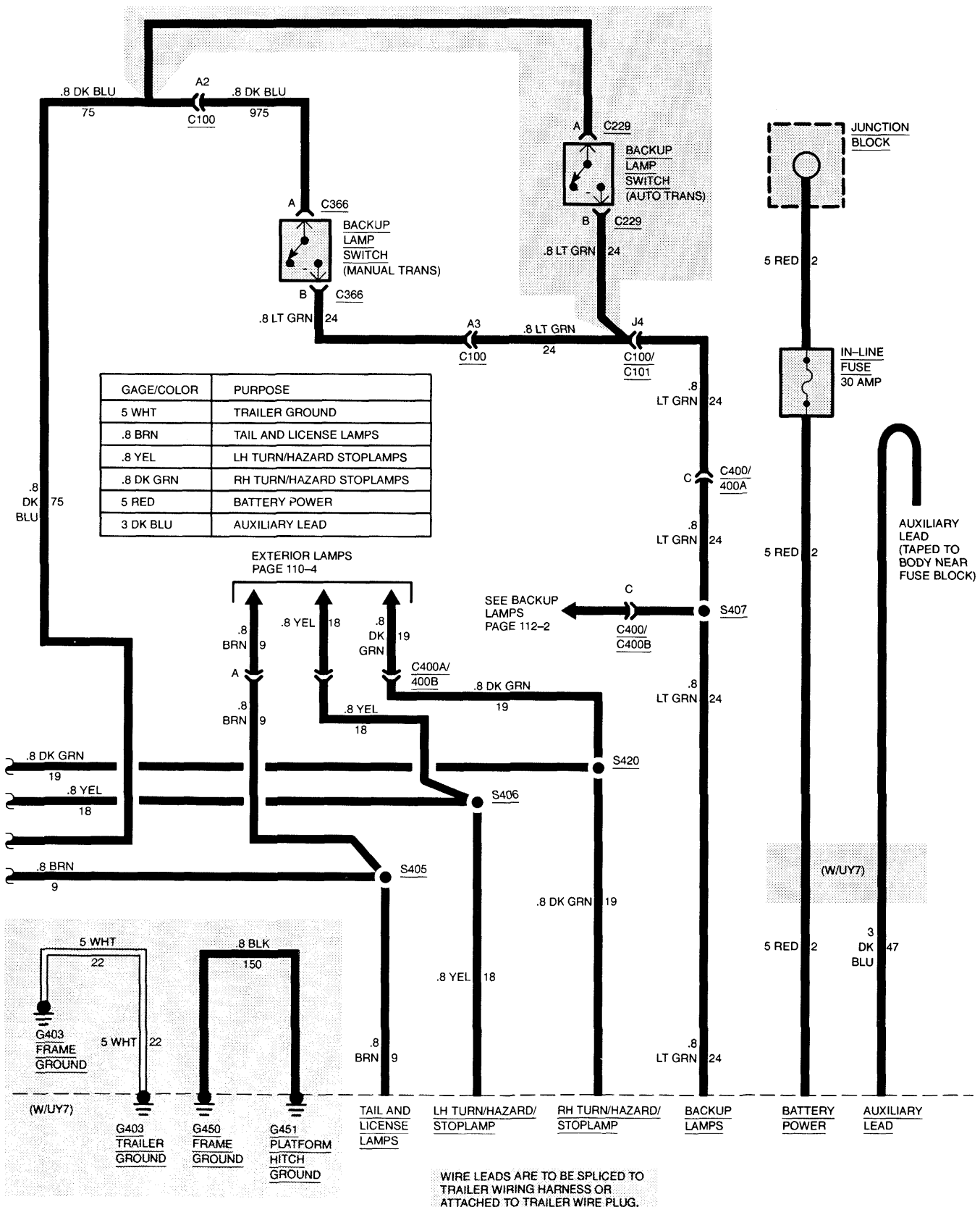
|                   |                                       |           |   |
|-------------------|---------------------------------------|-----------|---|
| G106 (5.0L) ..... | Rear of RH cylinder head .....        | Not Shown |   |
| G106 (5.7L) ..... | Rear of RH cylinder head .....        | Not Shown |   |
| G106 (7.4L) ..... | Rear of RH cylinder head .....        | Not Shown |   |
| G106 (4.5L) ..... | Rear of RH cylinder head .....        | Not Shown |   |
| G403 .....        | At rear of LH frame rail .....        | 119-9     | 8 |
| G450 .....        | At rear of LH frame rail .....        | Not Shown |   |
| G451 .....        | At LH support of platform hitch ..... | Not Shown |   |

## SPLICES:

|                   |                                             |           |    |
|-------------------|---------------------------------------------|-----------|----|
| S118 (4.3L) ..... | Rear of RH cylinder head .....              | 119-5     | 1  |
| S190 .....        | Near center high mount stoplamp relay ..... | Not Shown |    |
| S208 .....        | Behind LH side of I/P .....                 | 119-10    | 9  |
| S210 .....        | Under LH side of I/P .....                  | 119-10    | 9  |
| S251 .....        | Under LH side of I/P .....                  | 119-10    | 9  |
| S275A .....       | Near center high mount stoplamp relay ..... | Not Shown |    |
| S405 .....        | In trailer harness, rear crossmember .....  | 119-11    | 10 |
| S406 .....        | In trailer harness, rear crossmember .....  | 119-9     | 8  |
| S407 .....        | In trailer harness, rear crossmember .....  | 119-9     | 8  |
| S420 .....        | In trailer harness, rear crossmember .....  | 119-9     | 8  |

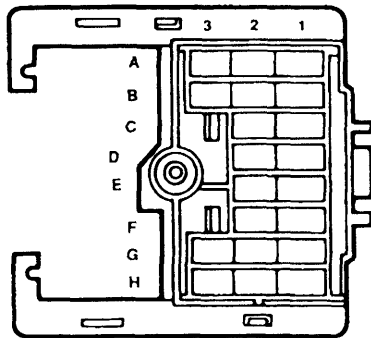
## 8A-119-2 TRAILER TOW





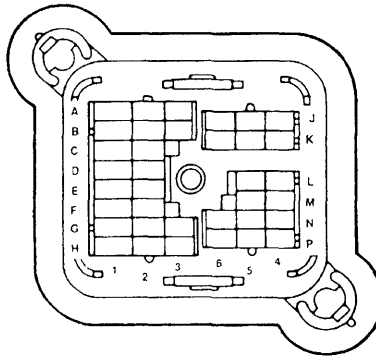
# 8A-119-4 TRAILER TOW

12020183



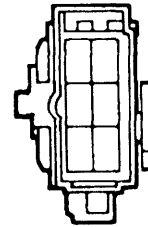
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



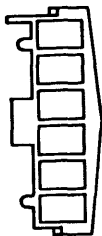
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12020099



**C101**  
Bulkhead – Rear Lamps

12040551



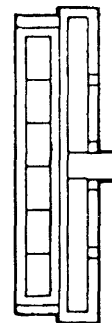
**BLACK**  
Metri-Pack 480  
**C271**  
Brake Switch

02973385



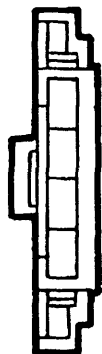
**BLACK**  
56 Series  
**C207**  
Hazard Flasher

12034061



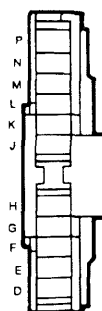
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

12034060



**NATURAL**  
Metri-Pack 480  
**C203**  
Panel Dimmer Switch

12004147



**BLACK**  
Pac/on  
**C206**  
I/P to Multi-Function Switch

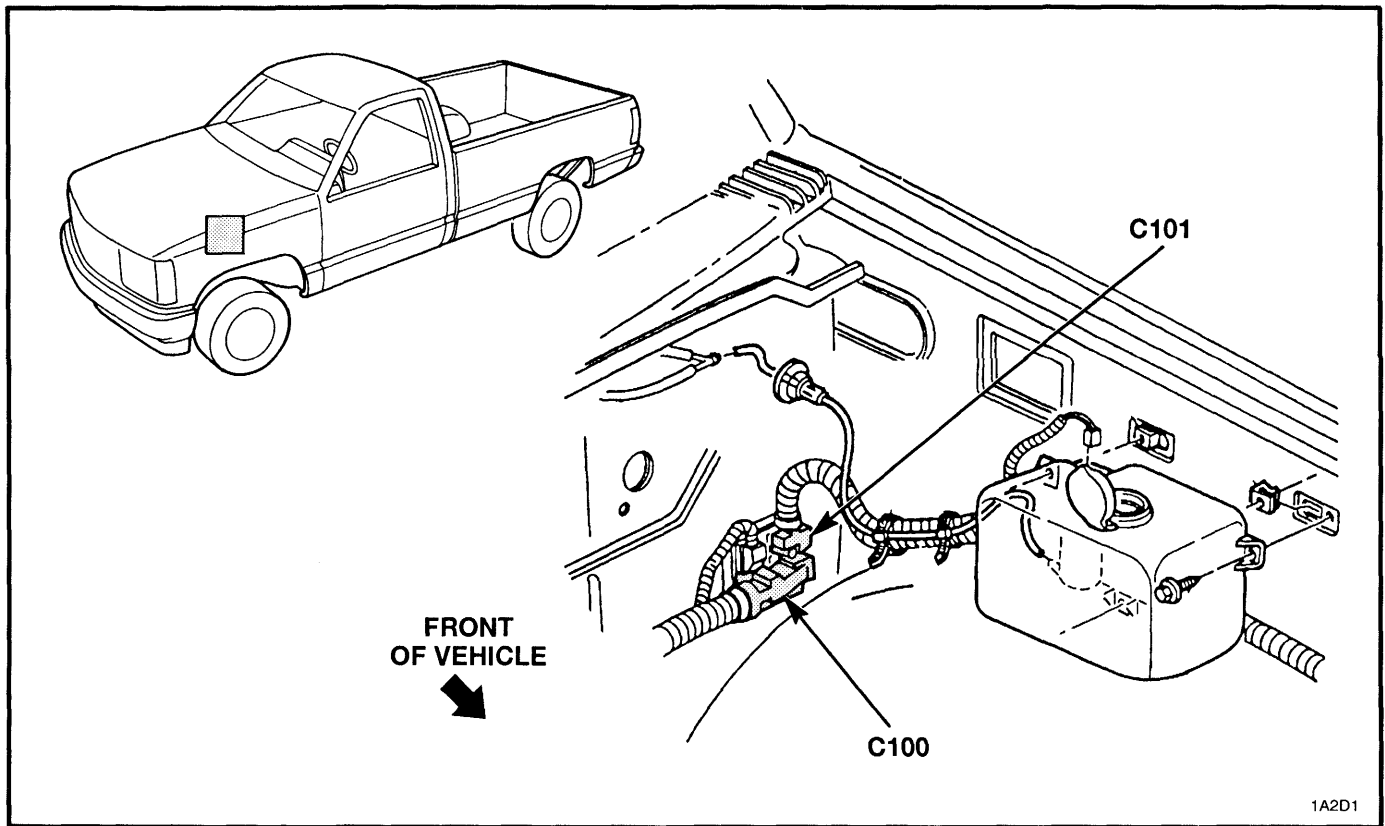


Figure 1 — LH Front Fender Wiring

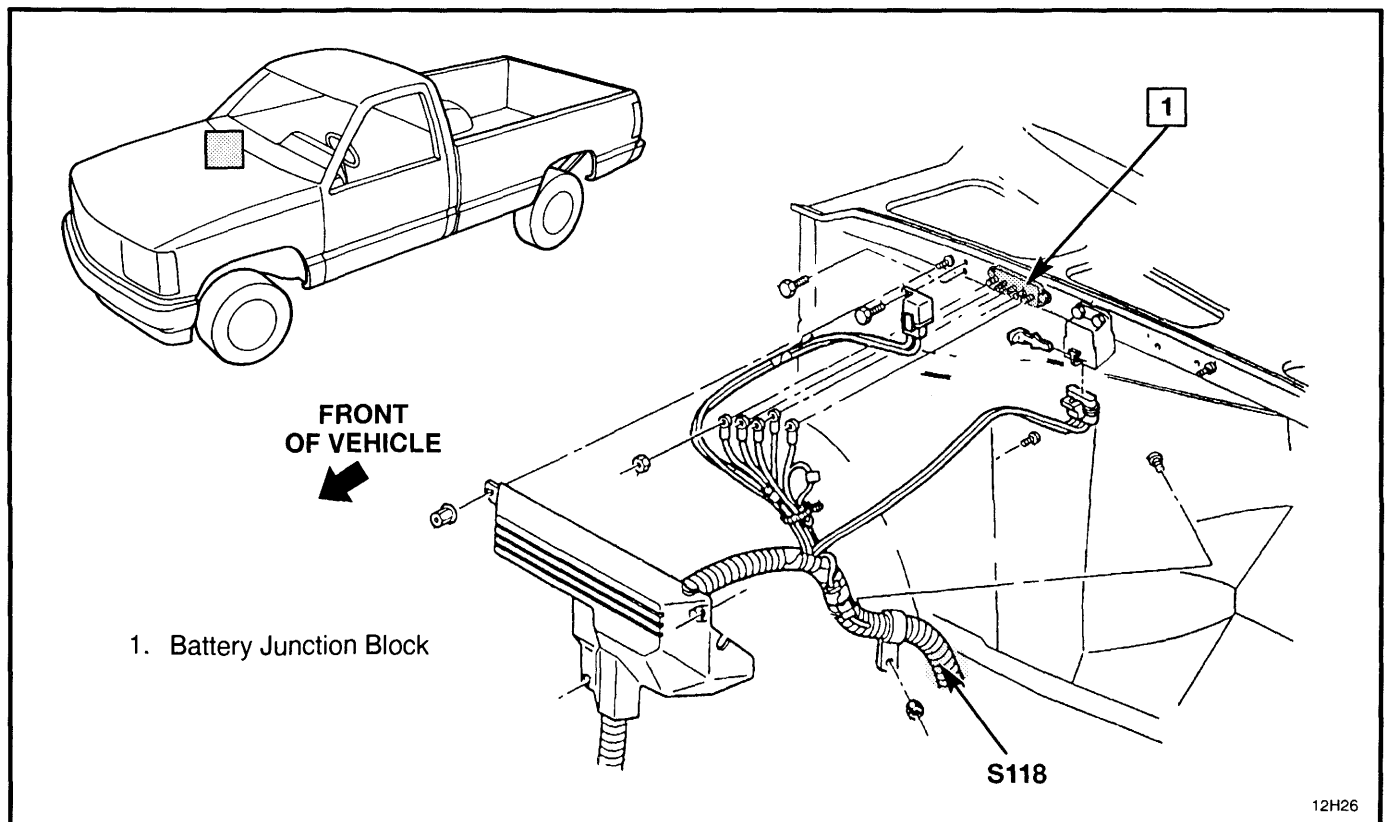


Figure 2 — Battery Junction Block and Relay Wiring



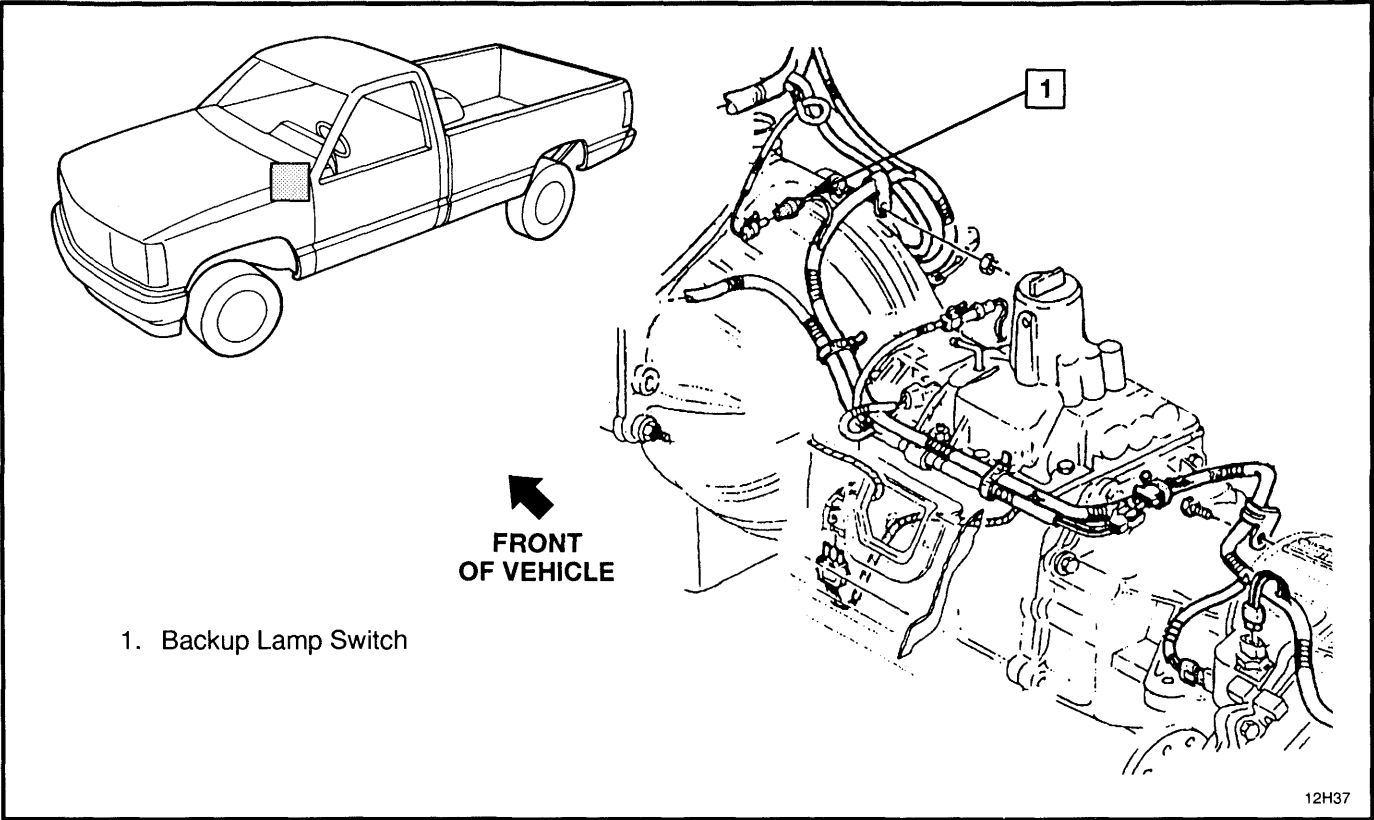


Figure 3 — Backup Lamp Switch Wiring

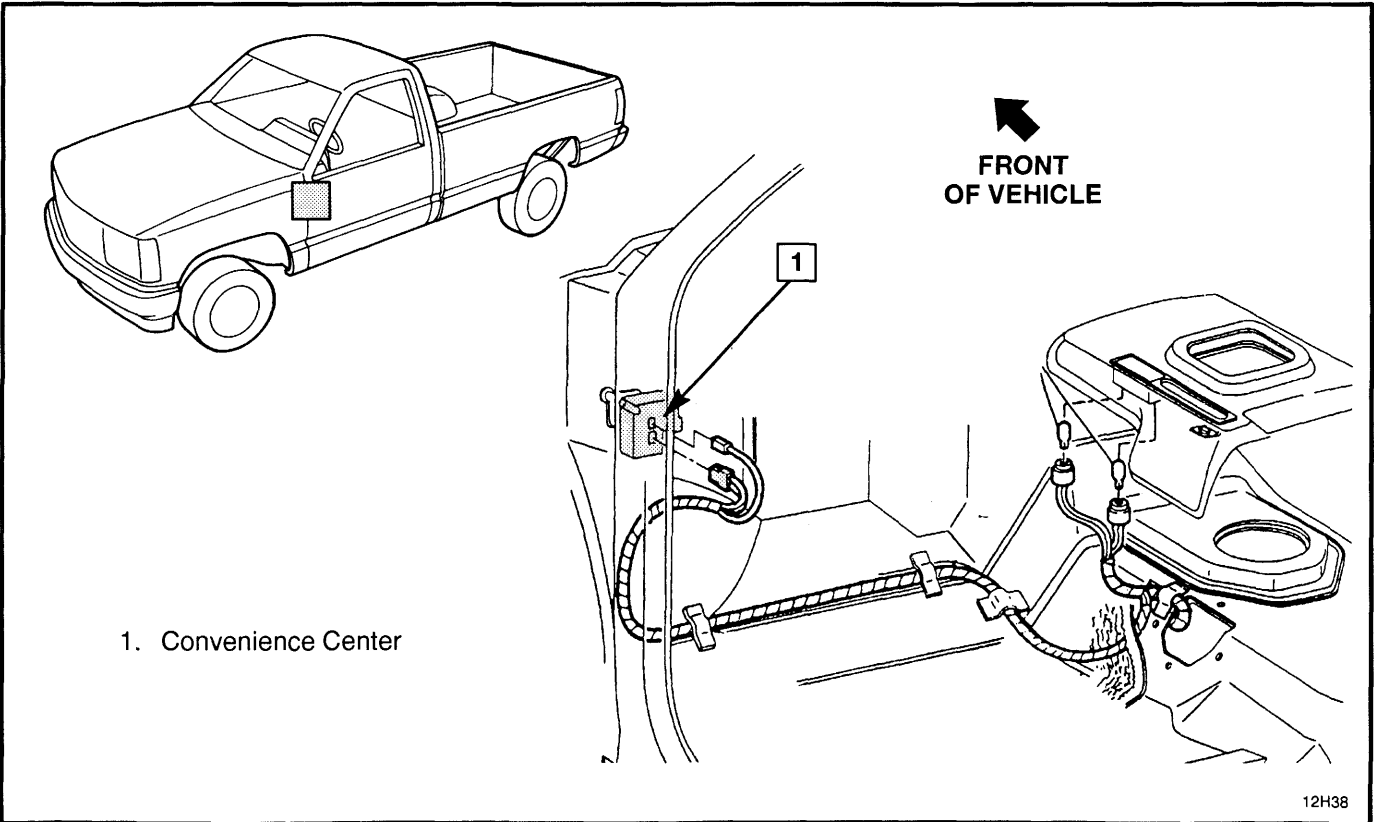


Figure 4 — LH I/P Wiring

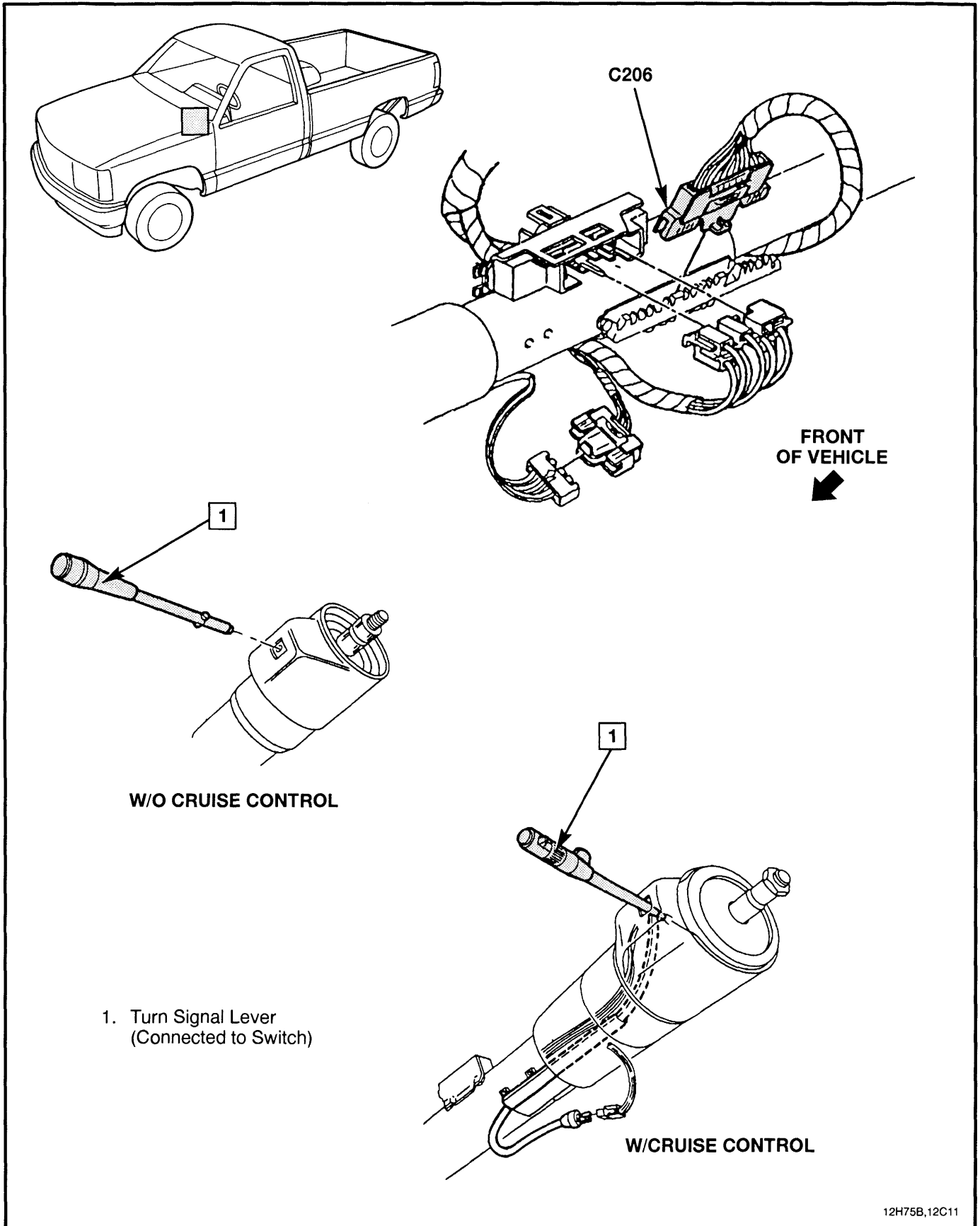


Figure 5 — RH Side of Steering Column Wiring

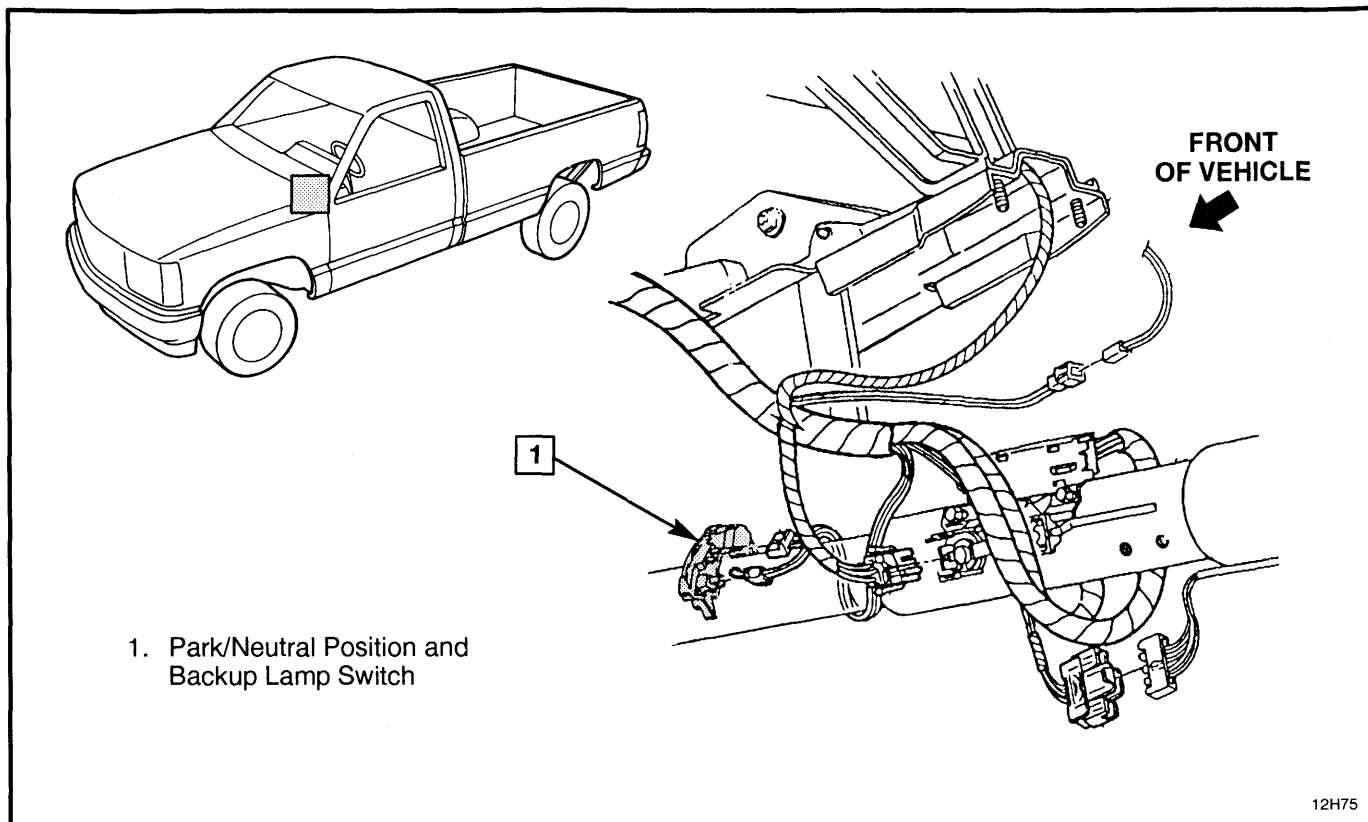


Figure 6 — LH Side of Steering Column Wiring

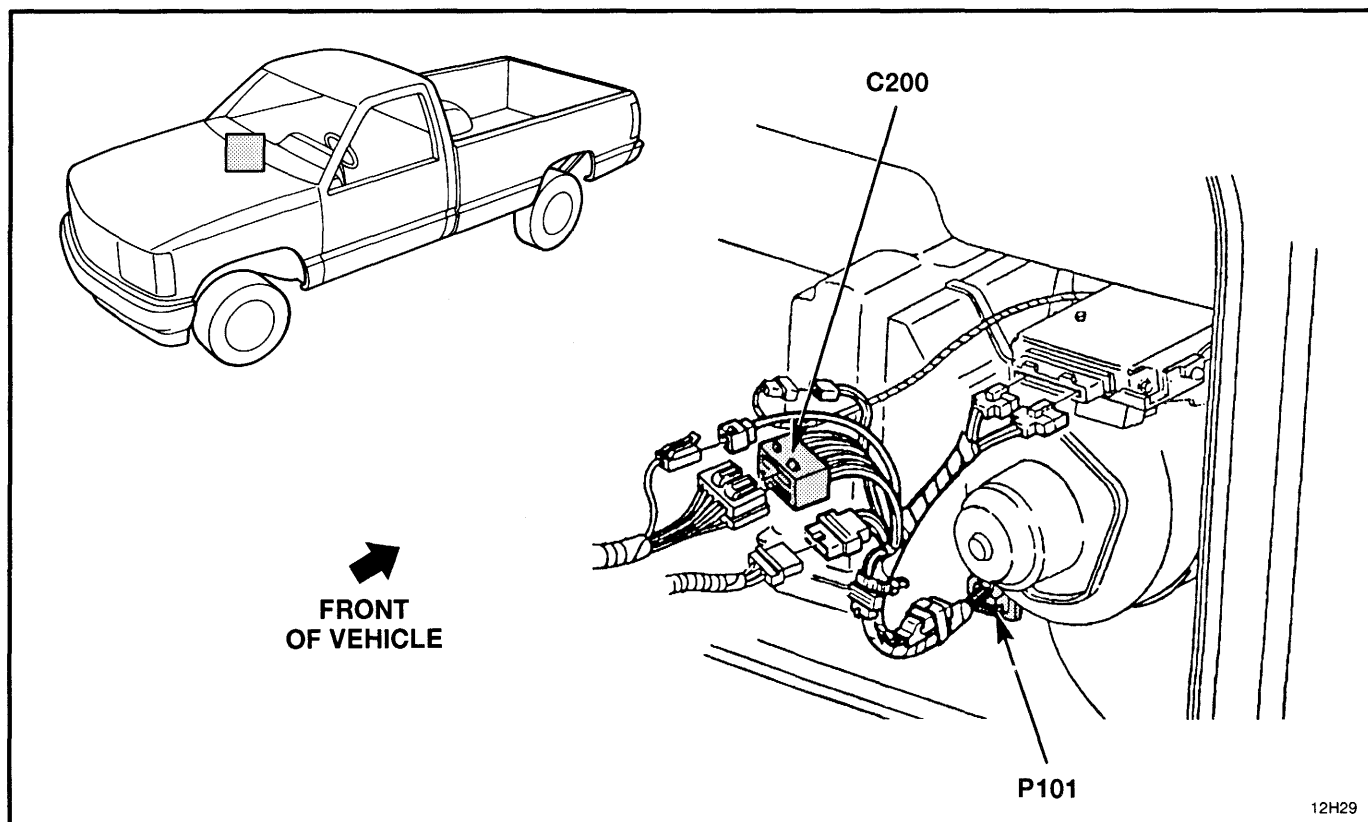


Figure 7 — Behind RH Side of I/P

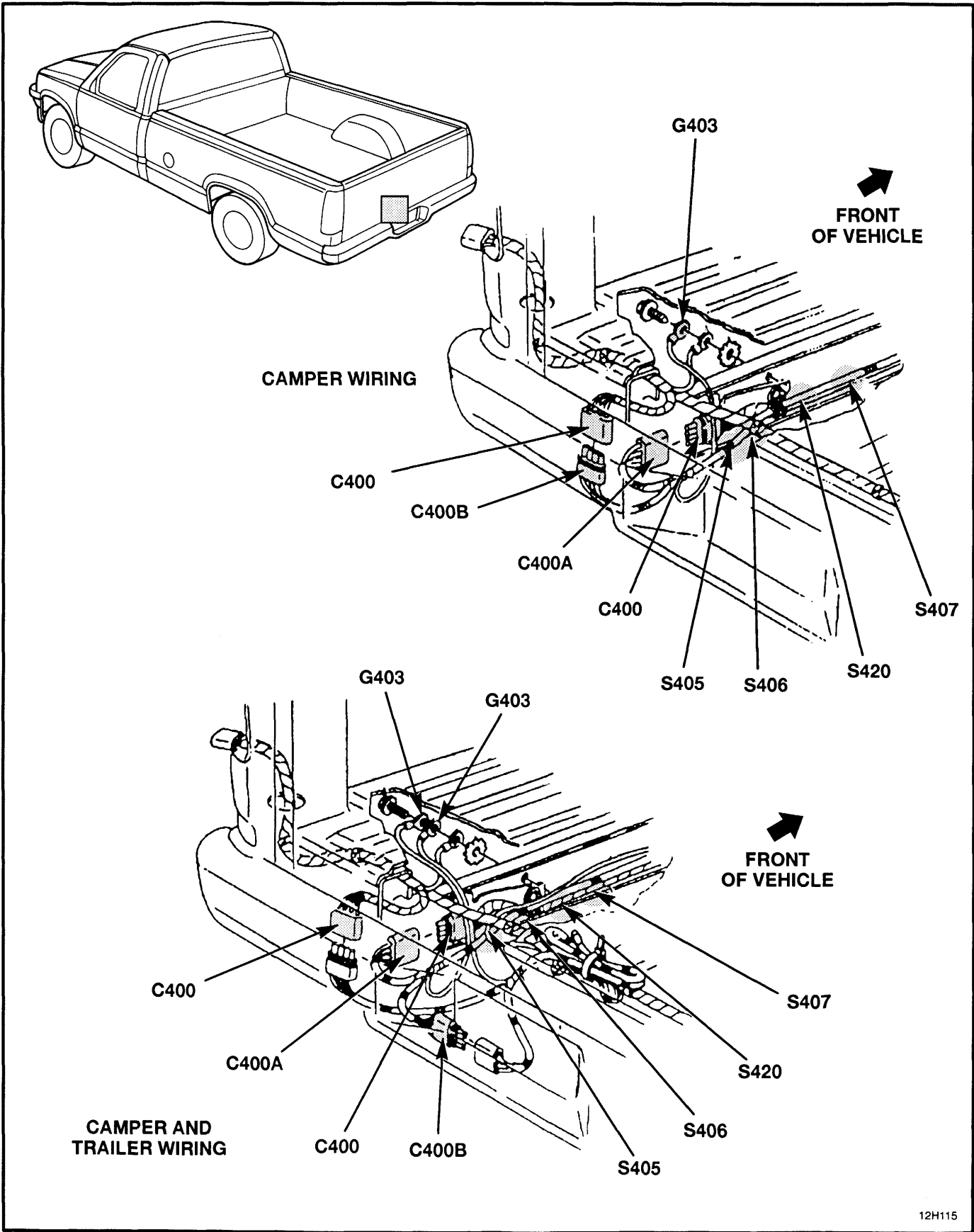


Figure 8 — Heavy Duty Trailer and Camper Rear Lamp Wiring, 2 Door Pickup

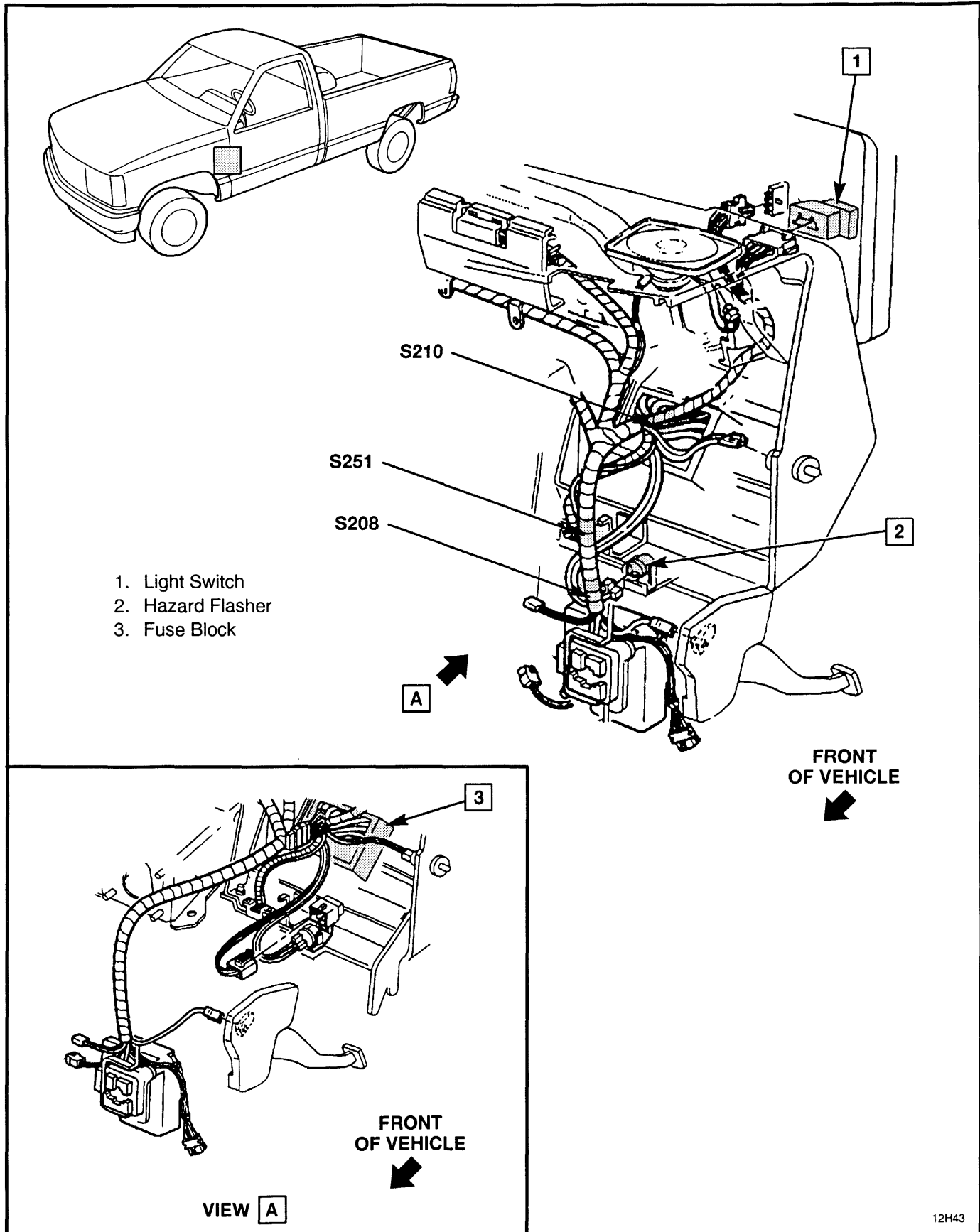


Figure 9 — LH Side of Instrument Panel

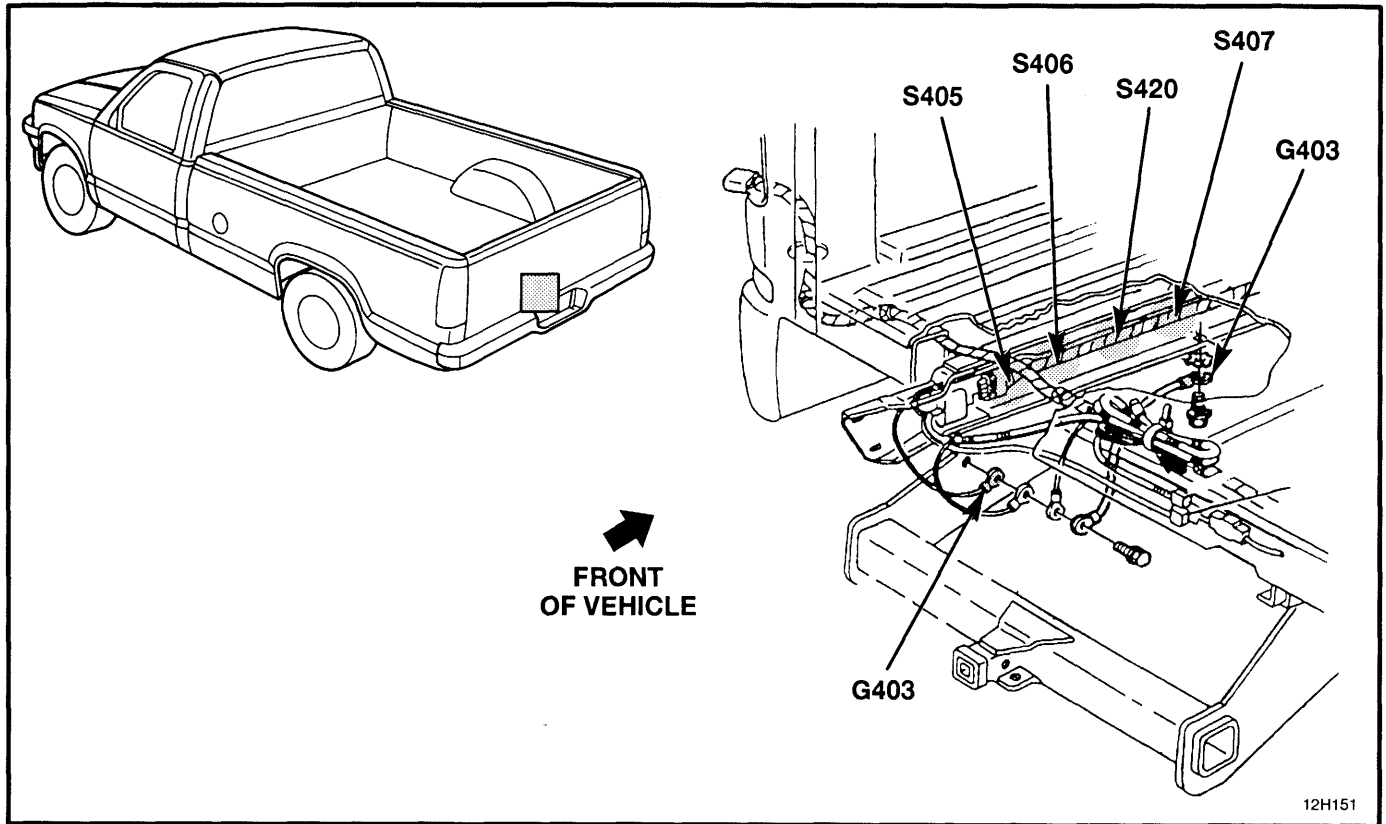


Figure 10 — Trailer Wiring W/Platform Hitch, 2 Door and Extended Cab Pickup

**BLANK**

## **CIRCUIT OPERATION**

### **CREW CAB, SUBURBAN, UTILITY**

A permanent magnet (PM) motor operates each of the Power Windows. Each Motor raises or lowers the window when the voltage is supplied to it. The direction the Motor turns depends on the polarity of the supply voltage. The Switches control the supply voltage. The Switches control the supply voltage polarity.

The Master Door Lock/Power Window Switch Assembly controls all of the Windows Motors. Each window also has its own control switch.

Each Motor is protected by a built-in circuit breaker. If a Window Switch is held too long with the window obstructed or after the window is fully up or down, the circuit breaker opens the circuit. The circuit breaker resets automatically.

When the Ignition Switch is in RUN or ACC, battery voltage is supplied to the Master Door Lock/Power Window Switch Assembly, the ACC-IGN Circuit Breaker and the PNK (76) wires.

When any of the UP Switches are operated, battery voltage is supplied to the Window Motor through the DK BLU/WHT (166) wire. The Window Motor is grounded through the DN contact. The Motor runs to drive the window up. When any of the DN Switches are operated, battery voltage is supplied to the Window Motor in the opposite direction through the BRN (165) wire. The Window Motor is grounded through the UP contact. The Motor runs to drive the window down.

### **2-DOOR AND EXTENDED CAB PICKUP**

A permanent magnet (PM) motor operates each of the Power Windows. Each Motor raises or lowers the glass when the voltage is supplied to it. The direction the Motor turns depends on the polarity of the supply voltage. The Switches control the supply voltage. The Switches control the supply voltage polarity.

The Master Door Lock/Power Window Switch Assembly controls both of the Motors. The RH Window Switch controls only the RH Window Motor.

Each Motor is protected by a built-in circuit breaker. If a Window Switch is held too long with the window obstructed or after the window is fully up or down, the circuit breaker opens the circuit. The circuit breaker resets automatically as it cools.

When the Ignition Switch is in RUN, or ACC, battery voltage is applied to the Master Door Lock/Power Window Switch Assembly, the ACC IGN Circuit Breaker and the PNK (76) wires. When any of the UP Switches are operated, battery voltage is supplied to the Window Motor through the DK BLU (164) wire. The Window Motor is grounded through the DN contact. The Motor runs to drive the window up. When any of the DN Switches are operated, battery voltage is supplied to the Window Motor in the opposite direction through the BRN (165) wire. The Window Motor is grounded through the UP contact. The Motor runs to drive the window down.

## **WINDOW SWITCH OPERATION**

When the Ignition Switch is in RUN or ACC, battery voltage is supplied to the Window Switch through the ACC-IGN Circuit Breaker and the PNK (76) wires. When the UP Switch in the Window Switch is operated, battery voltage is supplied to the Window Motor through the DK BLU/WHT (166) wire. The Motor is grounded through the BRN (165) wire, the DN contact in the Window Switch, the TAN (167) wire and the DN contact in the Master Door Lock/Power Window Switch Assembly. The Motor runs to drive the window up. When the DN switch in the Window Switch is operated, battery voltage is supplied to the Window Motor in the opposite direction through the BRN (165) wire. The Motor is grounded through the DK BLU (164) wire, the UP contact in the Window Switch, the DK BLU/WHT (166) wire and the UP contact in the Master Door Lock/Power Window Switch Assembly. The Motor runs to drive the window down.

## **FRONT DOOR WINDOW SWITCH LAMPS (EXCEPT PICK-UP)**

The front door power window switches have illumination lamps built into the switches. When the ignition switch is in ACC or RUN, battery voltage is supplied to the front door window switches through the GAGES fuse, PNK/BLK (39) and GRA (8) circuits.



## 8A-120-2 POWER WINDOWS

### COMPONENT LOCATION

### Page — Figure

|                               |                               |           |   |
|-------------------------------|-------------------------------|-----------|---|
| Convenience Center .....      | Under LH side of I/P .....    | 120-18    | 3 |
| Window Motor, LH Front .....  | Inside LH front door .....    | Not Shown |   |
| Window Motor, RH Front .....  | Inside RH front door .....    | Not Shown |   |
| Window Motor, LH Rear .....   | Inside LH rear door .....     | 120-20    | 5 |
| Window Motor, RH Rear .....   | Inside RH rear door .....     | 120-20    | 5 |
| Window Switch, Master .....   | On LH trim panel .....        | 120-19    | 4 |
| Window Switch, RH Front ..... | On RH trim panel .....        | Not Shown |   |
| Window Switch, LH Rear .....  | On rear door trim panel ..... | 120-20    | 5 |
| Window Switch, RH Rear .....  | On rear door trim panel ..... | 120-20    | 5 |

### CONNECTORS:

|                            |                             |        |   |
|----------------------------|-----------------------------|--------|---|
| C240 .....                 | At convenience center ..... | 120-18 | 3 |
| C247 .....                 | At convenience center ..... | 120-18 | 3 |
| C257 .....                 | At convenience center ..... | 120-18 | 3 |
| C325 (2-Door Pickup) ..... | LH body hinge pillar .....  | 120-18 | 3 |
| C326 .....                 | LH body hinge pillar .....  | 120-18 | 3 |
| C328 .....                 | RH body hinge pillar .....  | 120-18 | 3 |
| C330 .....                 | RH body hinge pillar .....  | 120-18 | 3 |
| C331 (2-Door Pickup) ..... | RH body hinge pillar .....  | 120-18 | 3 |
| C332 .....                 | LH body hinge pillar .....  | 120-18 | 3 |
| C341 .....                 | At LH center pillar .....   | 120-20 | 5 |
| C342 .....                 | At RH center pillar .....   | 120-20 | 5 |

### GROUND:

|            |                        |        |   |
|------------|------------------------|--------|---|
| G202 ..... | At DLC connector ..... | 120-17 | 2 |
|------------|------------------------|--------|---|

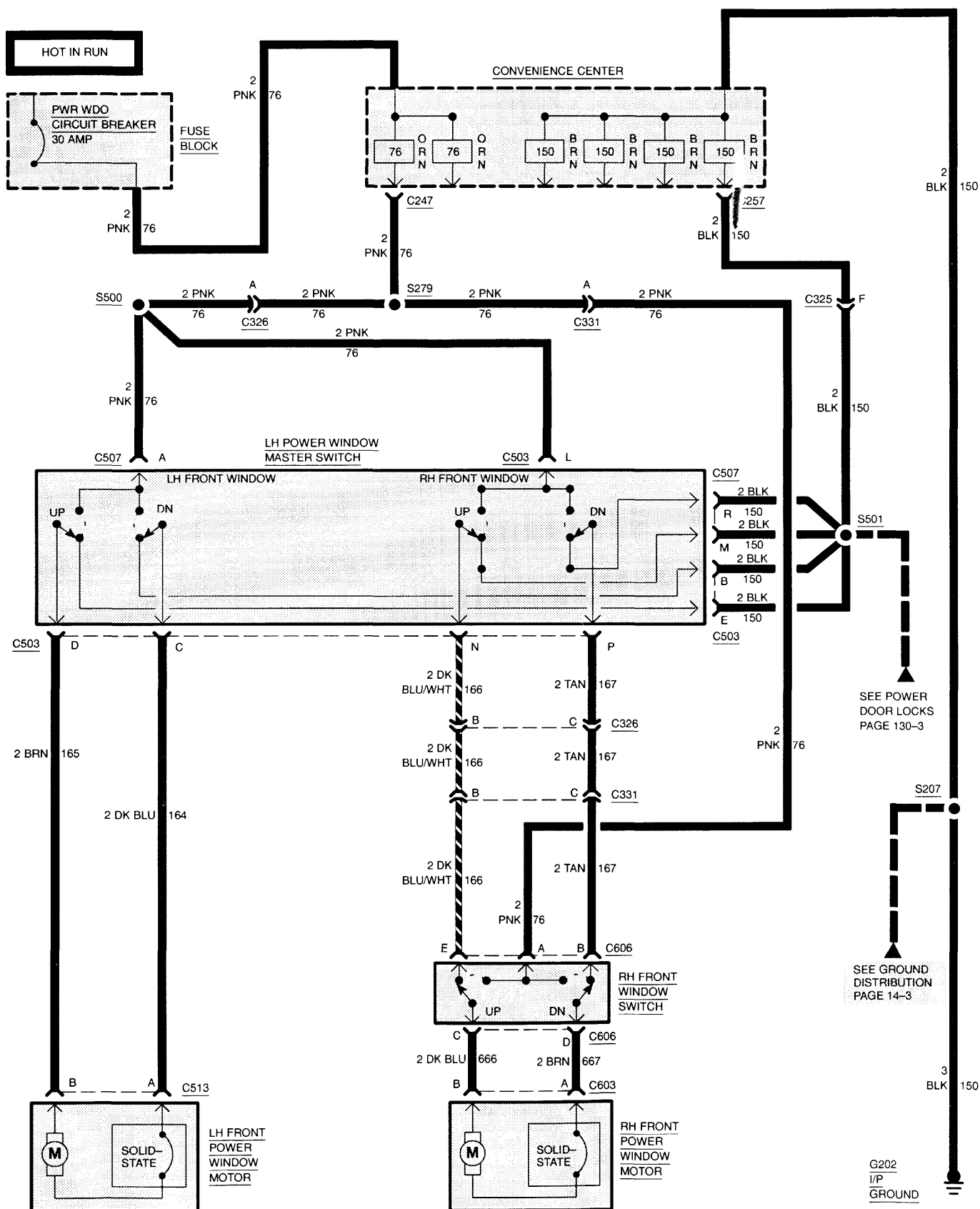
### SPLICES:

|            |                                                                                      |        |   |
|------------|--------------------------------------------------------------------------------------|--------|---|
| S207 ..... | Under LH side of I/P .....                                                           | 120-17 | 1 |
| S213 ..... | Under LH side of I/P .....                                                           | 120-17 | 1 |
| S272 ..... | Power window and door locks harness, near<br>convenience center leads .....          | 120-18 | 3 |
| S277 ..... | Power window and door locks harness, near<br>convenience center leads .....          | 120-18 | 3 |
| S279 ..... | Power window and door locks harness, near<br>convenience center leads .....          | 120-18 | 3 |
| S500 ..... | Power window and locks harness, LH front door, near<br>power window motor lead ..... | 120-19 | 4 |
| S501 ..... | Power window and locks harness, LH front door, near<br>power window motor lead ..... | 120-19 | 4 |

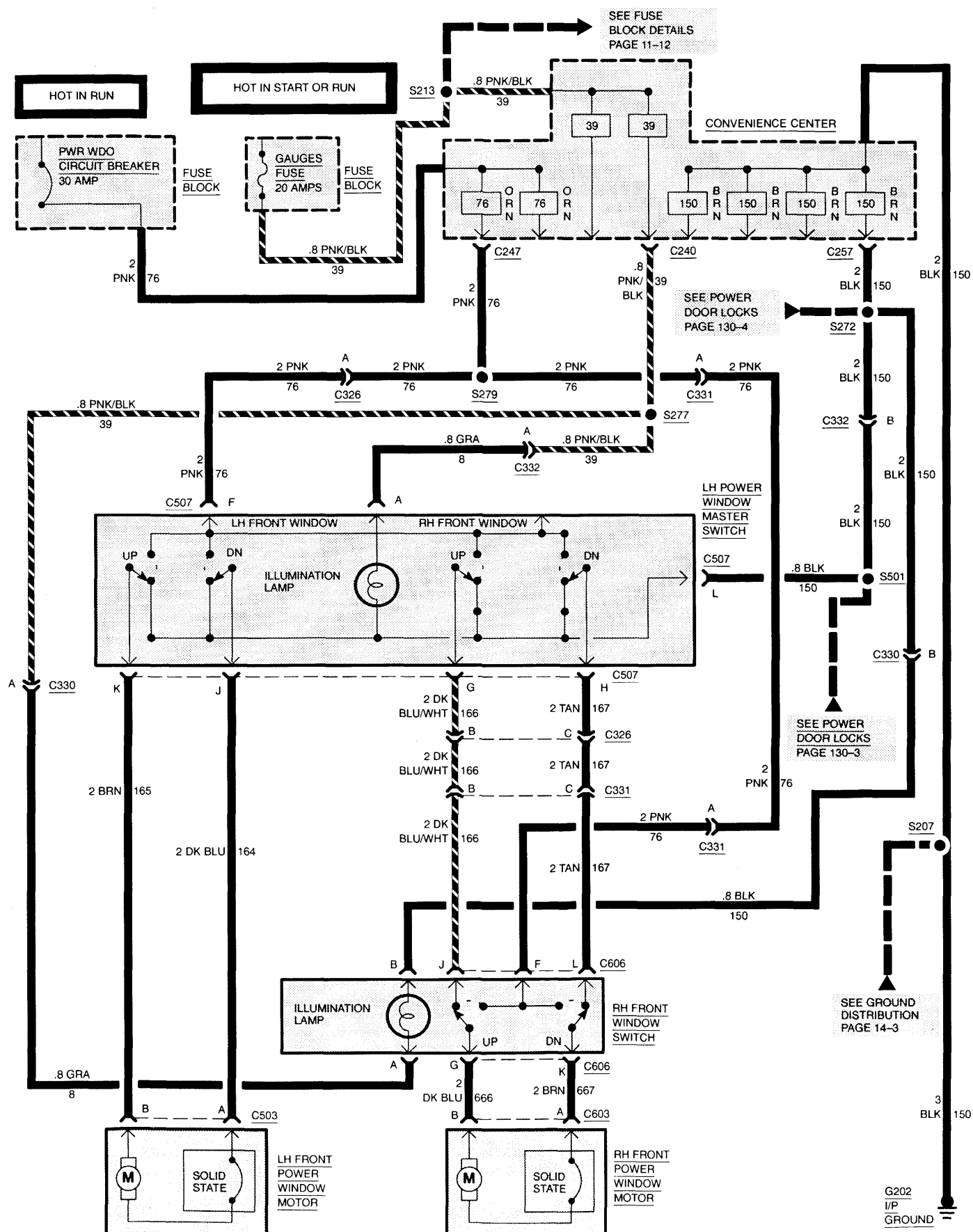
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# 8A-120-4 POWER WINDOWS

## 2 DOOR PICKUP

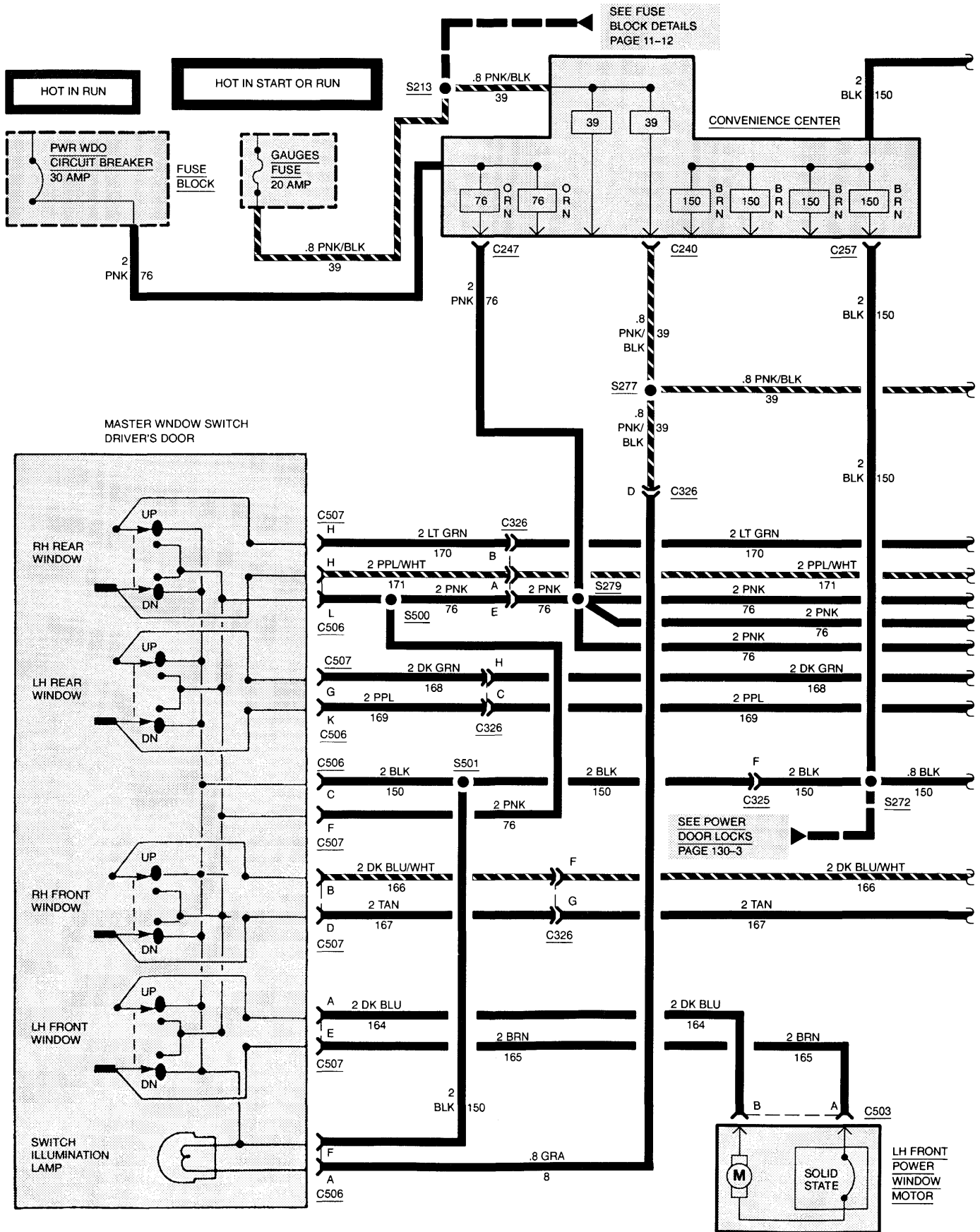


## UTILITY



# 8A-120-6 POWER WINDOWS

## CREW CAB & SUBURBAN



## CREW CAB & SUBURBAN



## DIAGNOSIS — POWER WINDOWS

### PRELIMINARY CHECKS:

1. Check condition of ACC-IGN circuit breaker. If circuit breaker is in good condition, use the following diagnostic procedures.
2. Check condition of GAUGES fuse. if fuse is blown, locate and repair source of overload. Replace fuse.

### BOTH POWER WINDOWS DO NOT OPERATE

| TEST                                                                                                                         | RESULT                    | ACTION                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Connect test lamp from PNK (76) wire at LH window switch connector C506 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                             |
|                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from LH window switch connector C506 to splice S279 or from splice S279 to convenience center connector C247. Also PNK (76) wire from convenience center connector to fuse block. |
| 2. Connect test lamp from PNK (76) wire to BLK (150) wire at LH window switch connector C506.                                | Test lamp lights.         | REPLACE LH window switch.                                                                                                                                                                                                 |
|                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from LH window switch connector C506 to convenience center connector C257.                                                                                                       |

### LH POWER WINDOW DOES NOT OPERATE OR ONLY GOES IN ONE DIRECTION (PICKUP, UTILITY)

| TEST                                                                                                                         | RESULT                    | ACTION                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Connect test lamp from PNK (76) wire at LH window switch connector C506 to ground. | Test lamp lights.         | GO to step 2.                                                                                 |
|                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from LH window switch connector C506 to splice S279.  |
| 2. Connect test lamp from PNK (76) wire to BLK (150) wire at LH window switch connector C506.                                | Test lamp lights.         | GO to step 3.                                                                                 |
|                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from LH window switch connector C506 to splice S501. |
| 3. Move and hold LH window switch to UP position. Connect test lamp from BRN (165) wire at LH window switch connector C506.  | Test lamp lights.         | GO to step 4.                                                                                 |
|                                                                                                                              | Test lamp does not light. | REPLACE LH window switch.                                                                     |
| 4. Connect test lamp from BRN (165) wire to DK BLU (164) wire at LH window switch connector C506.                            | Test lamp lights.         | GO to step 5.                                                                                 |
|                                                                                                                              | Test lamp does not light. | REPLACE LH window switch.                                                                     |

**LH POWER WINDOW DOES NOT OPERATE OR ONLY GOES IN ONE DIRECTION  
(PICKUP, UTILITY) (CONTINUED)**

| TEST                                                                                             | RESULT                    | ACTION                                                                                                                  |
|--------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 5. Connect test lamp from BRN (165) wire at LH window motor connector C503 to ground.            | Test lamp lights.         | GO to step 6.                                                                                                           |
|                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in BRN (165) wire from LH window motor connector C503 and LH window switch connector C506.       |
| 6. Connect test lamp from BRN (165) wire to DK BLU (164) wire at LH window motor connector C503. | Test lamp lights.         | REPLACE LH window motor.                                                                                                |
|                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in DK BLU (164) wire between LH window motor connector C503 and LH window switch connector C506. |

**RH POWER WINDOW ONLY OPERATES FROM DRIVER'S SIDE WINDOW SWITCH (PICKUP, UTILITY)**

| TEST                                                                                                                              | RESULT                    | ACTION                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Connect test lamp from PNK (76) wire at RH window switch connector C606 to ground.      | Test lamp lights.         | GO to step 2.                                                                                |
|                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from RH window switch connector C606 to splice S279. |
| 2. Move RH window switch to UP position. Connect test lamp from BRN (667) wire at RH window switch connector C606 to ground.      | Test lamp lights.         | GO to step 3.                                                                                |
|                                                                                                                                   | Test lamp does not light. | REPLACE RH window switch.                                                                    |
| 3. Move RH window switch to DOWN position. Connect test lamp from DK BLU (666) wire at RH window switch connector C606 to ground. | Test lamp does not light. | REPLACE RH window switch.                                                                    |

**RH POWER WINDOW DOES NOT OPERATE FROM EITHER SWITCH (PICKUP, UTILITY)**

| TEST                                                                                                                                                                   | RESULT                    | ACTION                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Position and hold RH window switch to UP. Connect test lamp from BRN (667) wire at RH window motor connector C603 to ground. | Test lamp lights.         | GO to step 2.                                                                                |
|                                                                                                                                                                        | Test lamp does not light. | GO to step 3.                                                                                |
| 2. Connect test lamp from BRN (667) wire to DK BLU (666) wire at RH window motor connector C603.                                                                       | Test lamp lights.         | REPLACE RH window motor.                                                                     |
|                                                                                                                                                                        | Test lamp does not light. | GO to step 4.                                                                                |
| 3. Connect test lamp from PNK (76) wire at LH window switch connector C507 to ground.                                                                                  | Test lamp lights.         | GO to step 4.                                                                                |
|                                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from LH window switch connector C507 to splice S279. |
| 4. Connect test lamp from PNK (76) wire to DK BLU/WHT (166) wire at LH window switch connector C507.                                                                   | Test lamp lights.         | GO to step 6.                                                                                |
|                                                                                                                                                                        | Test lamp does not light. | GO to step 5.                                                                                |



## 8A-120-10 POWER WINDOWS

### RH POWER WINDOW DOES NOT OPERATE FROM EITHER SWITCH (PICKUP, UTILITY) (CONTINUED)

| TEST                                                                                                                            | RESULT                                           | ACTION                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 5. Connect test lamp from PNK (76) wire to BLK (150) wire at LH window switch connector C507.                                   | Test lamp lights.                                | REPLACE LH window switch.                                                                                           |
|                                                                                                                                 | Test lamp does not light.                        | LOCATE and REPAIR open in BLK (150) wire from LH window switch connector C507 to splice S501.                       |
| 6. Connect test lamp from PNK (76) wire to TAN (167) wire at LH window switch connector C507.                                   | Test lamp lights.                                | GO to step 7.                                                                                                       |
|                                                                                                                                 | Test lamp does not light.                        | REPLACE LH window switch.                                                                                           |
| 7. Connect test lamp from PNK (76) wire to DK BLU/WHT (166) wire and then to TAN (167) wire at RH window switch connector C507. | Test lamp lights at both wires (166 and 167).    | REPLACE RH window switch.                                                                                           |
|                                                                                                                                 | Test lamp lights at only one wire or not at all. | LOCATE and REPAIR open in wires (166 and 167) from RH window switch connector C606 to master switch connector C507. |

### POWER WINDOW SWITCH ILLUMINATION LAMP(S) DO NOT LIGHT (CREW CAB, SUBURBAN, UTILITY)

| TEST                                                                                                                                    | RESULT                    | ACTION                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN or ACC position. Connect test lamp from GRA (8) wire at window switch connector C507 or C606 to ground. | Test lamp lights.         | GO to step 3 for LH, step 4 for RH.                                                                                                                                                                                                                                  |
|                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in GRA (8) wire between window switch connector C507 or C606 and body connector C326 or C328. If wire is good, GO to step 2.                                                                                                                  |
| 2. Connect test lamp from PNK/BLK (39) wire at body connector C326 or C328 to ground.                                                   | Test lamp lights.         | GO to step 3 for LH, step 4 for RH.                                                                                                                                                                                                                                  |
|                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in PNK/BLK (39) wire between body connector C326 or C328 and splice S277 or between splice S277 and convenience center connector C240. Also check PNK/BLK (39) wire from convenience center to fuse block.                                    |
| 3. Connect test lamp from GRA (8) wire to BLK (150) wire at window switch connector C507.                                               | Test lamp lights.         | REPLACE switch.                                                                                                                                                                                                                                                      |
|                                                                                                                                         | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from LH window switch connector C507 to splice S501, from splice S501 to splice S272, from splice S272 to convenience center connector C257, from convenience center to splice S207 or from splice S207 to I/P ground G202. |

**POWER WINDOW SWITCH ILLUMINATION LAMP(S) DO NOT LIGHT  
(CREW CAB, SUBURBAN, UTILITY) (CONTINUED)**

| TEST                                                                                      | RESULT                    | ACTION                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4. Connect test lamp from GRA (8) wire to BLK (150) wire at window switch connector C606. | Test lamp lights.         | REPLACE switch.                                                                                                                                                                                                                     |
|                                                                                           | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from RH window switch connector C606 to splice S272, from splice S272 to convenience center connector C257, from convenience center to splice S207 or from splice S207 to I/P ground G202. |

**POWER WINDOWS DO NOT OPERATE OR ONLY GO IN ONE DIRECTION (SUBURBAN, CREW CAB)**

| TEST                                                                                                                                                                                  | RESULT                    | ACTION                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in RUN or ACC position. Connect test lamp from PNK (76) wire at affected window switch connector C506, C507, C606, C556 or C616 to ground.                   | Test lamp lights.         | GO to step 2.                                                                                                                                                                         |
|                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from affected window switch connector C506, C507, C606, C556 or C616 to splice S279 or from splice S279 to convenience center connector C247. |
| 2. Connect a test lamp from PNK (76) wire to BLK (150) wire at affected window switch connector C506, C507.                                                                           | Test lamp lights.         | GO to step 3.                                                                                                                                                                         |
|                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from affected window switch connector C506, C507 to splice S501 or from splice S501 to convenience center connector C257.                    |
| 3. Move and hold affected window switch to UP position. Connect test lamp from BRN (165, 667, 669, 671) wire at affected window switch connector C506, C606, C556, or C616 to ground. | Test lamp lights.         | GO to step 4.                                                                                                                                                                         |
|                                                                                                                                                                                       | Test lamp does not light. | REPLACE affected window switch.                                                                                                                                                       |
| 4. Connect test lamp from BRN (165, 667, 669 or 671) wire to DK BLU (164, 666, 668 or 670) wire at affected window switch connector C506, C606, C556 or C616.                         | Test lamp lights.         | GO to step 5.                                                                                                                                                                         |
|                                                                                                                                                                                       | Test lamp does not light. | REPLACE affected window switch.                                                                                                                                                       |
| 5. Connect test lamp from BRN (165, 667, 669 or 671) wire at affected window motor connector C503, C603, C553 or C613 to ground.                                                      | Test lamp lights.         | GO to step 6.                                                                                                                                                                         |
|                                                                                                                                                                                       | Test lamp does not light. | LOCATE and REPAIR open in BRN (165, 667, 669 or 671) wire from affected window motor connector C503, C603, C553 or C613 to window switch connector C506, C507, C606, C556 or C616.    |

## 8A-120-12 POWER WINDOWS

### POWER WINDOWS DO NOT OPERATE OR ONLY GO IN ONE DIRECTION (SUBURBAN, CREW CAB) (CONTINUED)

| TEST                                                                                                                                                         | RESULT                    | ACTION                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Connect test lamp from BRN (165, 667, 669 or 671) wire to DK BLU (164, 666, 668 or 670) wire at affected window motor connector C503, C603, C553 or C613. | Test lamp lights.         | REPLACE affected window motor.                                                                                                                                                            |
|                                                                                                                                                              | Test lamp does not light. | LOCATE and REPAIR open in DK BLU (164, 666, 668 or 670) wire between affected window motor connector C503, C603, C553 or C613 and window switch connector C506, C507, C606, C553 or C616. |

### POWER WINDOWS DO NOT OPERATE FROM DRIVER'S SIDE WINDOW SWITCH (SUBURBAN)

| TEST                                                                                                                                                                                                                             | RESULT                    | ACTION                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Position and hold affected window switch to UP position. Connect test lamp from BRN (165, 667, 669 or 671) wire at affected window motor connector C503, C603, C553 or C613 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                         |
|                                                                                                                                                                                                                                  | Test lamp does not light. | GO to step 3.                                                                                                                                                                                         |
| 2. Connect test lamp from BRN (165, 667, 669, 671) wire to DK BLU (164, 666, 668 or 671) wire at affected window motor connector C503, C603, C553 or C613.                                                                       | Test lamp lights.         | REPLACE affected window motor.                                                                                                                                                                        |
|                                                                                                                                                                                                                                  | Test lamp does not light. | GO to step 3.                                                                                                                                                                                         |
| 3. Connect test lamp from PNK (76) wire at affected window switch connector C506, C507 to ground.                                                                                                                                | Test lamp lights.         | GO to step 4.                                                                                                                                                                                         |
|                                                                                                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from affected window switch connector C506, C507 to splice S500 or from splice S500 to splice S279.                                                           |
| 4. Connect test lamp from PNK (76) wire to DK BLU/WHT (166), DK GRN (168) or LT GRN (170) wires at affected window switch connector C506, C507.                                                                                  | Test lamp lights.         | GO to step 6.                                                                                                                                                                                         |
|                                                                                                                                                                                                                                  | Test lamp does not light. | GO to step 5.                                                                                                                                                                                         |
| 5. Connect test lamp from PNK (76) wire to BLK (150) wire at affected window switch connector C506, C507.                                                                                                                        | Test lamp lights.         | REPLACE affected window switch.                                                                                                                                                                       |
|                                                                                                                                                                                                                                  | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from affected window switch connector C506, C507 to splice S501 or from splice S501 to splice S272 or from splice S272 to convenience center connector C257. |
| 6. Connect test lamp from PNK (76) wire to TAN (167), PPL (169) or PPL/WHT (171) wire at affected window switch connector C506, C507.                                                                                            | Test lamp lights.         | GO to step 8.                                                                                                                                                                                         |
|                                                                                                                                                                                                                                  | Test lamp does not light. | GO to step 7.                                                                                                                                                                                         |

**POWER WINDOWS DO NOT OPERATE FROM DRIVER'S SIDE WINDOW SWITCH  
(SUBURBAN, CREW CAB) (CONTINUED)**

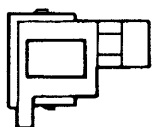
| TEST                                                                                                                                                                                                          | RESULT                                           | ACTION                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7. Connect test lamp from PNK (76) wire to BLK (150) wire at affected window switch connector C506, C507.                                                                                                     | Test lamp lights.                                | REPLACE affected window switch.                                                                                                                                                                                        |
|                                                                                                                                                                                                               | Test lamp does not light.                        | LOCATE and REPAIR open in BLK (150) wire from affected window switch connector C506, C507 to splice S501 or from splice S501 to splice S272 or from splice S272 to convenience center connector C257.                  |
| 8. Connect test lamp from PNK (76) wire to DK BLU/WHT (166), DK GRN (168) or LT GRN (170) wire and then to TAN (167), PPL (169) or PPL/WHT (171) wire at affected window switch connector C606, C556 or C616. | Test lamp lights at all wires.                   | REPLACE affected window switch.                                                                                                                                                                                        |
|                                                                                                                                                                                                               | Test lamp lights at only one wire or not at all. | LOCATE and REPAIR open in wires DK BLU/WHT (166), DK GRN (168), LT GRN (170), TAN (167), PPL (169) or PPL/WHT (171) from affected window switch connector C606, C556 or C616 to master switch connector(s) C506, C507. |

**POWER WINDOWS ONLY OPERATE FROM DRIVER'S SIDE WINDOW SWITCH (SUBURBAN, CREW CAB)**

| TEST                                                                                                                                                                   | RESULT                    | ACTION                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place ignition switch in ACC position. Connect test lamp from PNK (76) wire at affected window switch connector (C606, C556 or C616) to ground.                     | Test lamp lights.         | GO to step 2.                                                                                                                                                    |
|                                                                                                                                                                        | Test lamp does not light. | LOCATE and REPAIR open in PNK (76) wire from affected window switch C616, C556, or C616 to splice S279 or from splice S279 to convenience center connector C247. |
| 2. Move affected window switch to UP position. Connect test lamp from BRN (667, 679 or 671) wire at affected window switch connector C606, C556 or C616 to ground.     | Test lamp lights.         | GO to step 3.                                                                                                                                                    |
|                                                                                                                                                                        | Test lamp does not light. | REPLACE affected window switch.                                                                                                                                  |
| 3. Move affected window switch to DOWN position. Connect test lamp from DK BLU (666, 668 or 670) wire at affected window switch connector C606, C556 or C616 to ground | Test lamp lights.         | System operates normally.                                                                                                                                        |
|                                                                                                                                                                        | Test lamp does not light. | REPLACE affected window switch.                                                                                                                                  |

# 8A-120-14 POWER WINDOWS

12059235



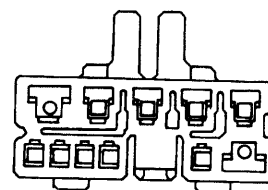
**C247**  
Ignition Tap to Convenience  
Center

12059236



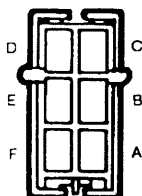
**C257**  
Ground Tap to Convenience  
Center

12084617



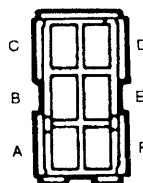
**BLACK**  
Metri-Pack  
**C606**  
RH Power Window Switch  
(Suburban and Crew Cab)

12015344



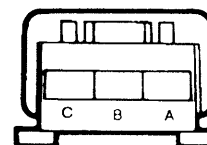
**BLACK**  
Metri-Pack 280  
**C325**  
LH Door to Crossbody (Pickup)

12015345



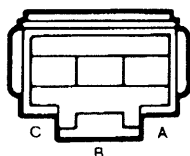
**BLACK**  
Metri-Pack 280  
**C325**  
Crossbody to LH Door (Pickup)

12020397



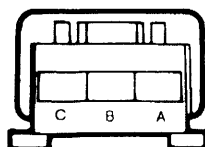
**BLACK**  
Metri-Pack 280  
**C326**  
LH Door to Crossbody (Pickup)

12020398



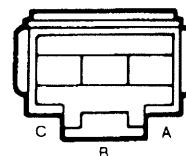
**BLACK**  
Metri-Pack 180  
**C326**  
Crossbody to LH Door (Pickup)

12020397



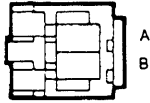
**BLACK**  
Metri-Pack 280  
**C330**  
RH Door to Crossbody (Pickup)

12020398



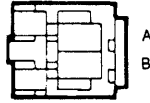
**BLACK**  
Metri-Pack 180  
**C330**  
Crossbody to RH Door (Pickup)

**12004140**



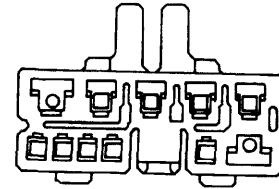
**BLACK**  
Pac/on  
**C503**  
**LH Power Window Motor**  
(Pickup)

**12004140**



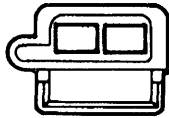
**BLACK**  
Pac/on  
**C603**  
**RH Power Window Motor**  
(Pickup)

**12084617**



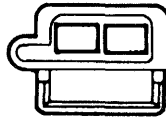
**BLACK**  
Metri-Pack  
**C507**  
**LH Power Window Switch**  
(Utility)

**12064870**



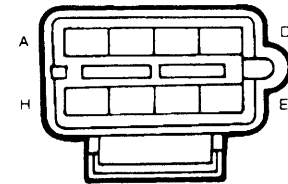
**C332**  
**Crossbody to LH Door**  
(All Except 2-Door Pickup)

**12064870**



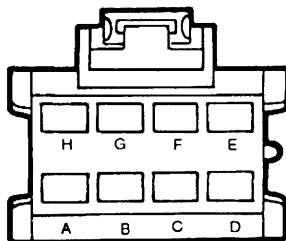
**C330**  
**Crossbody to RH Door**  
(All Except 2-Door Pickup)

**12066195**



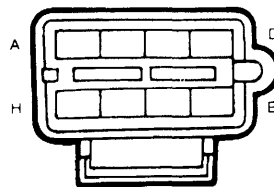
**BLACK**  
Metri-Pack 280  
**C326**  
**Crossbody to LH Front Door**  
(Suburban and Crew Cab)

**12064998**



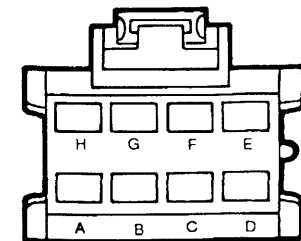
**BLACK**  
Metri-Pack 280  
**C326**  
**LH Front Door to Crossbody**  
(Suburban and Crew Cab)

**12066195**



**BLACK**  
Metri-Pack 280  
**C328**  
**Crossbody to RH Front Door**  
(Suburban and Crew Cab)

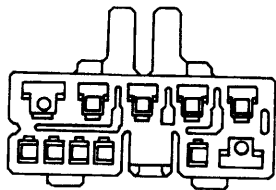
**12064998**



**BLACK**  
Metri-Pack 280  
**C328**  
**RH Front Door to Crossbody**  
(Suburban and Crew Cab)

8A-120-16 POWER WINDOWS

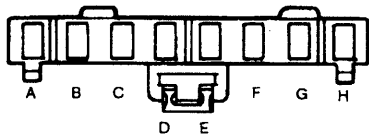
12084617



BLACK  
Metri-Pack

C506  
LH Door Master Power Window  
Switch

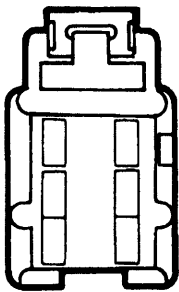
12084603



MED. GRAY  
Metri-Pack

C507  
LH Door Master Power Window  
Switch

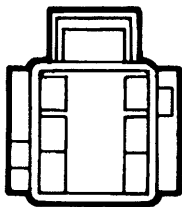
12064752



BLACK  
Metri-Pack 280

C325  
Crossbody to LH Door  
(Suburban and Crew Cab)

12064754



BLACK  
Metri-Pack 280

C325  
LH Door to Crossbody  
(Suburban and Crew Cab)

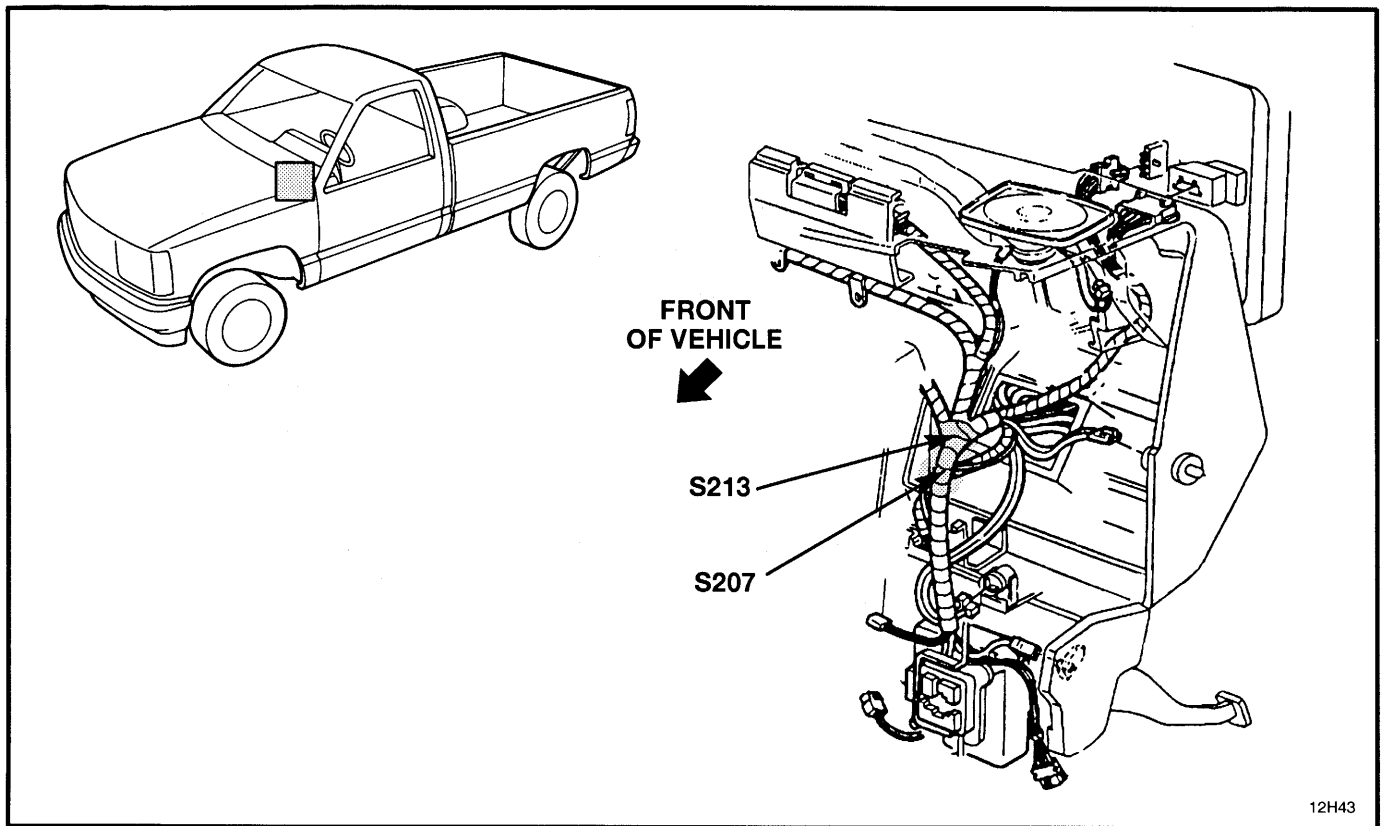


Figure 1 — LH Side of Instrument Panel

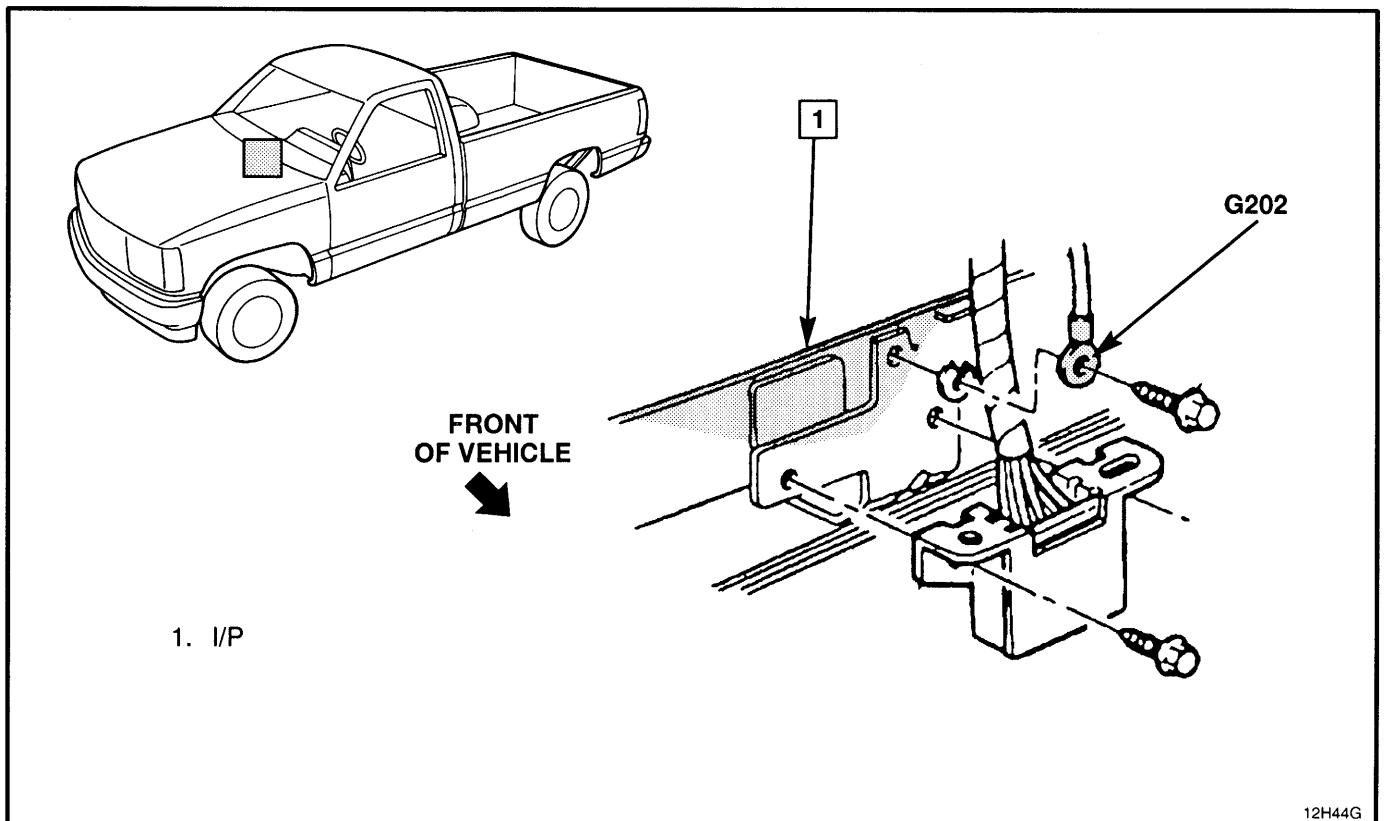


Figure 2 — I/P Ground Wiring



# 8A-120-18 POWER WINDOWS

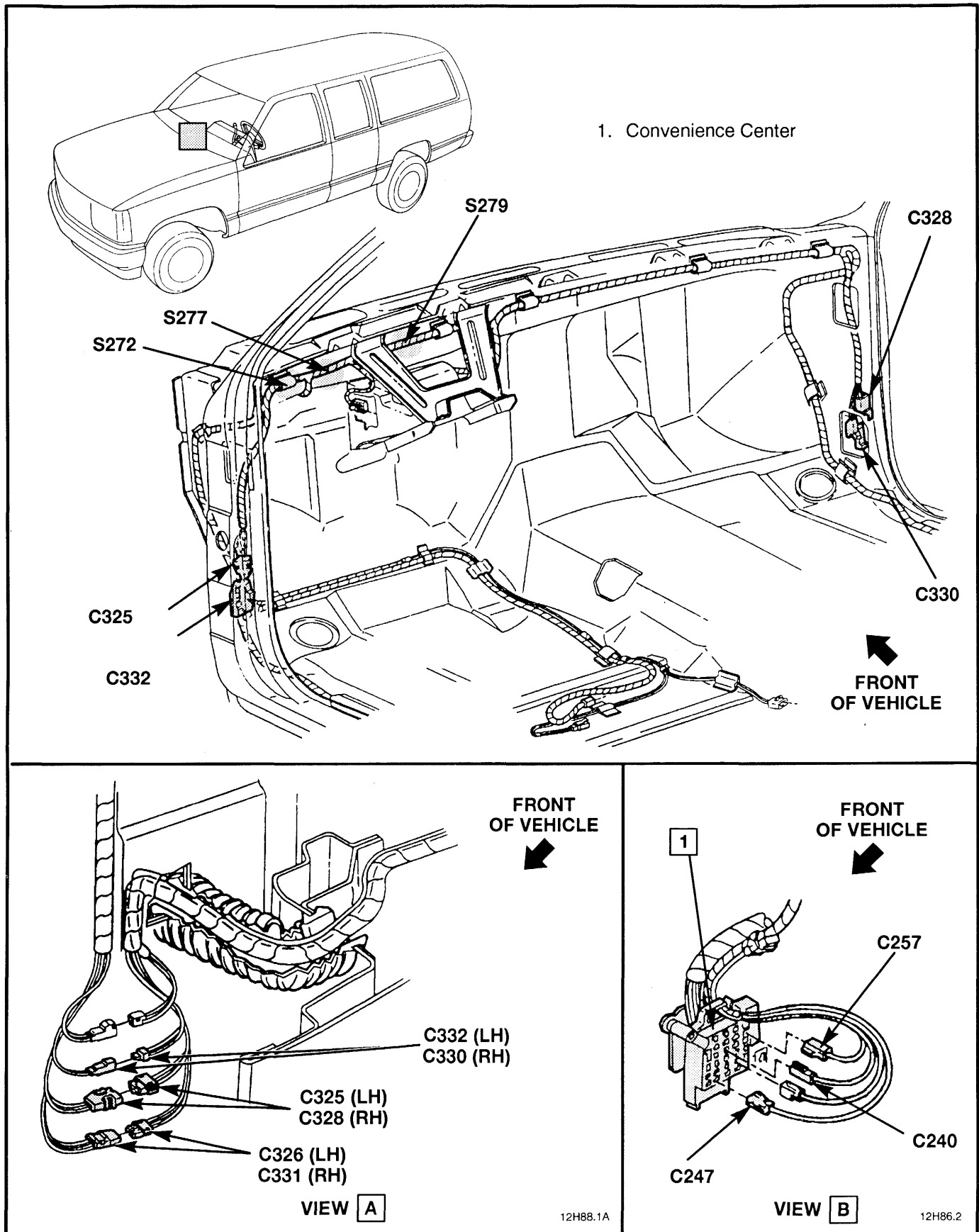
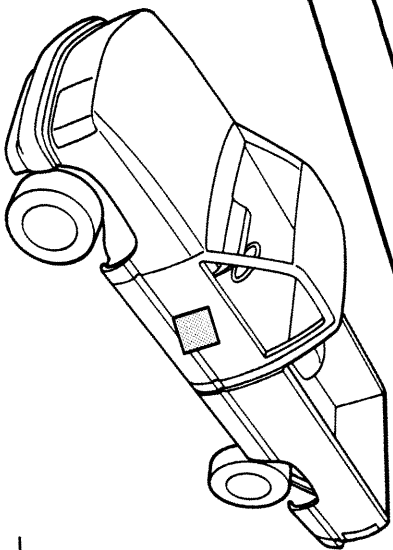
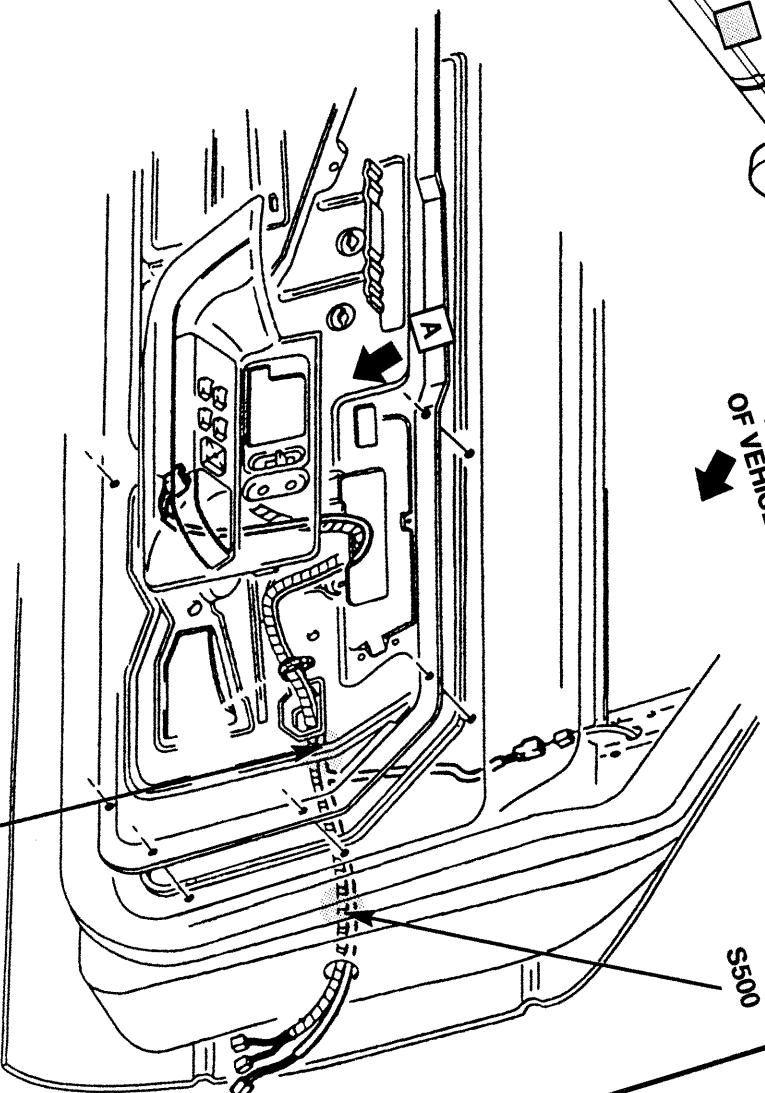


Figure 3 — Power Window and Door Lock Crossbody Wiring – Suburban

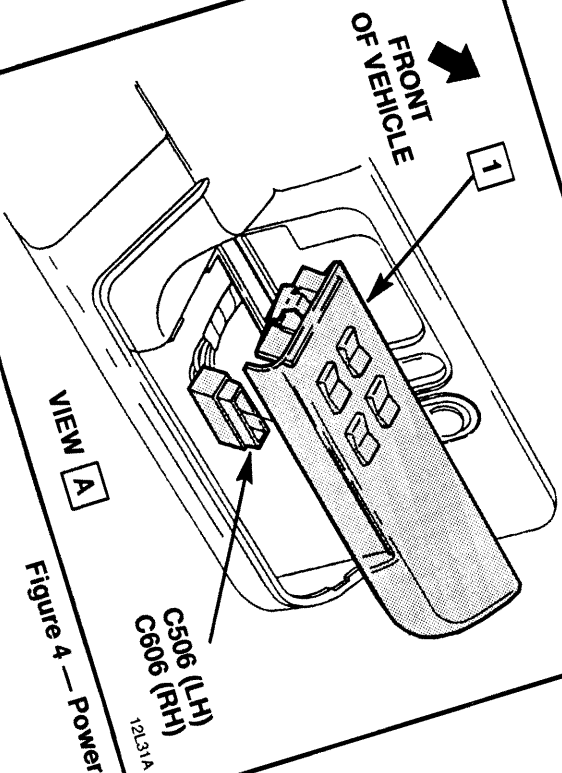
**POWER WINDOWS 8A-120-19**



FRONT  
OF VEHICLE

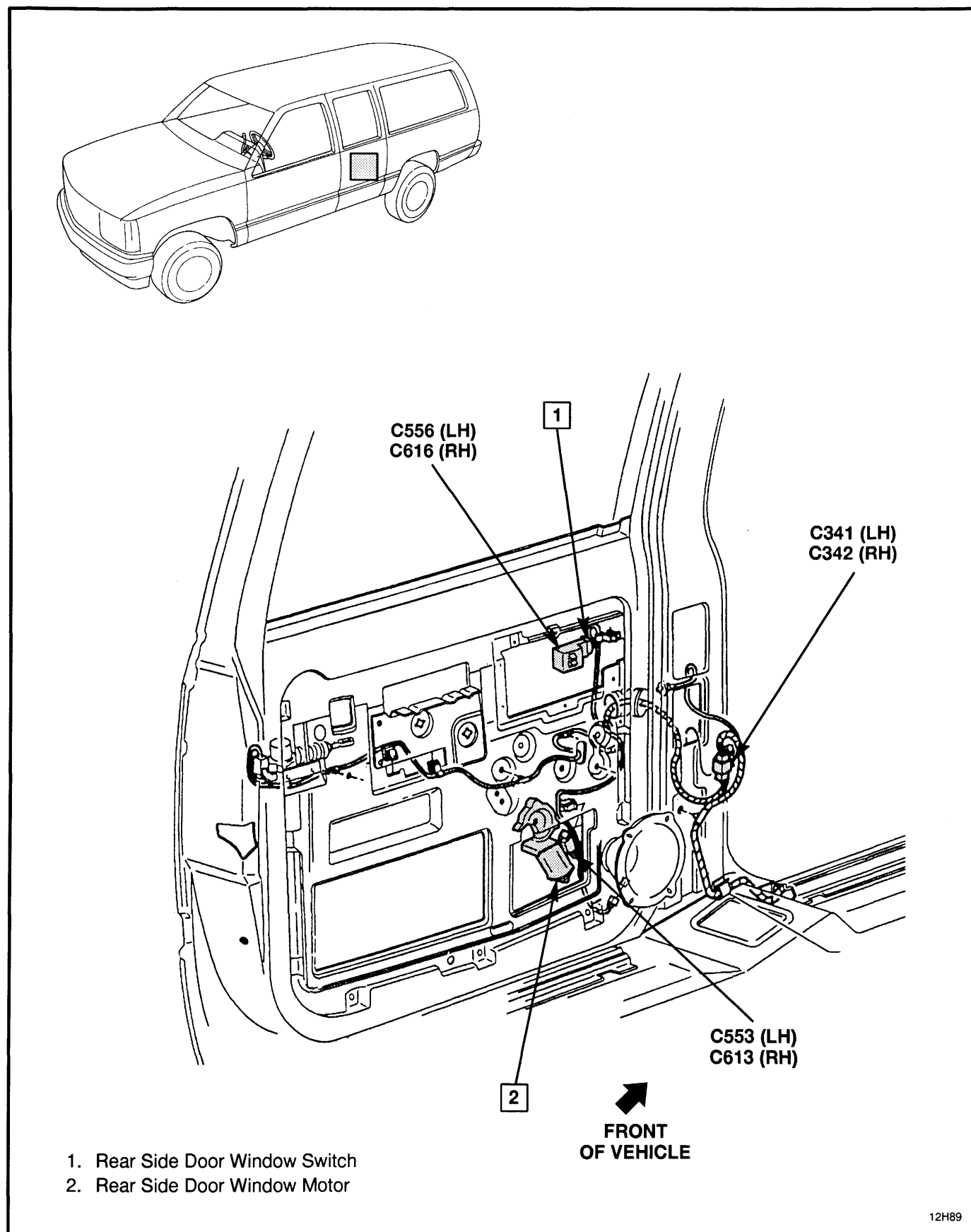


1. Power Window Switches



VIEW A

Figure 4 — Power Window Wiring



12H89

Figure 5 — Rear Side Door Wiring – Suburban and 4-Door

## CIRCUIT OPERATION

### 2-DOOR, EXTENDED CAB AND UTILITY

When a Door Lock Switch is operated, both of the doors will lock or unlock. Each lock can also be operated manually. The locks are operated by reversible motors that receive voltage from the ACC-BATT Circuit Breaker. The Door Lock Switches operate to turn the Motors on by supplying battery voltage to one of the terminals and ground the other terminal.

When either Door Lock Switch is moved to the LOCK position, it completes the circuit to the Motors. Voltage is supplied to the GRA (295) wire and to the Door Lock Motors, which are grounded by the TAN (294) wire from the other terminal of the Motor through the other switch contact to ground. The Motor in each door runs to operate the Door Locks. When the Door Lock Switch is released, the circuit is opened and the Motors turn off.

A similar action occurs with either of the Door Lock Switches closing to the UNLOCK position. Now the TAN (294) wires to the Motors supply battery voltage and the GRA (295) wires are grounded. The polarity of the voltage to the Motors has reversed. The Motors run in the opposite direction to unlock the doors.

The Door Lock Switches are usually closed for just a moment. If the Door Lock Switches are held closed, a circuit breaker in each Motor will open to protect against damage. The circuit breakers close automatically when they cool off.

### CREW CAB AND SUBURBAN

When a Door Lock Switch is operated, all of the doors will lock or unlock. Each lock can also be operated

manually. The locks are operated by reversible motors that receive voltage from the ACC-BATT Circuit Breaker. The Door Lock Switches operate to turn the Motors on by supplying battery voltage to one of the terminals and ground the other terminal.

When either Door Lock Switch is moved to the LOCK position, it completes the circuit to the Motors. Voltage is supplied to the GRA (295) wire and to the Door Lock Motors, which are grounded by the TAN (294) wire from the other terminal of the Motor through the other switch contact and through the Door Lock Relay to the BLK (150) wire and ground G202. The Motor in each door runs to operate the Door Locks. When the Door Lock Switch is released, the circuit is opened and the Motors turn off.

A similar action occurs with either of the Door Lock Switches closing to the UNLOCK position. Now the TAN (294) wires to the Motors supply battery voltage and the GRA (295) wires are grounded. The polarity of the voltage to the Motors has reversed. The Motors run in the opposite direction to unlock the doors.

The Door Lock Switches are usually closed for just a moment. If the Door Lock Switches are held closed, a circuit breaker in each Motor will open to protect against damage. The circuit breakers close automatically when they cool off.

### REAR CARGO DOORS (SUBURBAN)

The Rear Cargo Doors must be fully closed for the Door Lock Motor to operate. The Door Lock Motor is located in the right rear cargo door. Contact buttons are located on the cargo door opening on the body and also on the right rear cargo door.

## COMPONENT LOCATION

## Page — Figure

|                                   |                                                 |           |   |
|-----------------------------------|-------------------------------------------------|-----------|---|
| Convenience Center .....          | Under LH side of I/P .....                      | 130-12    | 3 |
| Door Lock Relay .....             | Under I/P, RH side of brake pedal bracket ..... | 130-12    | 3 |
| Door Lock Motor, Cargo Door ..... | Inside RH rear cargo door .....                 | 130-15    | 6 |
| Door Lock Motor, LH Front .....   | Inside door .....                               | Not Shown |   |
| Door Lock Motor, RH Front .....   | Inside door .....                               | Not Shown |   |
| Door Lock Motor, LH Rear .....    | Inside door .....                               | 130-14    | 5 |
| Door Lock Motor, RH Rear .....    | Inside door .....                               | 130-14    | 5 |
| Door Lock Switch, LH Front .....  | On door trim panel .....                        | Not Shown |   |
| Door Lock Switch, RH Front .....  | On door trim panel .....                        | Not Shown |   |

## 8A-130-2 POWER DOOR LOCKS

---

### COMPONENT LOCATION

Page — Figure

#### CONNECTORS:

|      |                            |        |   |
|------|----------------------------|--------|---|
| C237 | At LH body hinge pillar    | 130-16 | 8 |
| C241 | At convenience center      | 130-12 | 3 |
| C257 | At convenience center      | 130-12 | 3 |
| C325 | LH body hinge pillar       | 130-12 | 3 |
| C328 | RH body hinge pillar       | 130-12 | 3 |
| C341 | At LH center pillar        | 130-14 | 5 |
| C342 | At RH center pillar        | 130-14 | 5 |
| C404 | RH rear body pillar        | 130-16 | 7 |
| C904 | At rear cargo door contact | 130-15 | 6 |

#### GROUND:

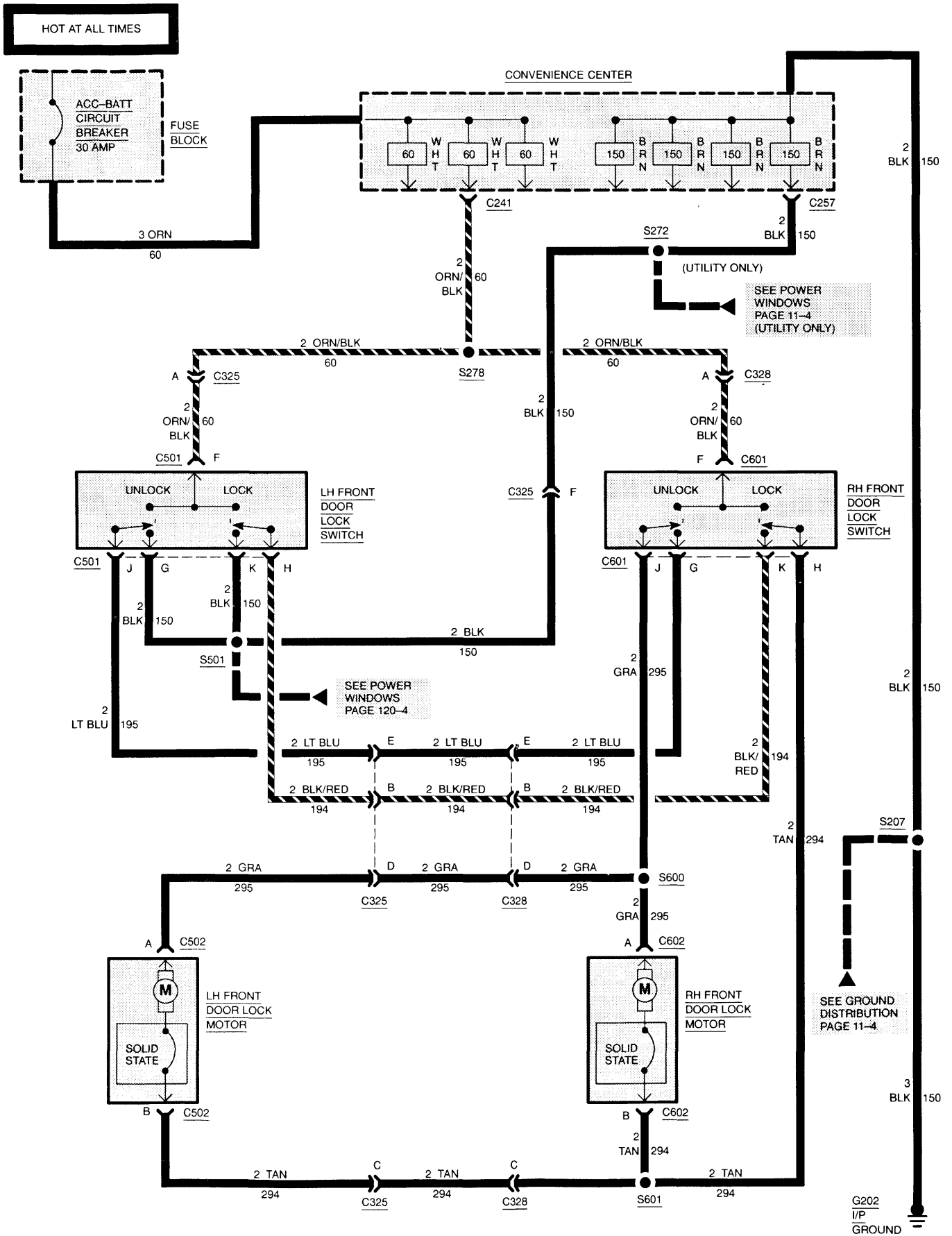
|      |                  |        |   |
|------|------------------|--------|---|
| G202 | At DLC connector | 130-11 | 2 |
|------|------------------|--------|---|

#### SPLICES:

|      |                                                                           |        |   |
|------|---------------------------------------------------------------------------|--------|---|
| S207 | Under LH side of I/P                                                      | 130-11 | 1 |
| S272 | Power window and door locks harness, near convenience center leads        | 130-12 | 3 |
| S278 | Power window and door locks harness, near convenience center leads        | 130-12 | 3 |
| S280 | Power window and door locks harness, near convenience center leads        | 130-12 | 3 |
| S281 | Power window and door locks harness, near door lock relay                 | 130-12 | 3 |
| S282 | Power window and door locks harness, near door lock relay                 | 130-12 | 3 |
| S283 | Power window and door locks harness, near door lock relay                 | 130-12 | 3 |
| S501 | Power window and lock harness LH front door, near power window motor lead | 130-13 | 4 |
| S600 | Power window and lock harness RH front door, near power window motor lead | 130-13 | 4 |
| S601 | Power window and lock harness RH front door, near power window motor lead | 130-13 | 4 |

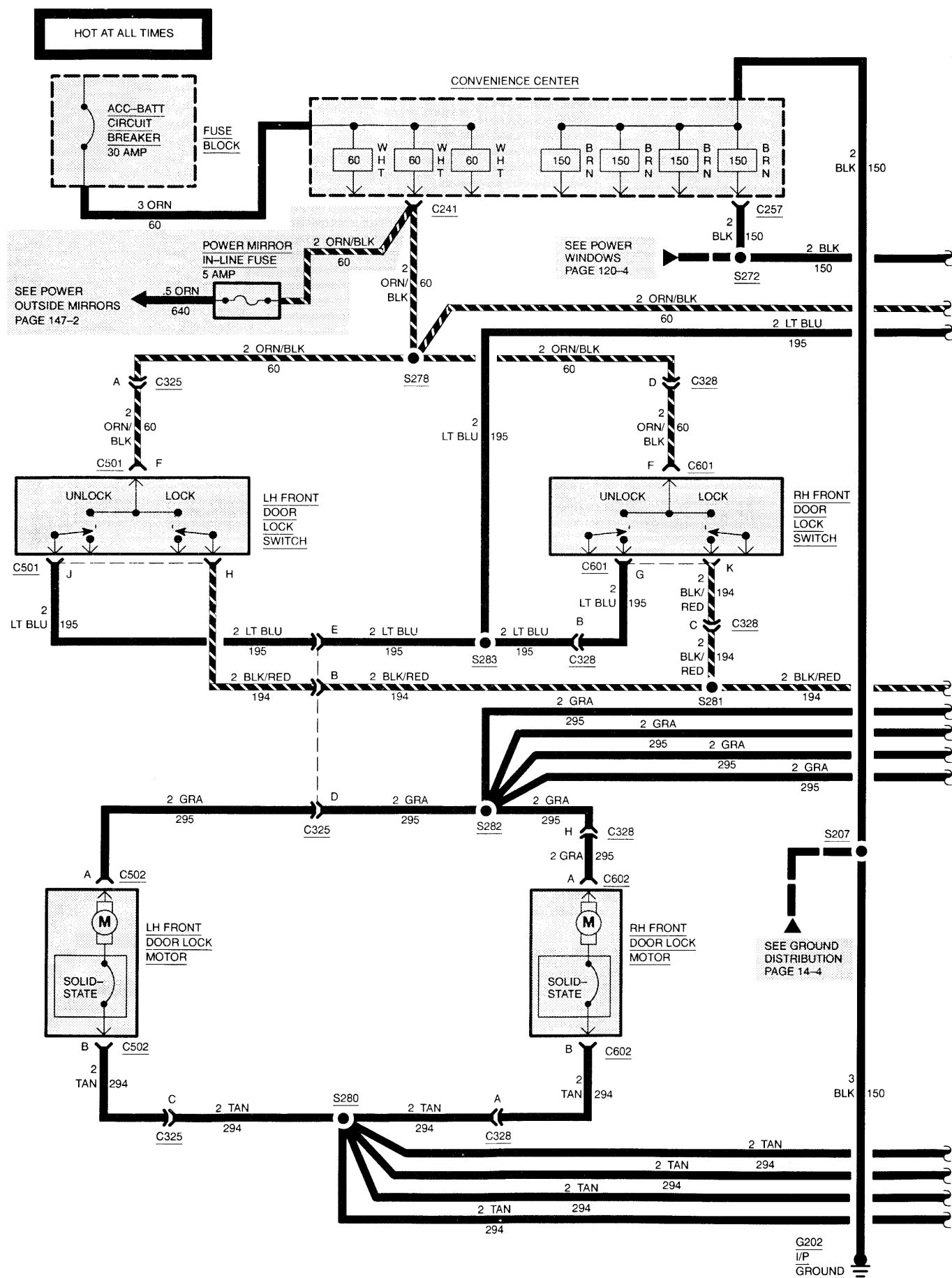
# POWER DOOR LOCKS 8A-130-3

## PICKUP AND UTILITY

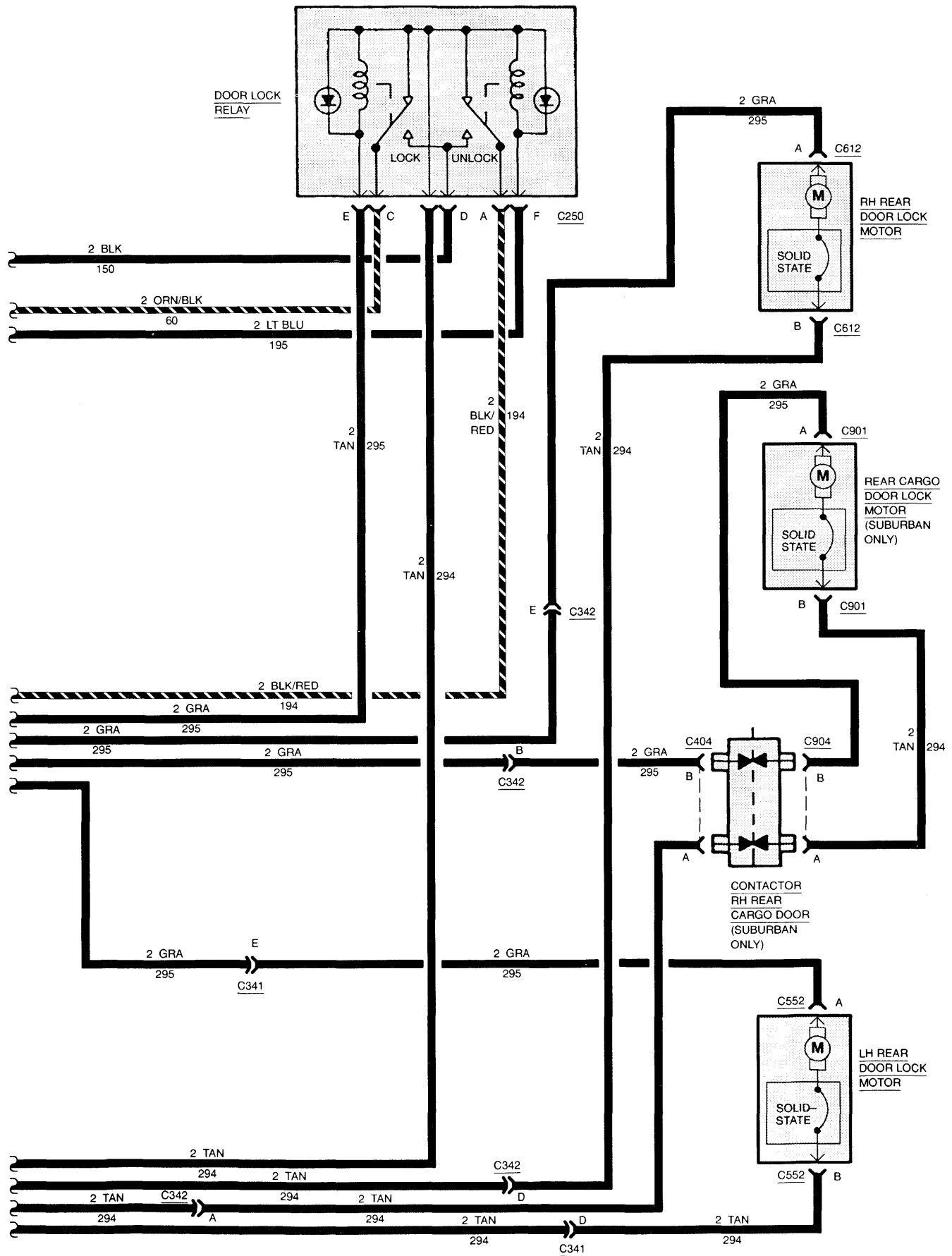


# 8A-130-4 POWER DOOR LOCKS

## CREW CAB AND SUBURBAN



## CREW CAB AND SUBURBAN





## 8A-130-6 POWER DOOR LOCKS

### DIAGNOSIS — POWER DOOR LOCKS

#### PRELIMINARY CHECKS:

1. Check to see that ACC-BATT Circuit Breaker and in-line (C296) fuse are not blown. If fuse is blown, locate and repair source of overload, then replace fuse. If Circuit Breaker is open, locate and repair source of overload, then check breaker for proper operation. If breaker does not reset, replace breaker.
2. Refer to Section 10A1 of the 1994 C/K Service Manual for diagnosis and repair of all non-electrical system components.

#### POWER DOOR LOCKS DO NOT OPERATE FROM EITHER SWITCH (2-DOOR AND EXTENDED CAB)

| TEST                                                                                               | RESULT                    | ACTION                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN/BLK (60) wire at LH lock switch connector C501 to ground.            | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                    |
|                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in ORN/BLK (60) wire between LH lock switch connector C501 and connector C325 or from connector C325 to splice S278 or between splice S278 and convenience center connector C257 or from convenience center connector C257 to fuse block. |
| 2. Connect test lamp from ORN/BLK (60) wire to BLK (150) wire(s) at LH lock switch connector C501. | Test lamp lights.         | REPLACE LH lock switch.                                                                                                                                                                                                                                          |
|                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire(s) from lock switch connector C501 to splice S501 or from splice S501 to connector C325 or from connector C325 to splice S272 or from splice S272 to convenience center connector C257.                                 |

#### BOTH SWITCHES ONLY OPEN ONE DOOR LOCK

| TEST                                                                                                                                                                                                       | RESULT                    | ACTION                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------|
| 1. Move one of the lock switches to UNLOCK position. Disconnect connector C502 or C602 at motor that is not working. Connect test lamp from GRA (295) wire at lock motor connector C502 or C602 to ground. | Test lamp lights.         | GO to step 2.                                                                                   |
|                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in GRA (295) wire from lock motor connector C502 or C602 to splice S600. |
| 2. Connect test lamp from GRA (295) wire to TAN (294) wire at inoperative lock motor connector C502 or C602.                                                                                               | Test lamp lights.         | REPLACE lock motor.                                                                             |
|                                                                                                                                                                                                            | Test lamp does not light. | LOCATE and REPAIR open in TAN (294) wire from lock motor connector C502 or C602 to splice S601. |

## POWER DOOR LOCKS 8A-130-7

### NONE OF THE DOOR LOCK MOTORS LOCK OR UNLOCK (CREW CAB AND SUBURBAN)

| TEST                                                                                                                                                               | RESULT                                         | ACTION                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN/BLK (60) wire at door lock relay connector C250 to ground.                                                                           | Test lamp lights.                              | GO to step 2.                                                                                                                                                                                                                       |
|                                                                                                                                                                    | Test lamp does not light.                      | LOCATE and REPAIR open in ORN/BLK (60) wire between door lock relay connector C250 and splice S278 or between splice S278 and convenience center connector C241 or from ORN (60) wire at convenience center to fuse block.          |
| 2. Connect test lamp from ORN/BLK (60) wire to BLK (150) wire at door lock relay connector C250.                                                                   | Test lamp lights.                              | GO to step 3.                                                                                                                                                                                                                       |
|                                                                                                                                                                    | Test lamp does not light.                      | LOCATE and REPAIR open in BLK (150) wire between door lock relay connector C250 and splice S272 or between splice S272 and convenience center connector C257. Also check BLK (150) wire from convenience center to I/P ground G202. |
| 3. Connect test lamp from TAN (294) or GRA (295) wire(s) at door lock relay connector C250 to ground. Move either door lock switch to the lock or unlock position. | Test lamp lights on both wires.                | LOCATE and REPAIR open in TAN (294)/GRA (295) wire(s) between door lock relay connector C250 and splice S280 or S282.                                                                                                               |
|                                                                                                                                                                    | Test lamp does not light on one or both wires. | REPLACE door lock relay.                                                                                                                                                                                                            |

### BOTH SWITCHES ONLY OPEN ONE DOOR LOCK (CREW CAB AND SUBURBAN)

| TEST                                                                                                                                                                                                                                           | RESULT                    | ACTION                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------|
| 1. Move one of lock switches to UNLOCK position. Disconnect door lock motor connector C502, C552, C602 or C612 at motor that is not working. Connect test lamp from GRA (295) wire at lock motor connector C502, C552, C602 or C612 to ground. | Test lamp lights.         | GO to step 2.                                                                                               |
|                                                                                                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in GRA (295) wire from lock motor connector C502, C552, C602 or C612 to splice S282. |
| 2. Connect test lamp from GRA (295) wire to TAN (294) wire at inoperative lock motor connector C502, C552, C602 or C612.                                                                                                                       | Test lamp lights.         | REPLACE lock motor.                                                                                         |
|                                                                                                                                                                                                                                                | Test lamp does not light. | LOCATE and REPAIR open in TAN (294) wire from lock motor connector C502, C552, C602 or C612 to splice S280. |

### POWER DOOR LOCKS ONLY WORK FROM ONE LOCK SWITCH (ALL VEHICLES)

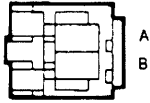
| TEST                                                                                                     | RESULT                    | ACTION                                                                       |
|----------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN/BLK (60) wire at inoperative lock switch connector C501 or C601 to ground. | Test lamp lights.         | REPLACE inoperative lock switch.                                             |
|                                                                                                          | Test lamp does not light. | LOCATE and REPAIR open in ORN/BLK (60) wire from lock switch to splice S278. |

## 8A-130-8 POWER DOOR LOCKS

### CARGO DOOR LOCK MOTOR DOES NOT LOCK AND/OR UNLOCK (SUBURBAN)

| TEST                                                                                                                                                                                                | RESULT                                             | ACTION                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. Open rear cargo doors. Connect test lamp from TAN (294) or GRA (295) wire(s) at cargo door contact button connector C404 to ground. Move either door lock switch to the lock or unlock position. | Test lamp lights.                                  | GO to step 2.                                                                                                               |
|                                                                                                                                                                                                     | Test lamp does not light.                          | LOCATE and REPAIR open in TAN (294) or GRA (295) wire(s) from contact button connector C404 to splice(s) S280 or S282.      |
| 2. Close cargo doors. Connect test lamp from GRA (295) wire at door lock motor connector C901 to ground. Move one lock switch to UNLOCK position.                                                   | Test lamp lights.                                  | GO to step 3.                                                                                                               |
|                                                                                                                                                                                                     | Test lamp does not light.                          | LOCATE and REPAIR open in GRA (295) wire from door lock motor connector C901 to door mounted contact button connector C904. |
| 3. Connect test lamp from GRA (295) wire to TAN (294) wire at door lock motor connector C901. Move one lock switch to LOCK and UNLOCK positions.                                                    | Test lamp lights in both positions.                | REPLACE cargo door lock motor.                                                                                              |
|                                                                                                                                                                                                     | Test lamp does not light in one or both positions. | LOCATE and REPAIR open in TAN (294) wire from door lock motor connector C901 to door mounted contact button connector C904. |

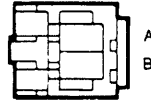
**12004140**



**BLACK**  
Pac/on  
**C502**

**LH Front Power Door Lock Motor**

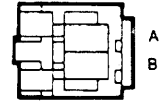
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**BLACK**  
Pac/on  
**C602**

**RH Front Power Door Lock Motor**

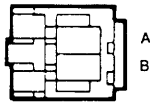
**12004140**



**BLACK**  
Pac/on  
**C552**

**LH Rear Power Door Lock Motor**

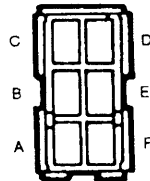
**12004140**



**BLACK**  
Pac/on  
**C612**

**RH Rear Power Door Lock Motor**

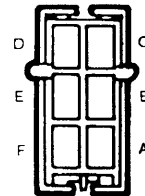
**12015345**



**BLACK**  
Metri-Pack 280  
**C325**

**Crossbody to LH Front Door**

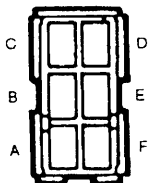
**12015344**



**BLACK**  
Metri-Pack 280  
**C325**

**LH Front Door to Crossbody**

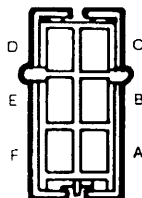
**12015345**



**BLACK**  
Metri-Pack 280  
**C328**

**Crossbody to RH Front Door**

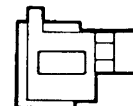
**12015344**



**BLACK**  
Metri-Pack 280  
**C328**

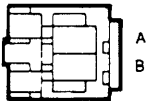
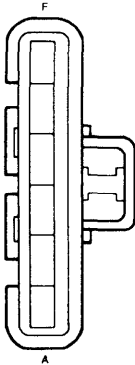
**RH Front Door to Crossbody**

**12059233**



**C241**  
**Power Tap at Convenience Center**

8A-130-10 POWER DOOR LOCKS

|                                                                                                                                                                                          |                                                                                                                                                                                 |                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>12059236</div> <div></div> <div>C257<br/>Ground Tap at Convenience<br/>Center</div>                | <div>12004140</div> <div></div> <div>BLACK<br/>Pac/on<br/>C901<br/>Cargo Door Lock Motor</div> | <div>12033709</div> <div></div> <div>BLACK<br/>Metri-Pack 280<br/>C404<br/>Door Contactor - Body</div> |
| <div>12033709</div> <div></div> <div>BLACK<br/>Metri-Pack 280<br/>C904<br/>Door Contactor - Door</div> | <div>12059561</div> <div></div> <div>C250<br/>Power Door Lock Relay</div>                     |                                                                                                                                                                                           |

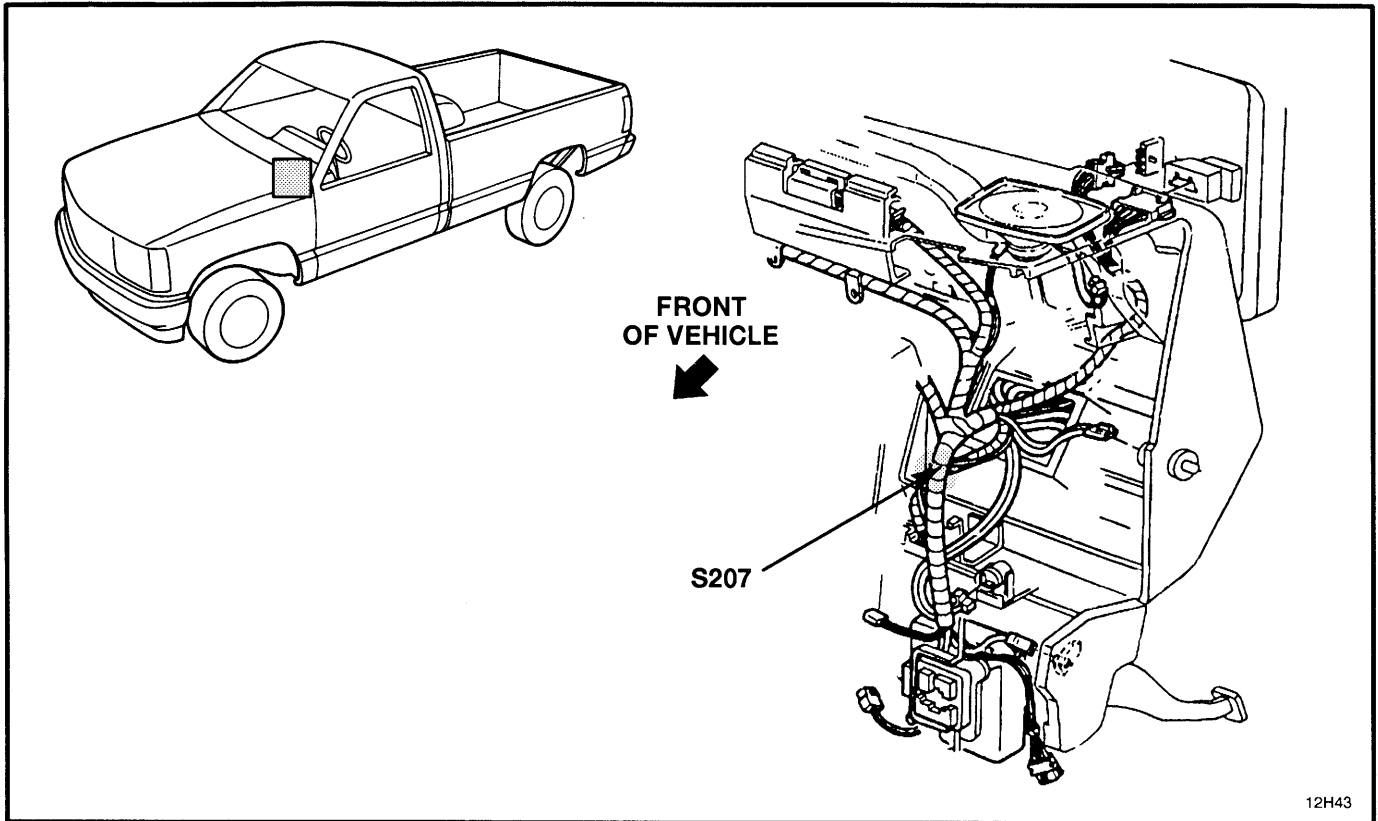


Figure 1 — LH Side of Instrument Panel

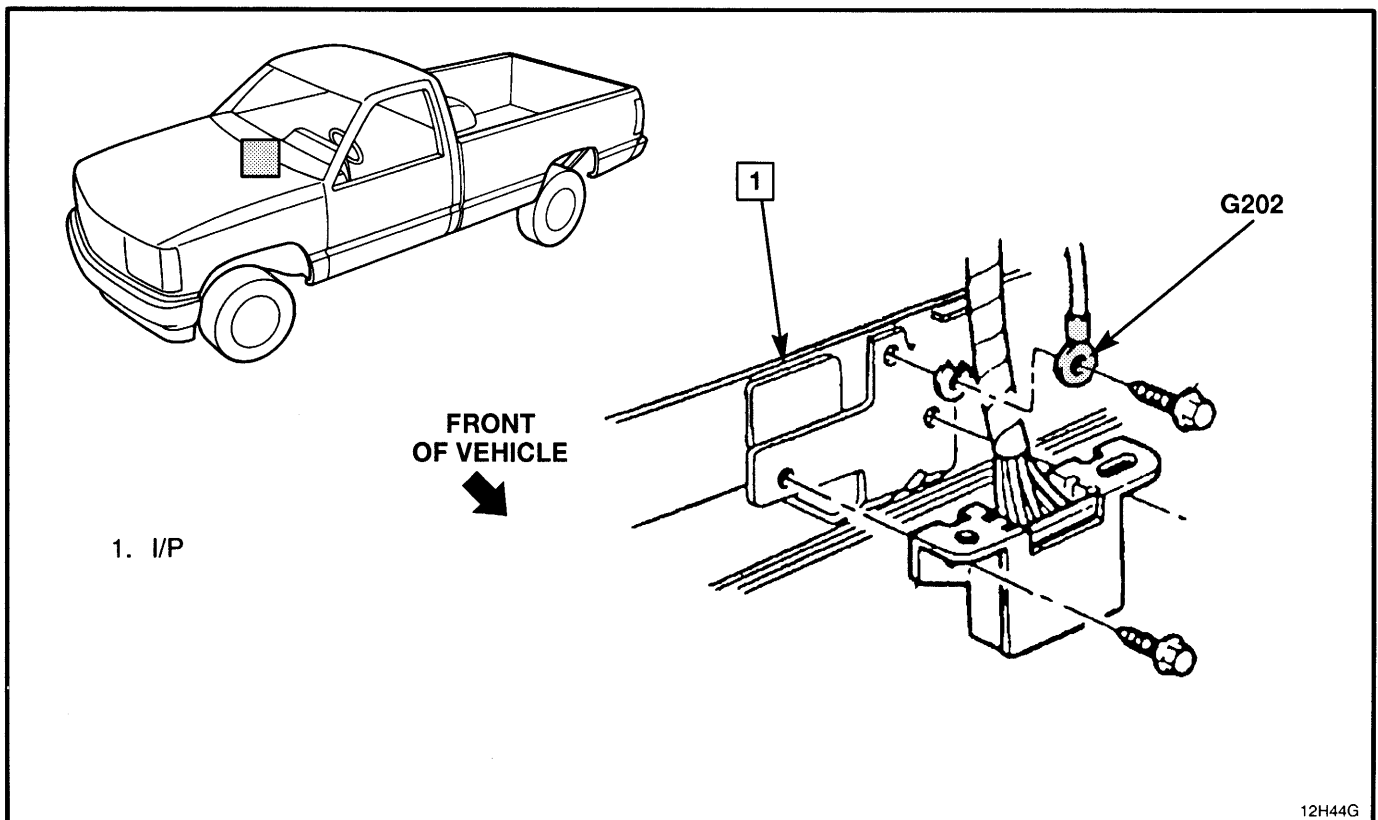


Figure 2 — I/P Ground Wiring

# 8A-130-12 POWER DOOR LOCKS

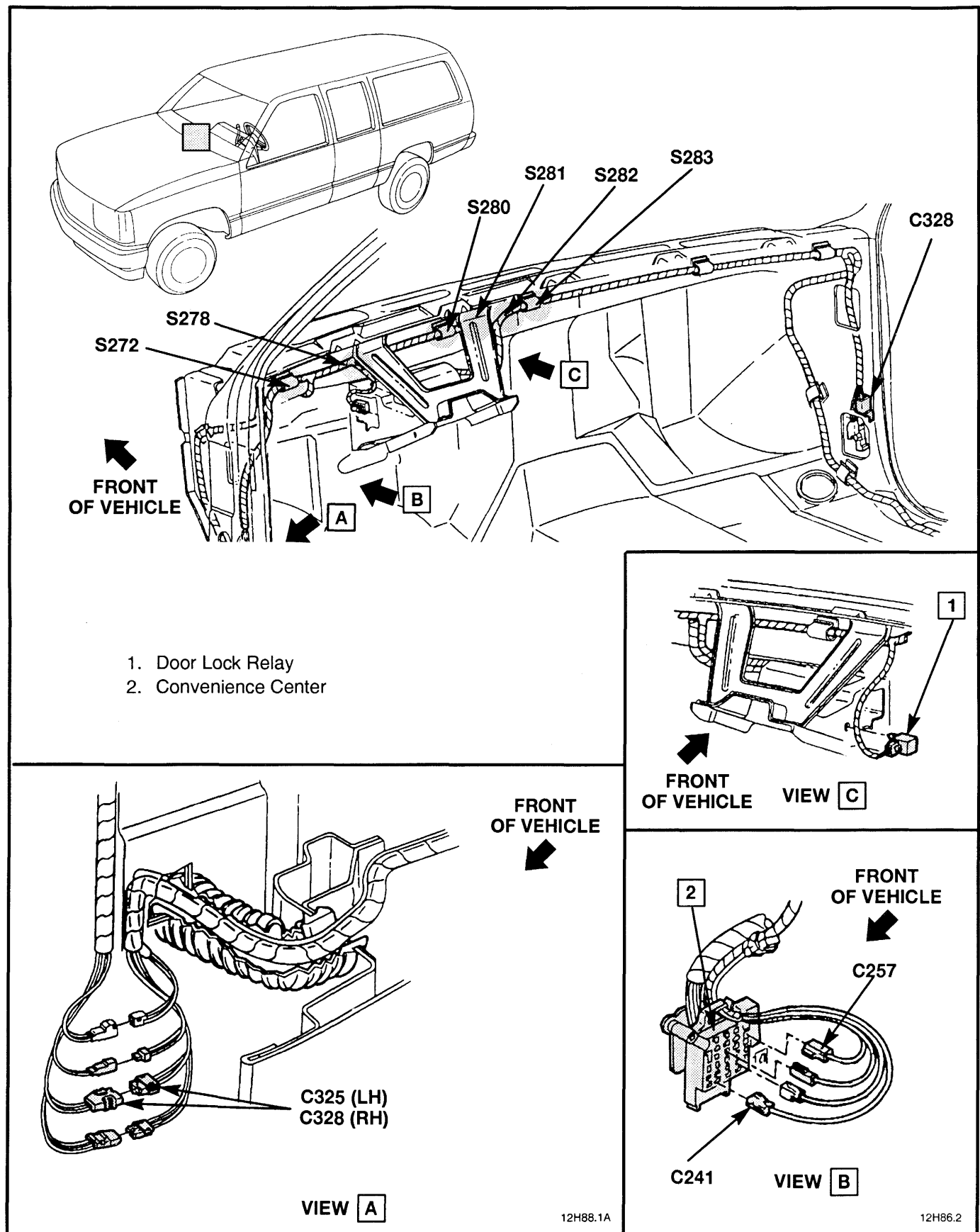


Figure 3 — Crossbody Wiring – Suburban

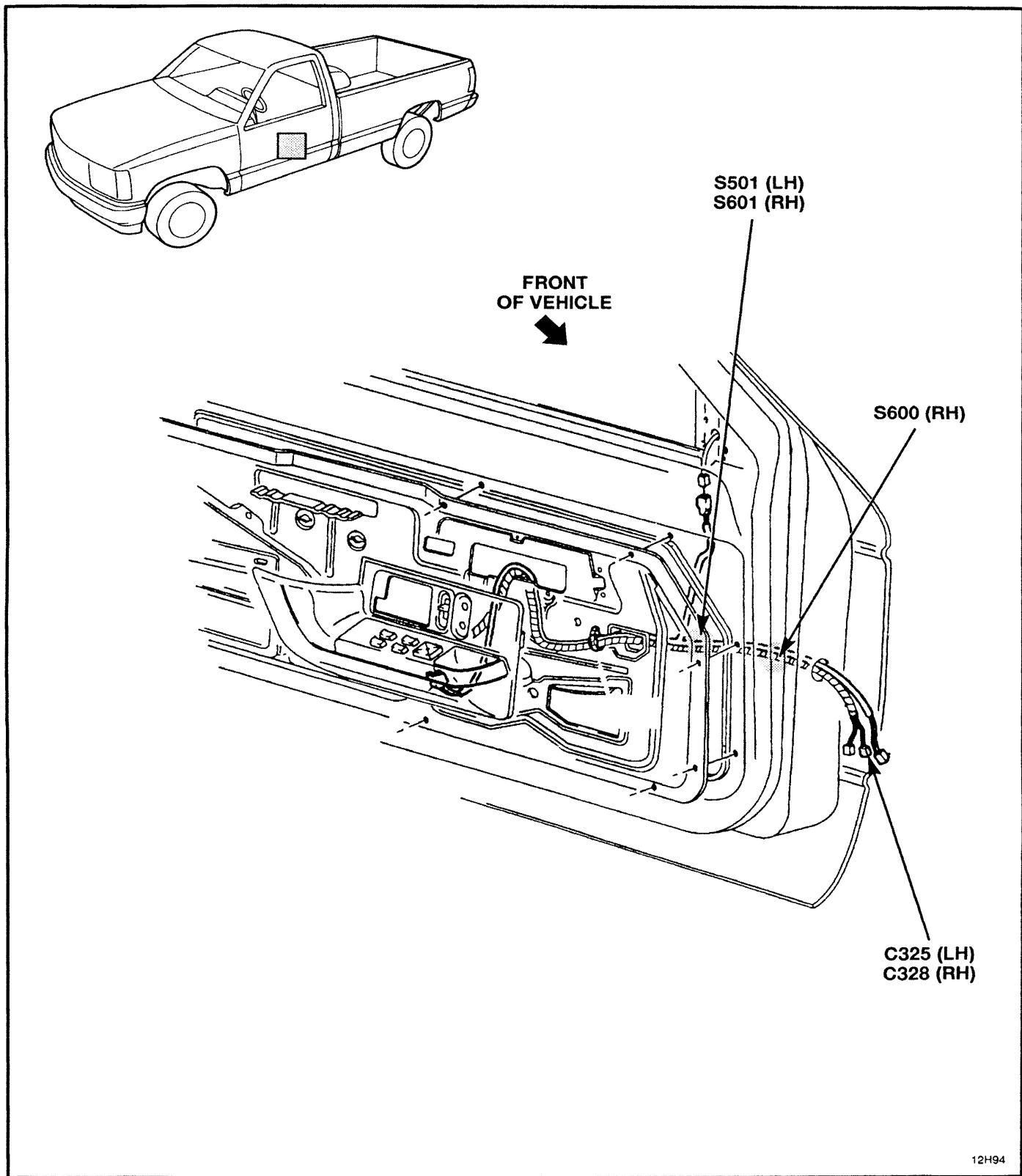


Figure 4 — Door Wiring



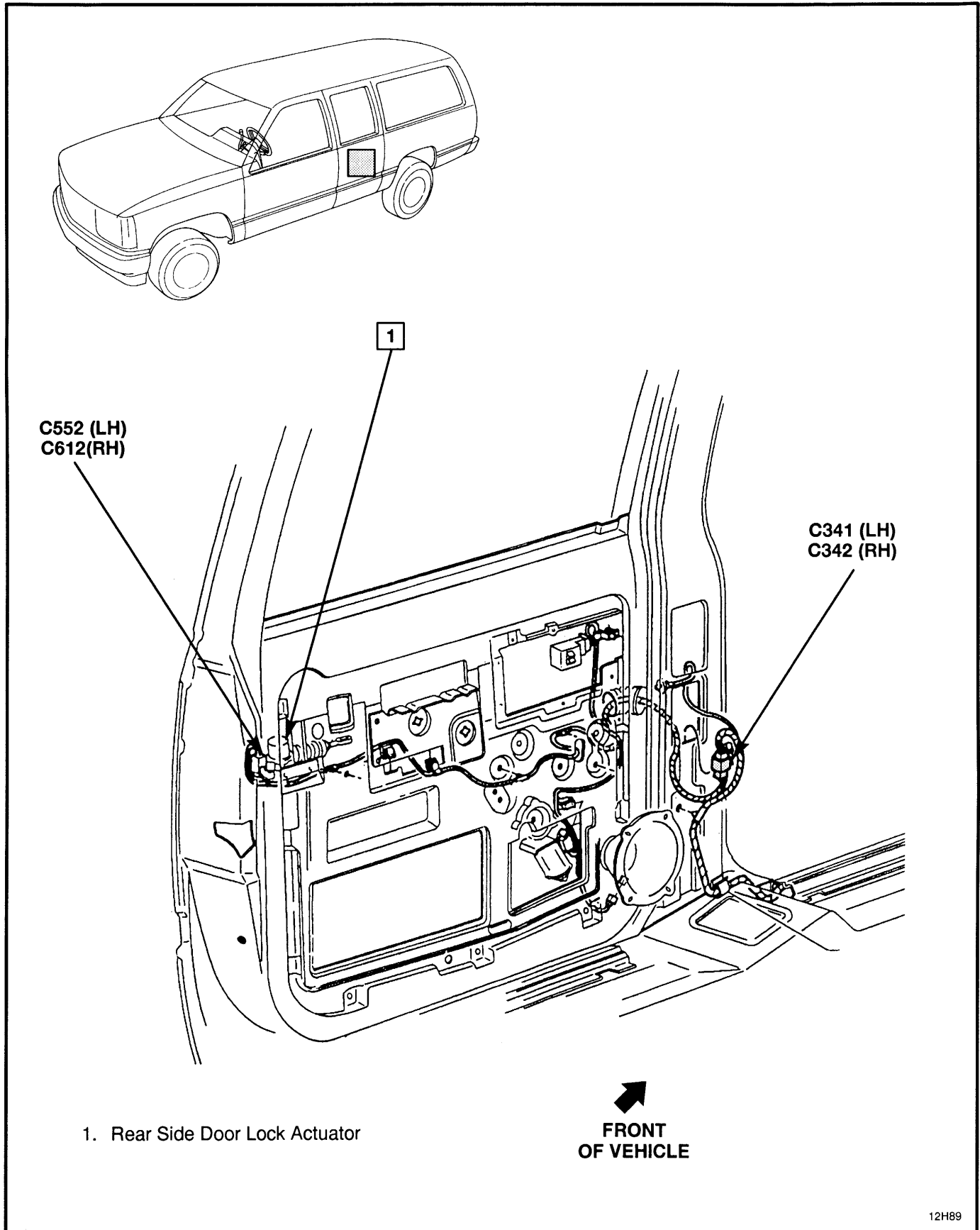


Figure 5 — Rear Side Door Wiring – Suburban and 4-Door

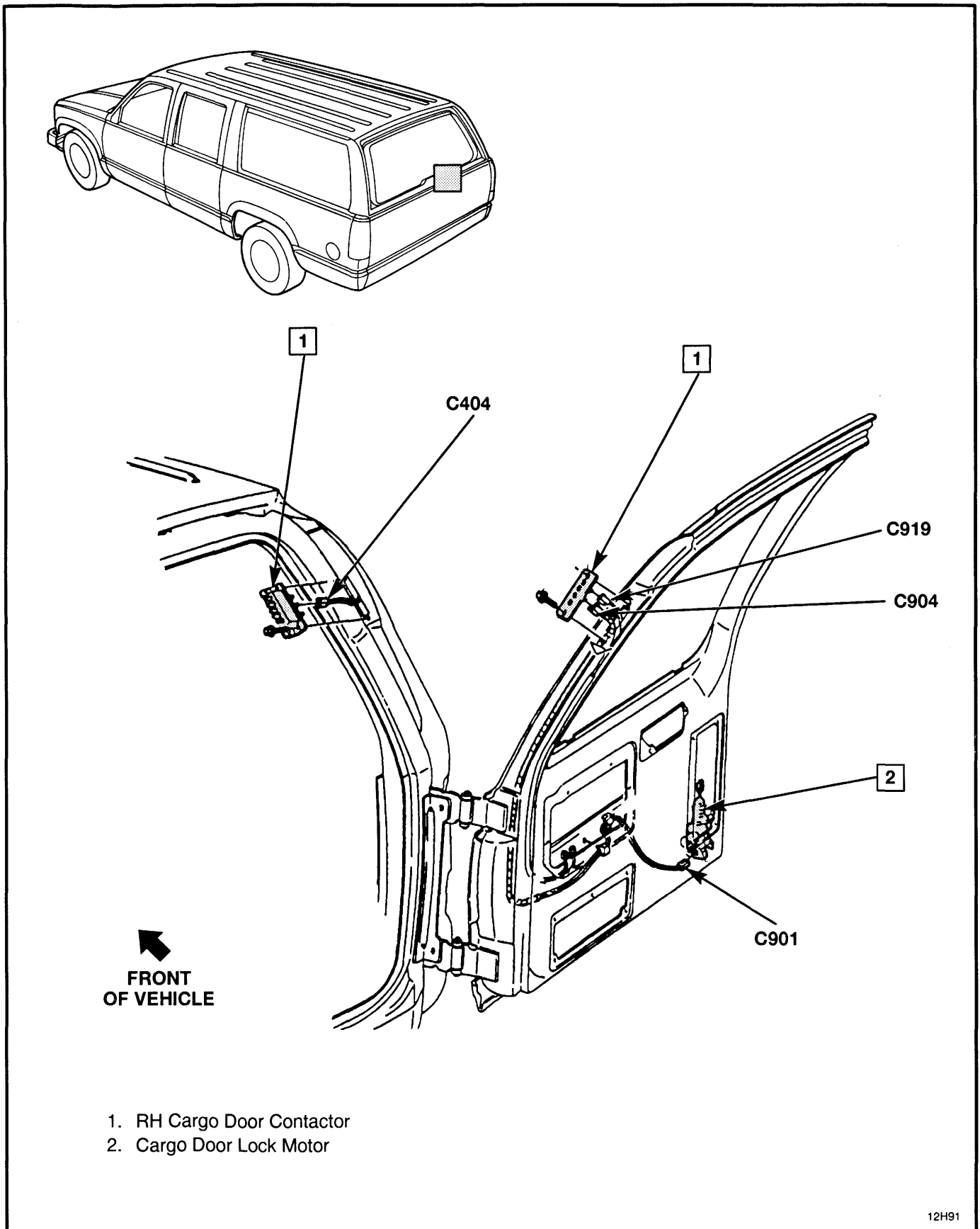


Figure 6 — Power Door Lock — Rear Door Wiring — Suburban

## 8A-130-16 POWER DOOR LOCKS

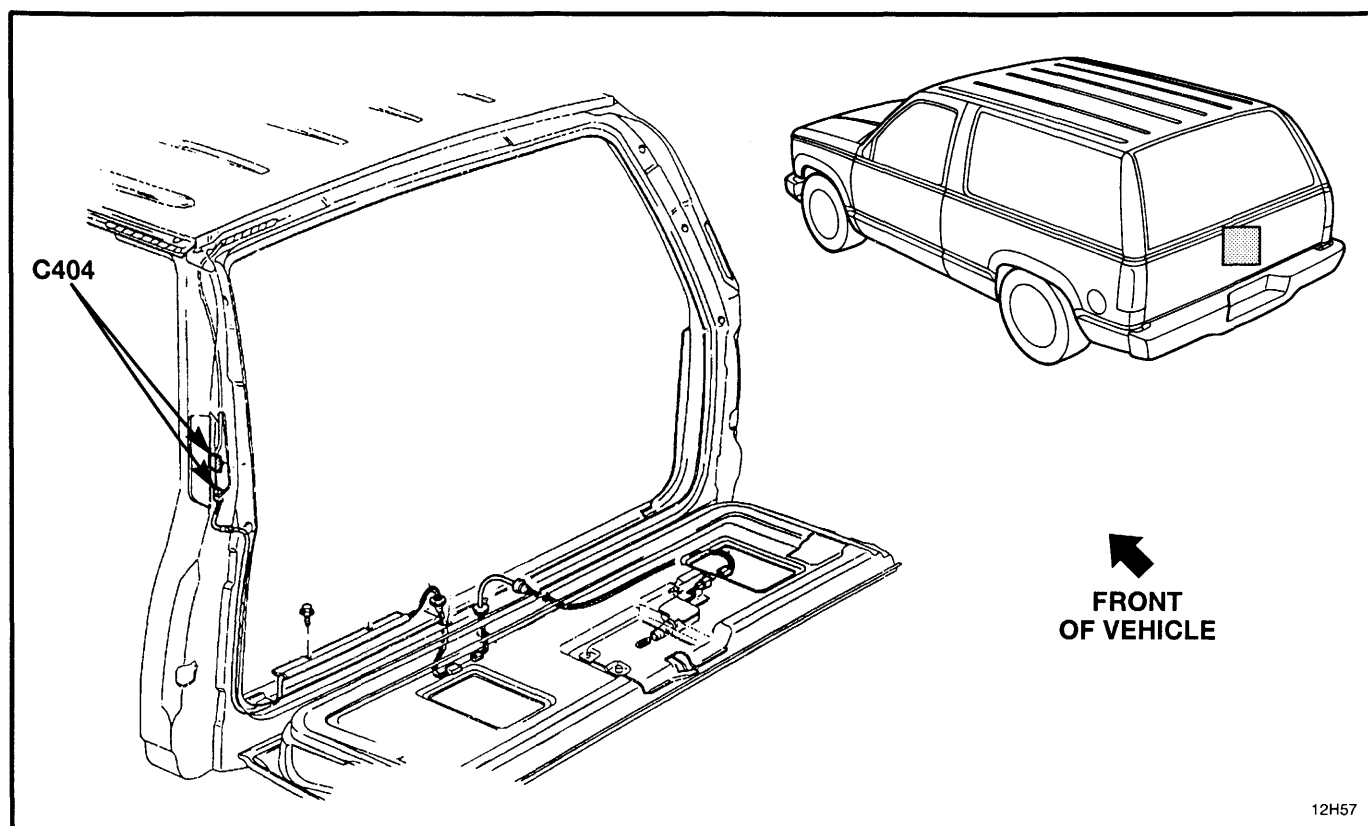


Figure 7 — Rear Window Release Rear Wiring – Utility and Suburban W/Endgate

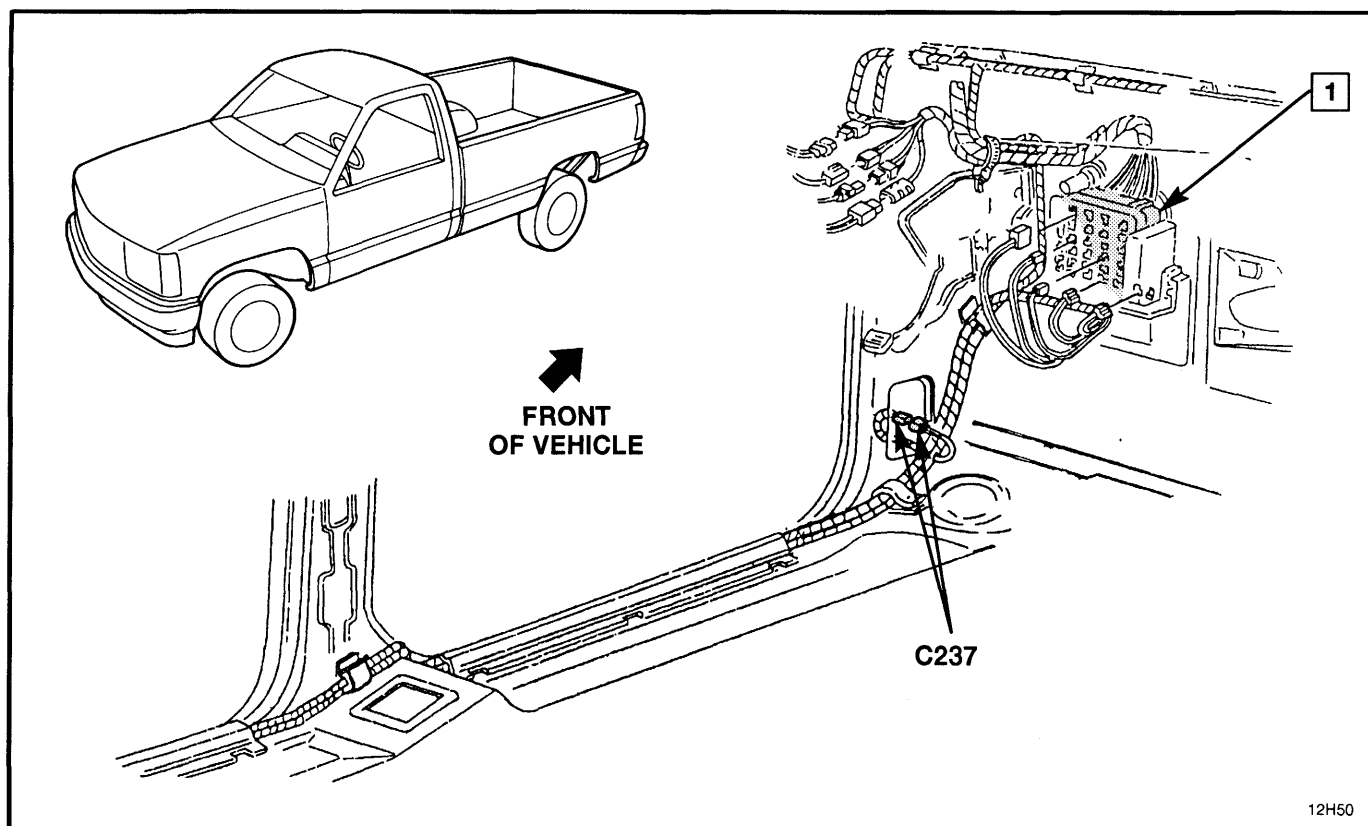


Figure 8 — Body Wiring Harness, Front

## CIRCUIT OPERATION

Voltage to the Rear Window Release system is available at all times through the T/GREL Fuse and the ORN (640) wire. Ground for the Rear Window Release Control Relay is provided through the TAN/WHT (33) wire and the Park Brake Warning Switch on manual transmissions or the ORN/BLK (434) wire and the Park/Neutral Position Switch on automatic transmissions.

These switches are closed to ground with the Parking Brake set or the transmission in PARK or NEUTRAL.

Closing the Rear Window Release Switch allows current to flow through the switch and the BRN (1146) wire to the Rear Window Release Control Relay.

The Relay is energized and current flows through the relay contacts and the DK GRN (1148) wire to energize the Rear Window Release Solenoid, which grounds through the BLK (150) wire at G400 and releases the Rear Window Latch.

## COMPONENT LOCATION

### Page — Figure

|                              |                                    |        |   |
|------------------------------|------------------------------------|--------|---|
| Convenience Center           | Under LH side of I/P               | 135-11 | 7 |
| Park Brake Warning Switch    | At park brake, under LH end of I/P | 135-10 | 5 |
| Park/Neutral Position Switch | Under I/P, above steering column   | 135-9  | 3 |
| Rear Window Release Relay    | Behind LH side of I/P              | 135-8  | 2 |
| Rear Window Release Solenoid | Inside of endgate                  | 135-12 | 9 |
| Rear Window Release Switch   | LH side of I/P                     | 135-8  | 2 |

## CONNECTORS:

|       |                                         |           |   |
|-------|-----------------------------------------|-----------|---|
| C200  | Under RH side of I/P, near blower motor | 135-9     | 4 |
| C200B | Under RH side of I/P, near blower motor | 135-9     | 4 |
| C262  | Under LH end of I/P                     | 135-8     | 2 |
| C296  | Under LH side of I/P                    | Not Shown |   |
| C404  | LH rear door pillar                     | 135-12    | 9 |
| C905  | At lower rear body frame opening        | 135-12    | 9 |
| C906  | At rear window release solenoid         | 135-12    | 9 |

## DIODES:

|      |                        |        |   |
|------|------------------------|--------|---|
| D200 | Near park brake switch | 135-12 | 9 |
|------|------------------------|--------|---|

## GROMMETS:

|      |                                     |           |   |
|------|-------------------------------------|-----------|---|
| P101 | RH lower cowl (engine compartment)  | 135-9     | 4 |
| P409 | At lower rear body opening          | 135-12    | 9 |
| P410 | At lower rear body to endgate       | 135-12    | 9 |
| P910 | At liftgate window release solenoid | Not Shown |   |

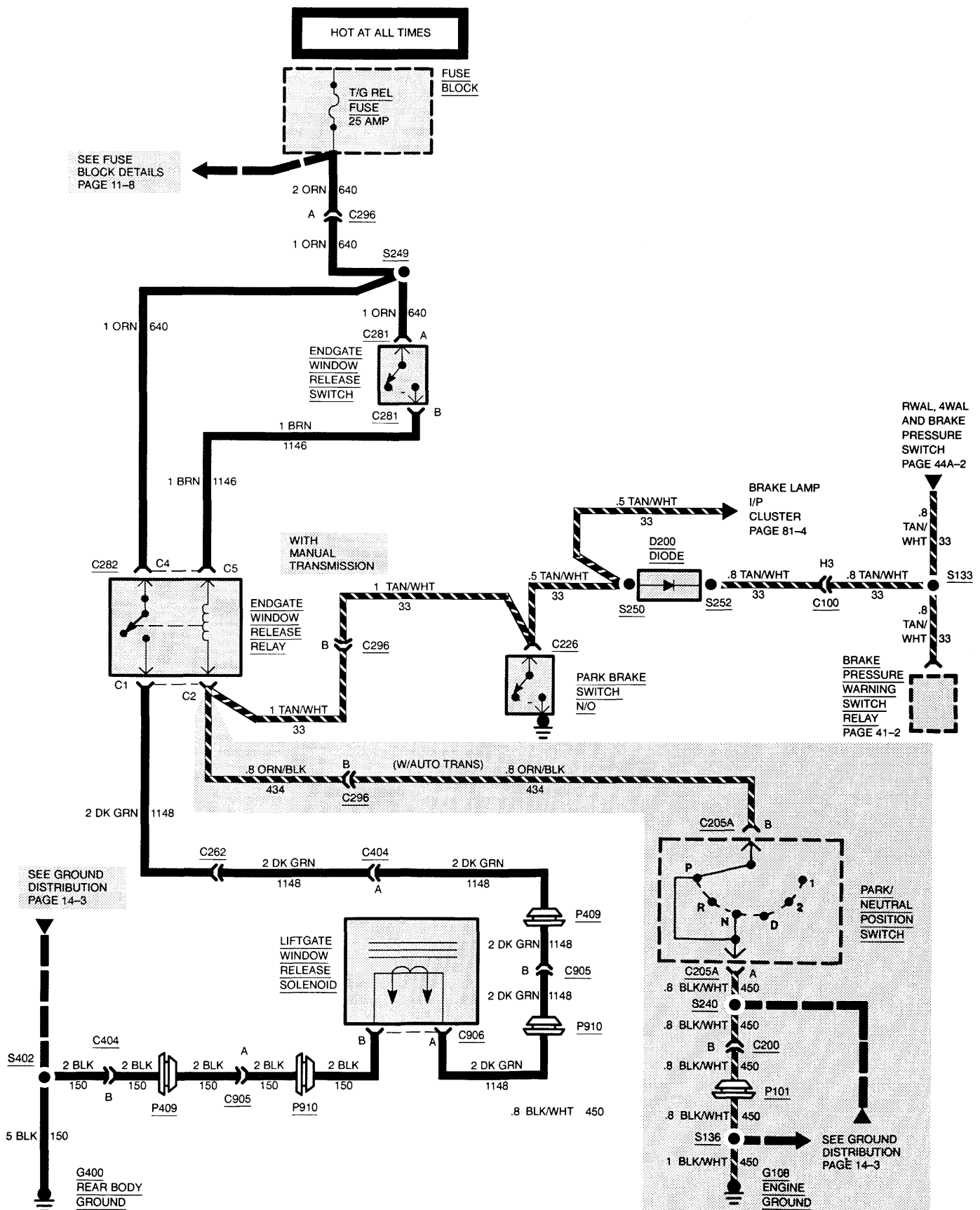
## GROUND:

|      |                            |           |   |
|------|----------------------------|-----------|---|
| G108 | LH top front of engine     | 135-7     | 1 |
| G109 | Top front center of engine | 135-7     | 1 |
| G400 | At RH D-pillar             | Not Shown |   |

## SPLICES:

|      |                                                   |           |   |
|------|---------------------------------------------------|-----------|---|
| S136 | Rear of engine compartment, near center           | 135-7     | 1 |
| S240 | Behind LH side of I/P                             | 135-10    | 6 |
| S242 | Under LH side of I/P                              | 135-10    | 6 |
| S248 | Endgate release harness, near release switch lead | Not Shown |   |
| S402 | Above rear liftgate glass opening                 | 135-11    | 8 |

# 8A-135-2 REAR WINDOW RELEASE



## DIAGNOSIS — REAR LIFTGATE WINDOW RELEASE

### PRELIMINARY CHECKS:

1. Check to see that T/GREL Fuse is not blown. If fuse is blown, locate and repair source of overload, then replace fuse.
2. If fuse is not blown, proceed with the following diagnostic procedures.

### REAR WINDOW RELEASE DOES NOT OPERATE

| TEST                                                                                                                                                               | RESULT                    | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (640) wire at rear window release switch connector C281 to ground.                                                                   | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in ORN (640) wire from rear window release switch connector C281 to fuse panel. Be sure to check all splices and connectors between.                                                                                                                                                                                                                                                                                                                                |
| 2. Connect test lamp from ORN (640) wire at rear window release relay connector C282 to ground.                                                                    | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in ORN (640) wire from rear window release control relay connector C282 to splice S248.                                                                                                                                                                                                                                                                                                                                                                             |
| 3. Connect test lamp from BRN (1146) wire at rear window release switch connector C281 to ground.                                                                  | Test lamp lights.         | GO to step 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                    | Test lamp does not light. | REPLACE rear window release switch.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 4. Connect test lamp from BRN (1146) wire at rear window release control relay connector C282 to ground.                                                           | Test lamp lights.         | GO to step 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                    | Test lamp does not light. | LOCATE and REPAIR open in BRN (1146) wire from rear window release control relay connector C282 to rear window release switch connector C281.                                                                                                                                                                                                                                                                                                                                              |
| 5. Connect test lamp from BRN (1146) wire to ORN/BLK (434) wire (auto trans) or TAN/WHT (33) wire (man trans) at rear window release control relay connector C282. | Test lamp lights.         | GO to step 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                    | Test lamp does not light. | Man Trans Only: LOCATE and REPAIR open in TAN/WHT (33) wire from rear window release control relay connector C282 to park brake switch connector C226. If wire is not open, check adjustment of parking brake switch.<br>Auto Trans Only: LOCATE and REPAIR open in ORN/BLK (434) wire from rear window release control relay connector C282 to grounds G108 or G109. Be sure to check between all splices and connectors. If wire is good, check park/neutral position switch adjustment. |

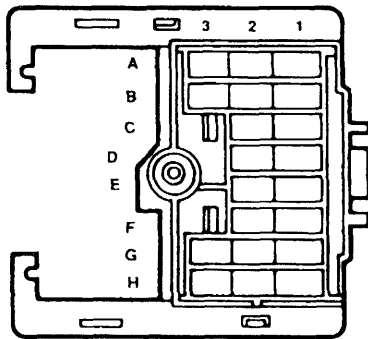
## 8A-135-4 REAR WINDOW RELEASE

### REAR WINDOW RELEASE DOES NOT OPERATE (CONTINUED)

| TEST                                                                                                                                                                                                                | RESULT                    | ACTION                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Apply park brake (man trans) or place transmission in PARK (auto trans). Turn rear window release switch ON. Connect test lamp from DK GRN (1148) wire at rear window release solenoid connector C906 to ground. | Test lamp lights.         | GO to step 7.                                                                                                                                                  |
|                                                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in DK GRN (1148) wire from rear window release solenoid connector C909 to rear window release control relay connector C282.             |
| 7. Connect test lamp from DK GRN (1148) wire to BLK (151) wire at rear window release solenoid connector C906.                                                                                                      | Test lamp lights.         | REPLACE rear window release solenoid.                                                                                                                          |
|                                                                                                                                                                                                                     | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from rear window release solenoid connector C909 to ground G400. Be sure to check between all splices and connectors. |

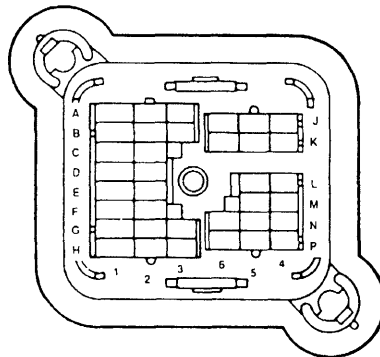
# REAR WINDOW RELEASE 8A-135-5

12020183



**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – Eng

12020184



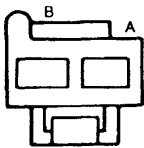
**GRAY**  
Metri-Pack  
**C100**  
Bulkhead Connector – I/P

12015034



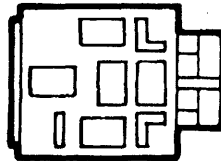
**BLACK**  
56 Series  
**C205A**  
Park/Neutral Position Switch

12041433



**BLACK**  
Metri-Pack 150  
**C281**  
Endgate Window Release Switch

12034003



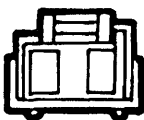
**BLACK**  
Metri-Pack 630  
**C282**  
Endgate Window Release Relay

12034343



**BLACK**  
Metri-Pack  
**C296**  
In-Line I/P to Release Switch

12034344



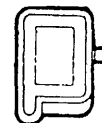
**BLACK**  
Metri-Pack 280  
**C296**  
In-Line Release Switch to I/P

12059884



**C262**  
In-Line Release Relay to  
Extension Harness

12059885

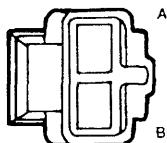


**C262**  
In-Line Extension Harness to  
Release Relay



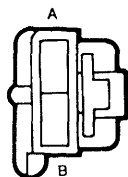
## 8A-135-6 REAR WINDOW RELEASE

12064750



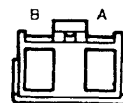
**BLACK**  
Metri-Pack 480  
**C404**  
In-Line Extension to I/P

12064749



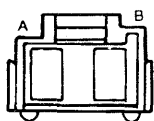
**BLACK**  
Metri-Pack 480  
**C404**  
In-Line I/P to Extension

12015199



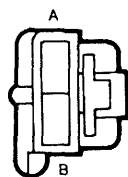
**NATURAL**  
Metri-Pack 280  
**C905**  
In-Line Extension to Solenoid

12015271

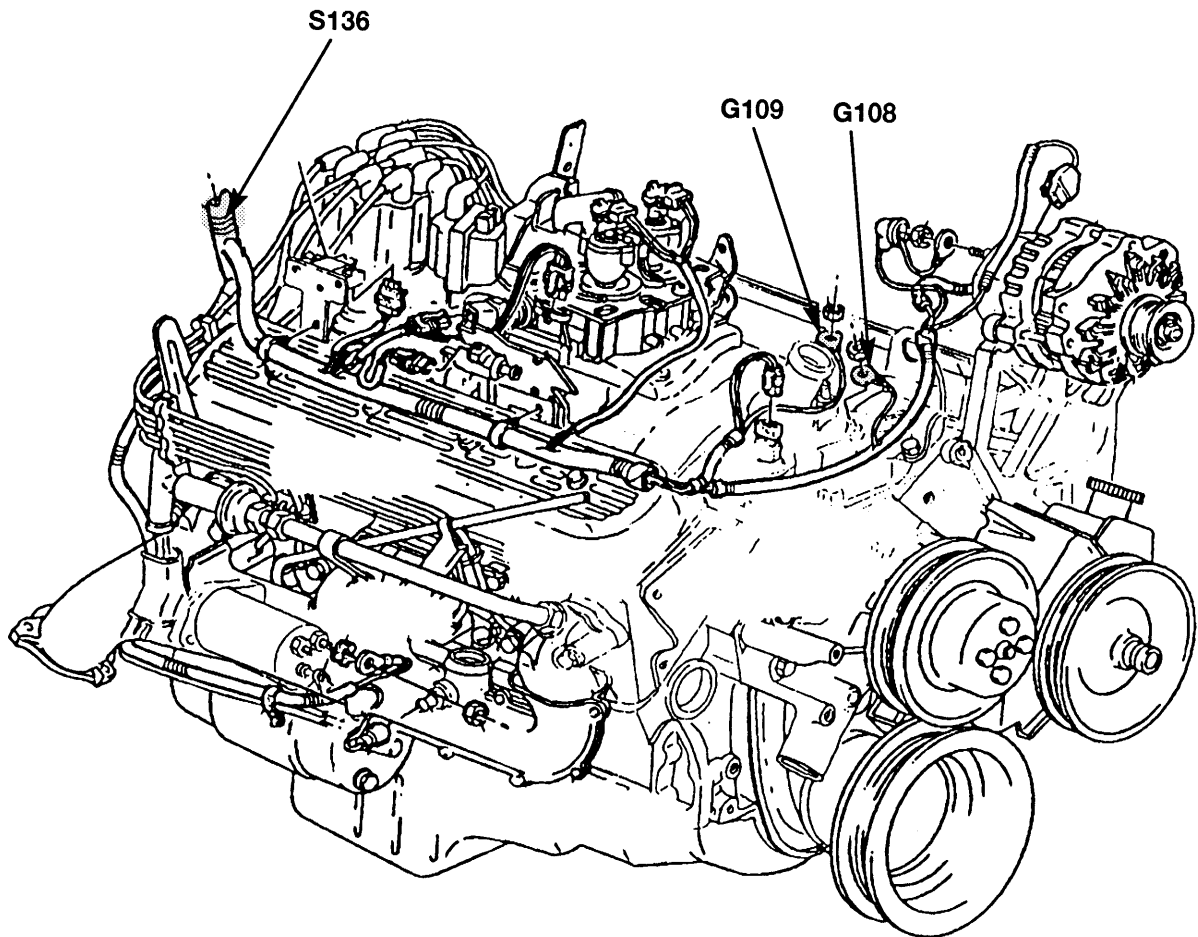
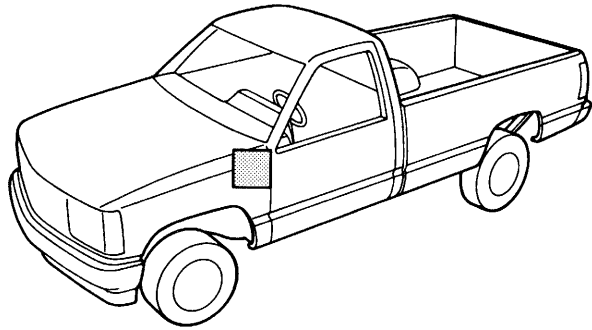


**BLACK**  
Metri-Pack  
**C905**  
In-Line Solenoid to Extension

12064749



**BLACK**  
Metri-Pack 480  
**C906**  
Release Solenoid



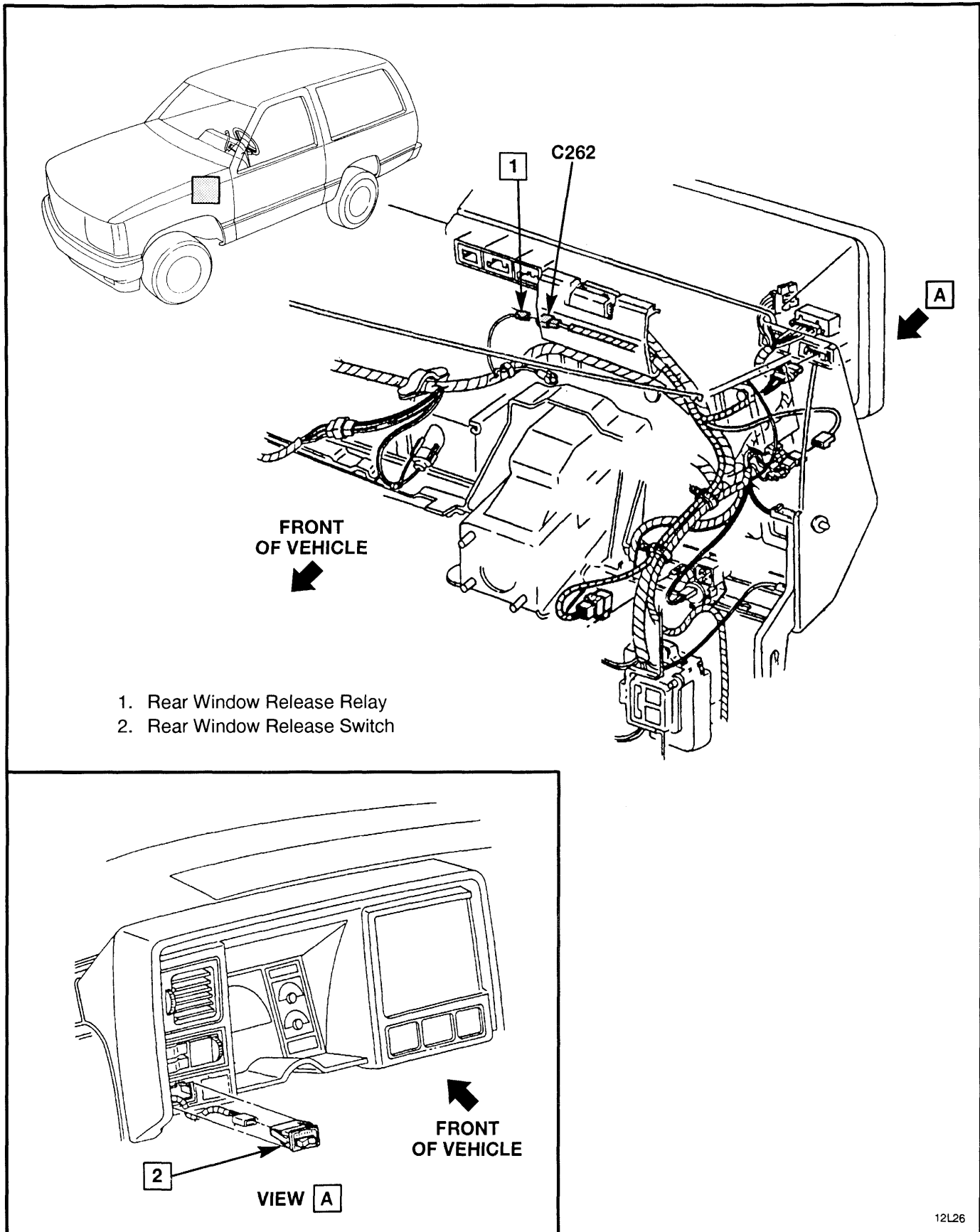
5.0L AND 5.7L ENGINES SHOWN,  
ALL OTHER ENGINES SIMILAR

FRONT  
OF VEHICLE



Figure 1 — LH Side of Engine, 5.0L (305 CID) Engine — Gasoline

## 8A-135-8 REAR WINDOW RELEASE



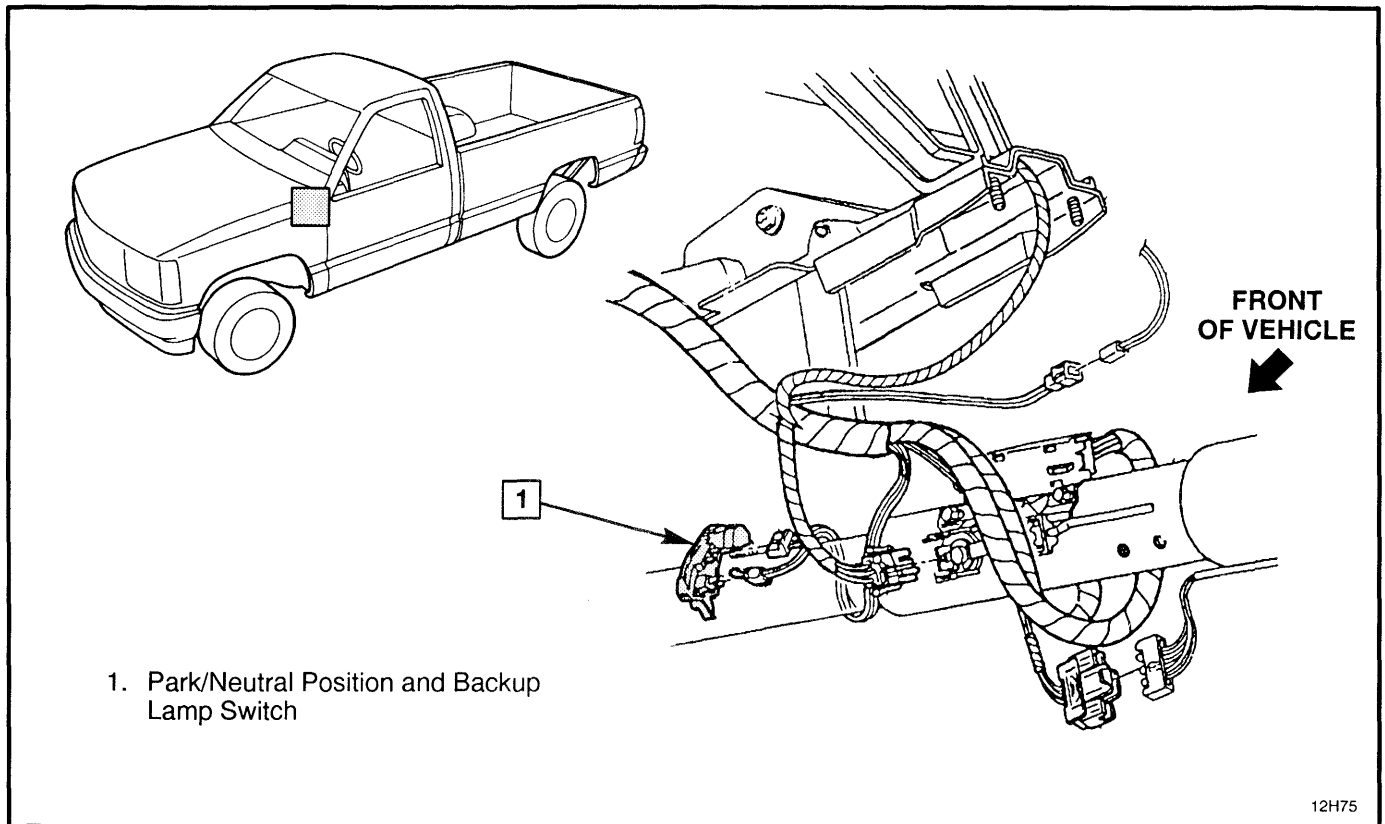


Figure 3 — Steering Column Wiring, LH Side

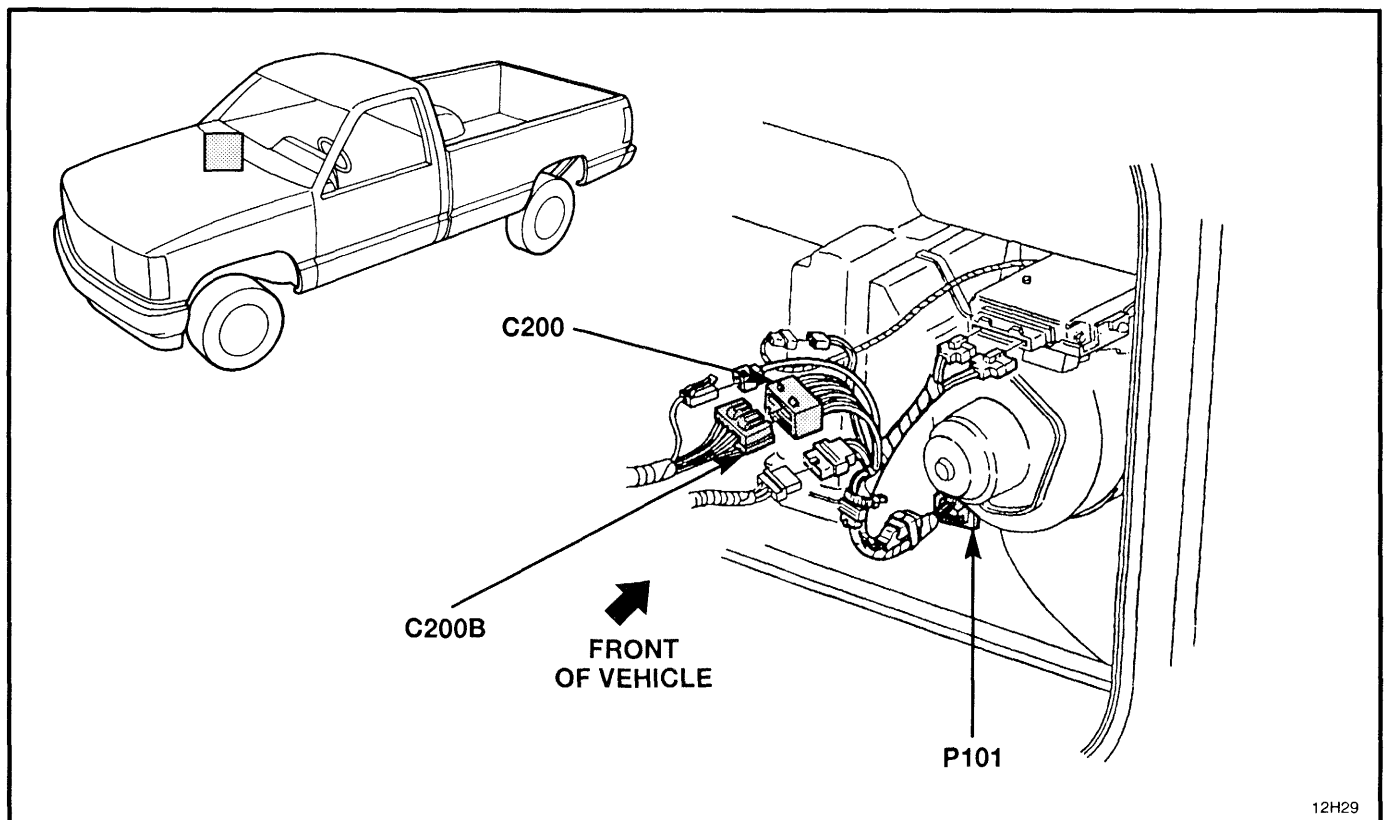


Figure 4 — Behind RH Side of I/P

## 8A-135-10 REAR WINDOW RELEASE

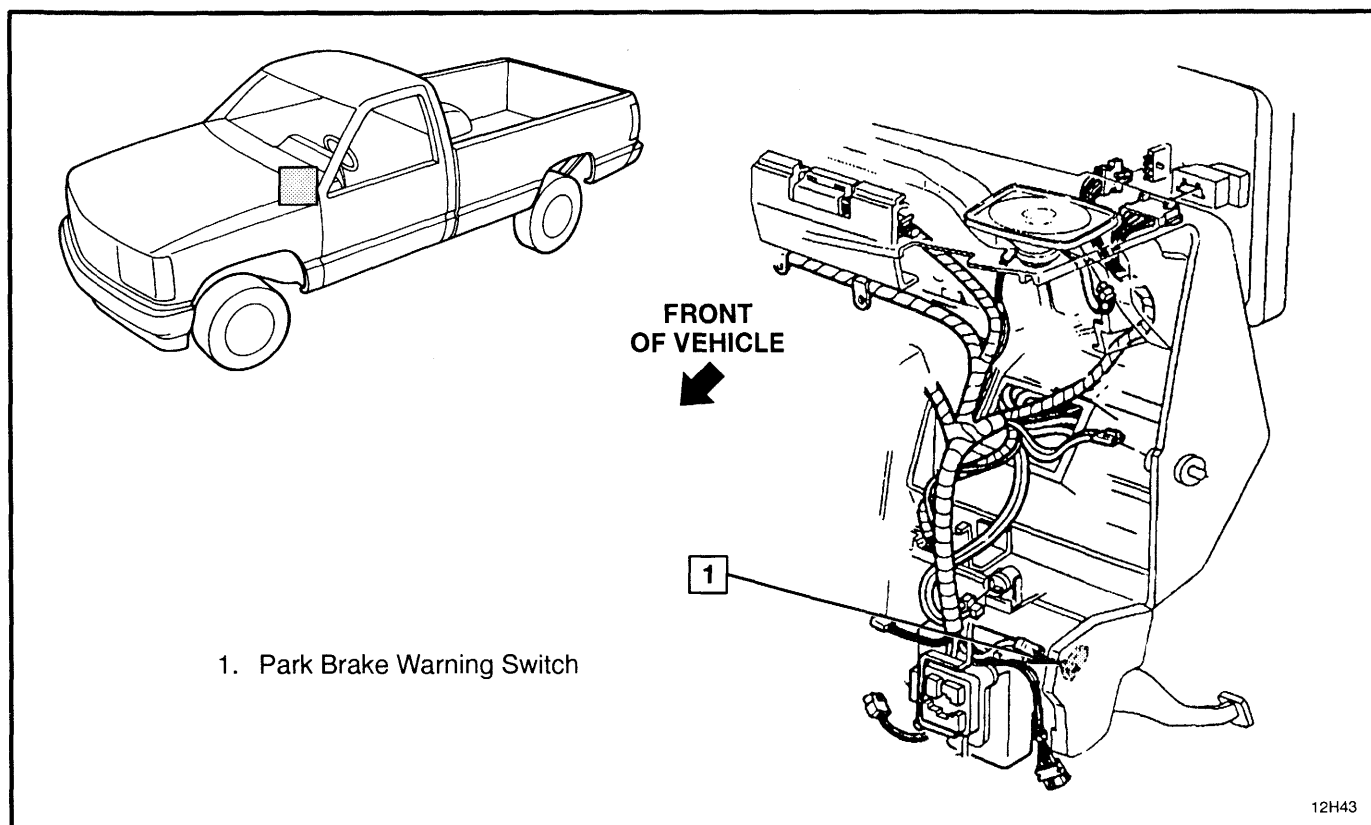


Figure 5 — Instrument Panel, LH Side

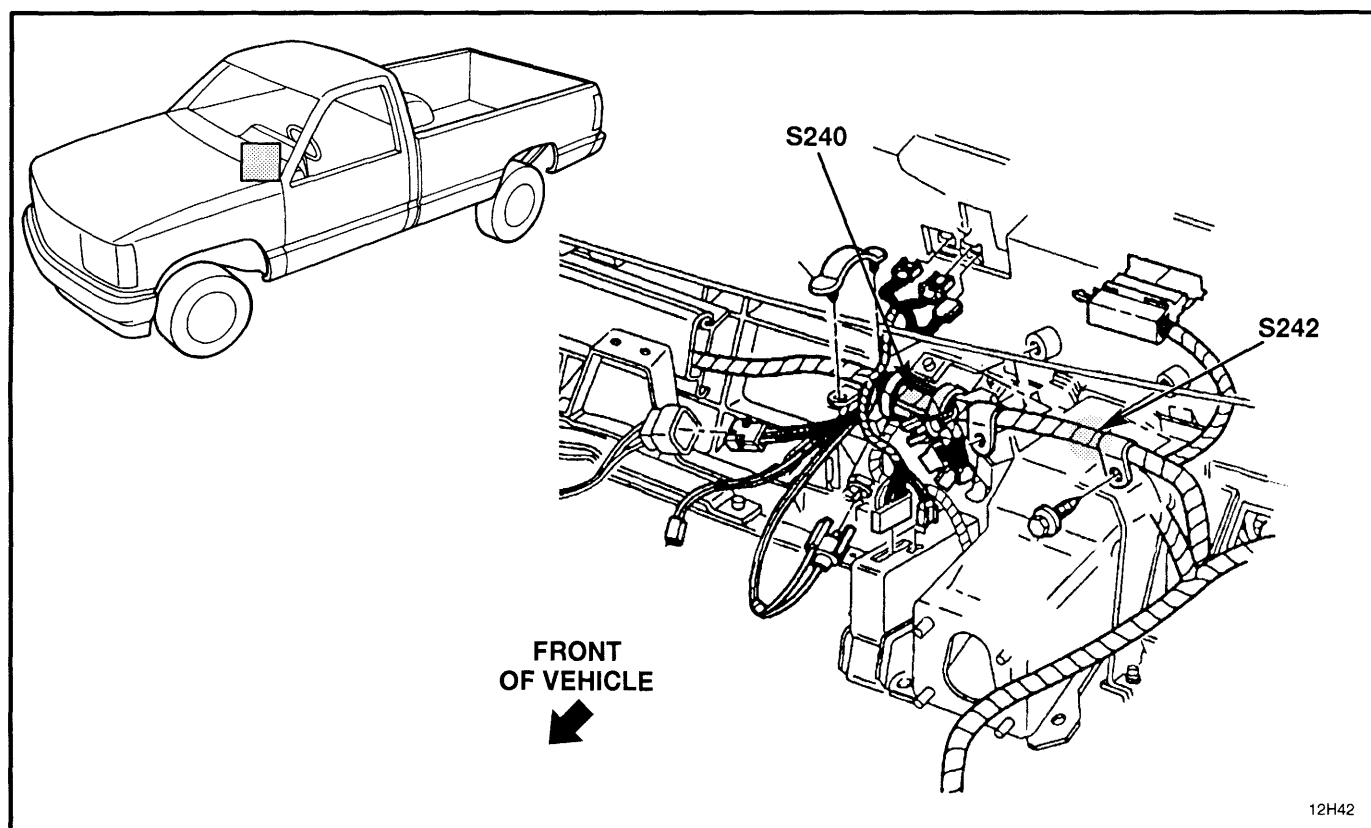


Figure 6 — Instrument Panel, RH Side

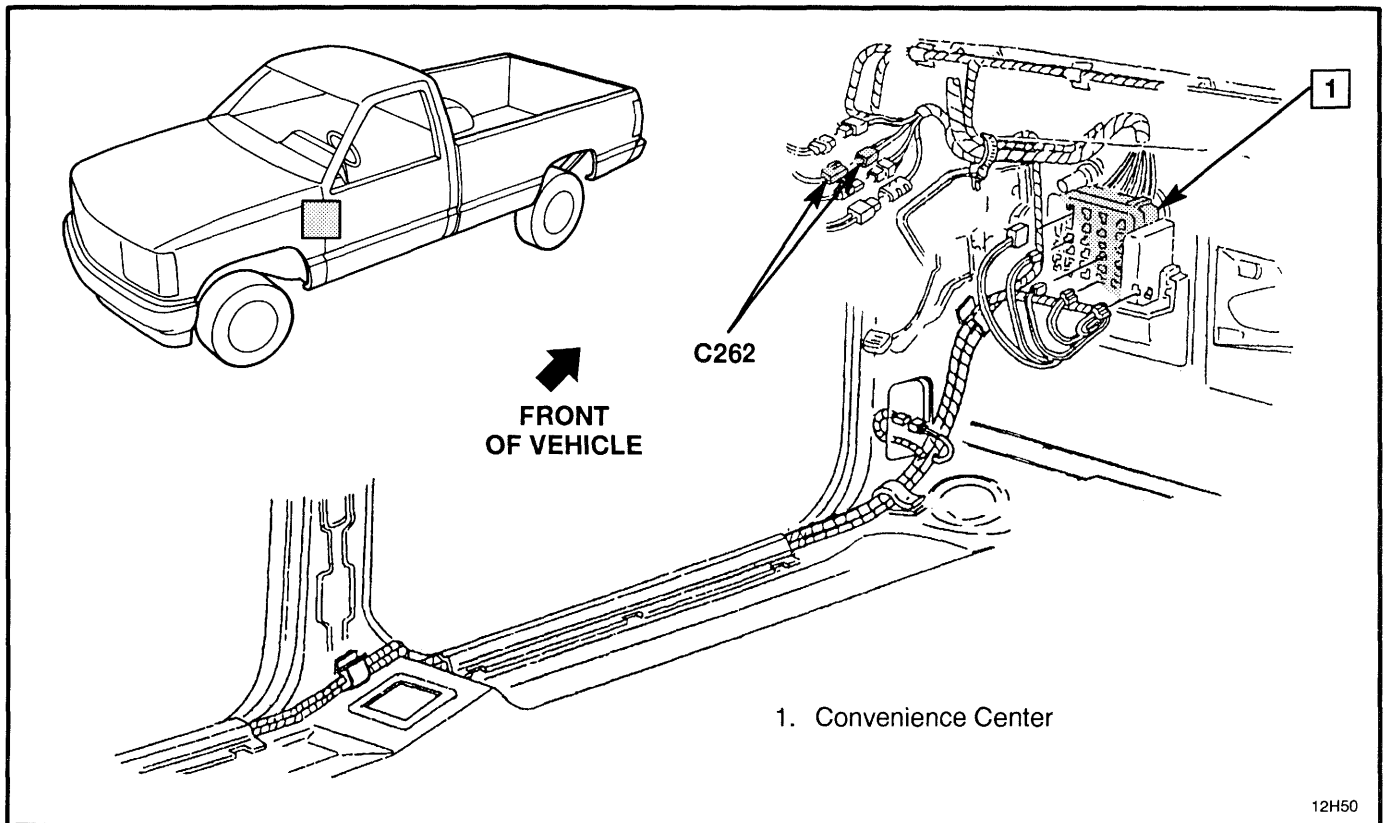


Figure 7 — Body Wiring Harness, Front

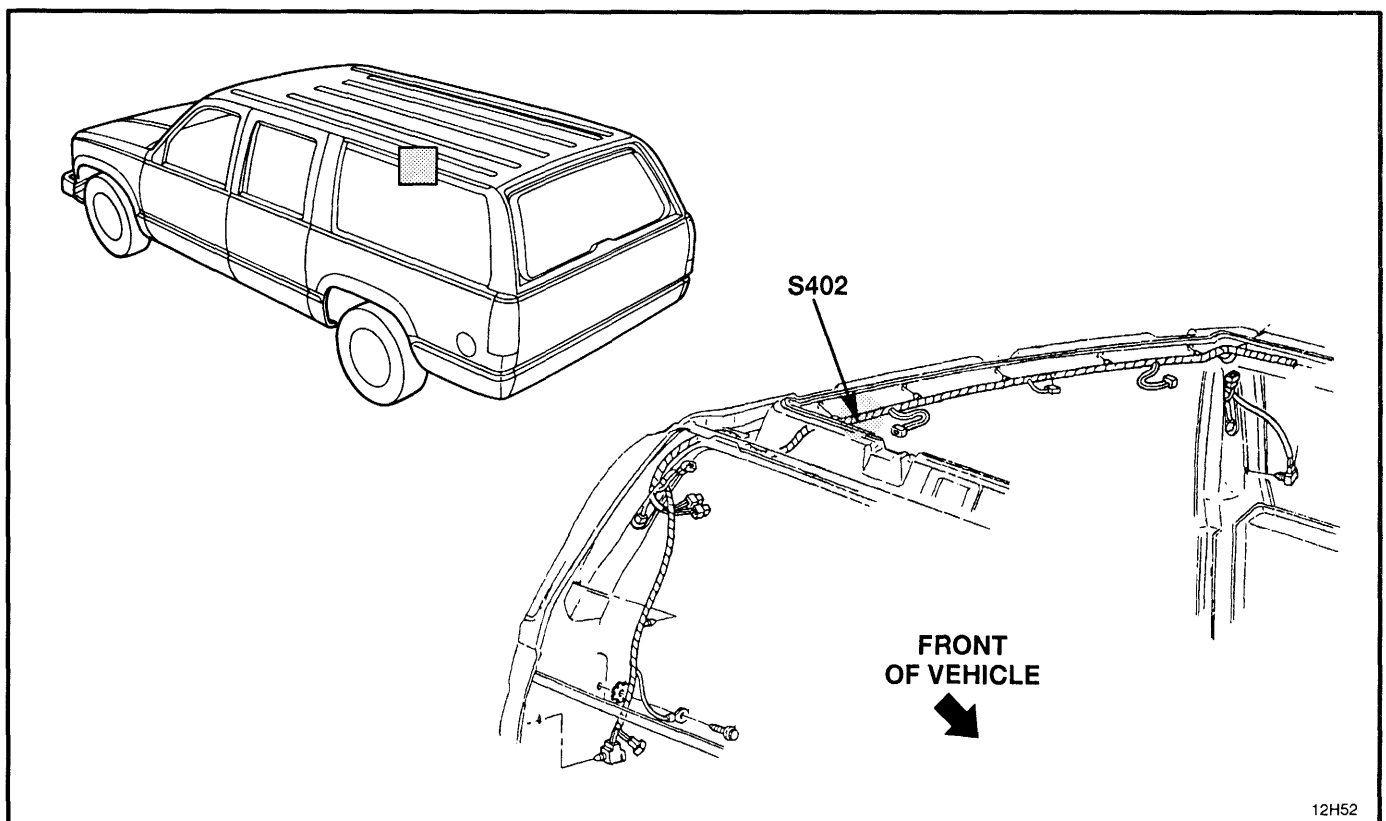


Figure 8 — Body Wiring, Rear - Suburban

## 8A-135-12 REAR WINDOW RELEASE

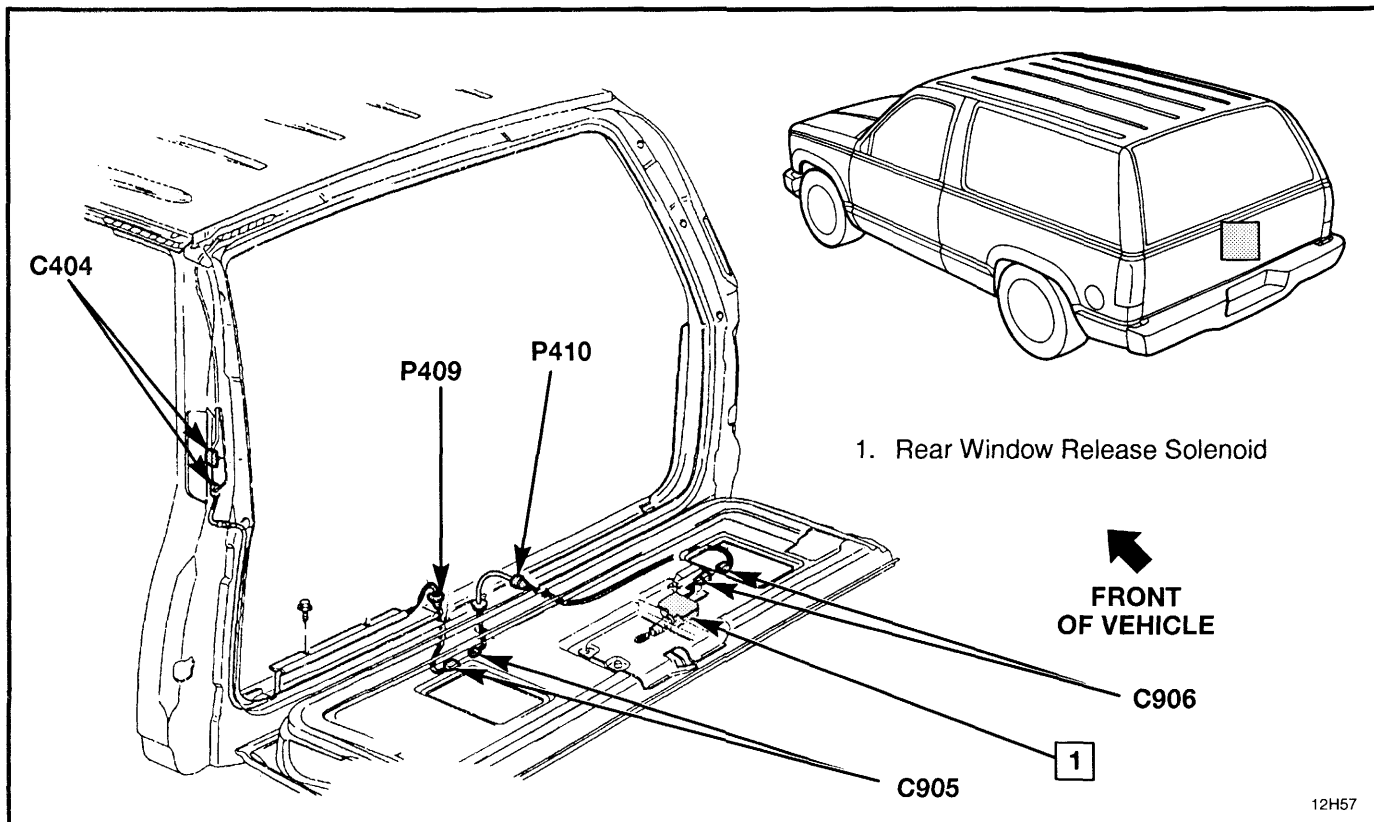


Figure 9 — Rear Window Release Wiring, Rear — Utility and Suburban W/Endgate

CIRCUIT OPERATION

Three reversible motors operate the power seat. One motor raises or lowers the front of the seat. One motor raises or lowers the rear of the seat. The third motor moves the seat forward or back.

Moving the Front Tilt Switch UP supplies voltage to the Front Tilt Motor through the YEL wire (282). The motor is grounded through the Front Tilt Down Switch and the front of the seat is raised. Moving the Front Tilt Switch to the DOWN position reverses the polarity and the front of the seat is lowered.

The Rear Tilt Motor is operated in the same way through the Rear Tilt Switch.

Moving the Forward/Rearward, UP and DOWN Switch up or down operates the Front Tilt Motor and Rear Tilt Motor at the same time.

Moving the Forward/Rearward, UP and DOWN Switch up or down operates the Fore/Aft and the seat moves forward or back.

COMPONENT LOCATION

|                                                    |                            | Page — Figure |   |
|----------------------------------------------------|----------------------------|---------------|---|
| Convenience Center .....                           | Under LH side of I/P ..... | 140-8         | 3 |
| Power Front Seat Control Switch ...                | On driver's seat .....     | 140-8         | 3 |
| Power Front Seat Forward/<br>Rearward Motor, ..... | Under driver's seat .....  | Not Shown     |   |
| Power Front Seat Front Tilt Motor ..               | Under driver's seat .....  | Not Shown     |   |
| Power Front Seat Rear Tilt Motor ...               | Under driver's seat .....  | Not Shown     |   |

CONNECTORS:

|             |                             |       |   |
|-------------|-----------------------------|-------|---|
| C276A ..... | At convenience center ..... | 140-8 | 3 |
| C287A ..... | At convenience center ..... | 140-8 | 3 |
| C387 .....  | Under driver's seat .....   | 140-8 | 3 |

GROUNDS:

|            |                        |       |   |
|------------|------------------------|-------|---|
| G202 ..... | At DLC connector ..... | 140-7 | 2 |
|------------|------------------------|-------|---|

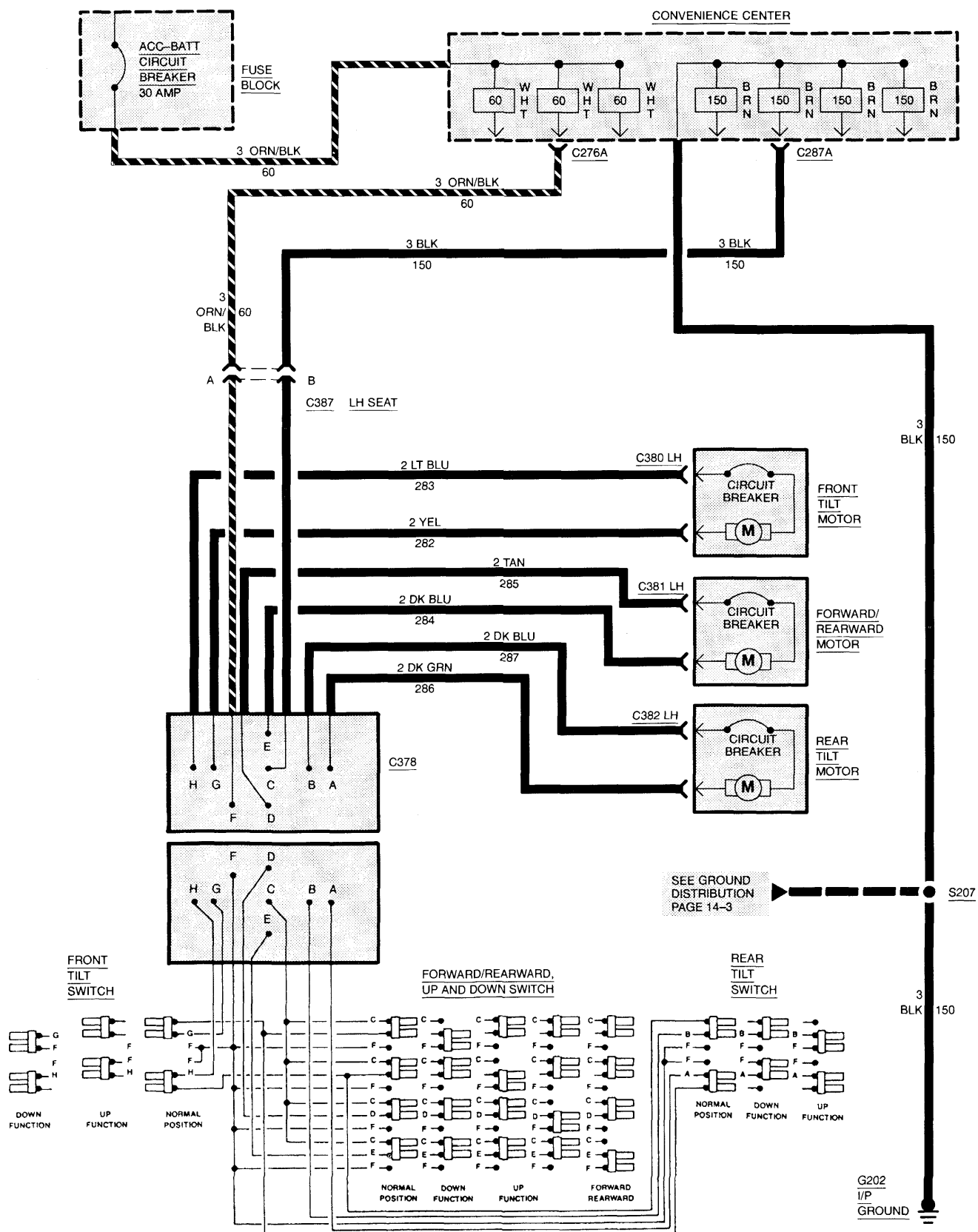
SPLICES:

|            |                            |       |   |
|------------|----------------------------|-------|---|
| S207 ..... | Under LH side of I/P ..... | 140-7 | 1 |
|------------|----------------------------|-------|---|



# 8A-140-2 POWER SEAT

## EXTENDED CAB, CREW CAB, SUBURBAN, YUKON



**DIAGNOSIS — POWER DRIVER'S SEAT****PRELIMINARY CHECKS:**

1. Check to see that the ACC-BATT circuit breaker is resetting. Replace if necessary.
2. Refer to Section 10A2 1994 CK Service Manual for diagnosis and repair of all non-electrical system components.
3. If seat tilts forward and/or rearward but does not move up or down, then REPLACE the forward/rearward up and down switch assembly.

**POWER SEAT DOES NOT OPERATE IN ANY DIRECTION**

| TEST                                                                                                                            | RESULT                    | ACTION                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Remove power seat switch assembly from connector C378. Connect test lamp from ORN/BLK (60) wire at connector C378 to ground. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                 |
|                                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in ORN/BLK (60) wire from seat switch connector C378 to connector C377, from connector C377 to convenience center connector C276A, or from convenience center connector to fuse block. |
| 2. Connect test lamp from BLK (150) wire to ORN/BLK (60) wire at seat switch connector C378.                                    | Test lamp lights.         | GO to "Power Seat Does Not Tilt Forward" diagnosis.                                                                                                                                                           |
|                                                                                                                                 | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire from seat switch assembly connector C378 to convenience center connector C277A, from convenience center to splice S207 or from splice S207 to ground G202.           |

**POWER SEAT DOES NOT TILT FORWARD**

| TEST                                                                                                                                                                                                                                | RESULT               | ACTION                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------|
| 1. Using jumper lead, connect YEL (282) wire to BLK (150) wire cavity at seat switch assembly connector C378. Connect jumper momentarily from LT BLU (283) wire to ORN/BLK (60) wire cavity at seat switch assembly connector C378. | Motor moves.         | REPLACE switch assembly.            |
|                                                                                                                                                                                                                                     | Motor does not move. | GO to step 2.                       |
| 2. Connect LT BLU (283) wire to BLK (150) wire at power seat switch assembly connector C378 with jumper lead. Momentarily connect YEL (282) wire cavity to ORN/BLK (60) wire cavity with jumper lead.                               | Motor moves.         | REPLACE power seat switch assembly. |
|                                                                                                                                                                                                                                     | Motor does not move. | GO to step 3.                       |

## 8A-140-4 POWER SEAT

### POWER SEAT DOES NOT TILT FORWARD (CONTINUED)

| TEST                                                                                                                                                                                                                              | RESULT         | ACTION                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 3. Connect YEL (282) wire to LT BLU (283) wire at power seat switch assembly connector C378. Remove connector C380 from front tilt motor. Using ohmmeter check YEL (282) wire and LT BLU (283) wire for continuity to each other. | Continuity.    | REPLACE front tilt motor.                                                                                                                         |
|                                                                                                                                                                                                                                   | No continuity. | LOCATE and REPAIR open YEL (282) wire and/or LT BLU (283) wire from front tilt motor connector C380 to power seat switch assembly connector C378. |

### POWER SEAT DOES NOT TILT TO THE REAR

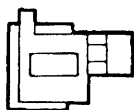
| TEST                                                                                                                                                                                                                                   | RESULT               | ACTION                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect DK GRN (286) wire to BLK (150) wire at power seat switch assembly connector C378 with jumper lead. Momentarily connect DK BLU (287) wire cavity to ORN/BLK (60) wire cavity with jumper lead.                               | Motor moves.         | REPLACE power seat switch assembly.                                                                                                                    |
|                                                                                                                                                                                                                                        | Motor does not move. | GO to step 2.                                                                                                                                          |
| 2. Connect DK BLU (287) wire to BLK (150) wire at power seat switch assembly connector C378 with jumper lead. Momentarily connect DK GRN (286) wire cavity to ORN/BLK (60) wire cavity with jumper lead.                               | Motor moves.         | REPLACE power seat switch assembly.                                                                                                                    |
|                                                                                                                                                                                                                                        | Motor does not move. | GO to step 3.                                                                                                                                          |
| 3. Connect DK GRN (286) wire to DK BLU (287) wire at power seat switch assembly connector C378. Remove connector C382 from rear tilt motor. Using ohmmeter check DK GRN (286) wire and DK BLU (287) wire for continuity to each other. | Continuity.          | REPLACE rear tilt motor.                                                                                                                               |
|                                                                                                                                                                                                                                        | No continuity.       | LOCATE and REPAIR open in DK GRN (286) wire and/or DK BLU (287) wire from rear tilt motor connector C382 to power seat switch assembly connector C378. |

**POWER SEAT DOES NOT MOVE FORWARD/REARWARD**

| TEST                                                                                                                                                                                                                                    | RESULT               | ACTION                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect LT GRN (284) wire to BLK (150) wire at power seat switch assembly connector C378 with jumper lead. Momentarily connect TAN (285) wire cavity to ORN/BLK wire cavity with jumper lead.                                        | Motor moves.         | REPLACE power seat switch assembly.                                                                                                                        |
|                                                                                                                                                                                                                                         | Motor does not move. | GO to step 2.                                                                                                                                              |
| 2. Connect TAN (285) wire to BLK (150) wire cavity at power seat switch assembly connector C378 with jumper lead. Momentarily connect LT GRN (284) wire cavity to ORN/BLK (60) wire cavity with jumper lead.                            | Motor moves.         | REPLACE power seat switch assembly.                                                                                                                        |
|                                                                                                                                                                                                                                         | Motor does not move. | GO to step 3.                                                                                                                                              |
| 3. Connect TAN (285) wire to LT GRN (284) wire at power seat switch assembly connector C378. Remove connector C381 from forward/rearward motor. Using ohmmeter check TAN (285) wire and LT GRN (284) wire for continuity to each other. | Continuity.          | REPLACE forward/rearward motor.                                                                                                                            |
|                                                                                                                                                                                                                                         | No continuity.       | LOCATE and REPAIR open in TAN (285) wire and/or LT GRN (284) wire from forward/rearward motor connector C381 to power seat switch assembly connector C378. |

# 8A-140-6 POWER SEAT

12059233



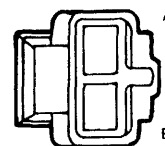
**C276A**  
Convenience Center Power Tap

12059236



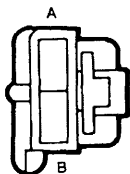
**C287A**  
Convenience Center Ground Tap

12064750



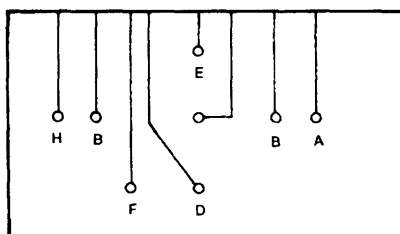
**BLACK**  
Metri-Pack 480  
**C387**  
Convenience Center to Power  
Seat In-Line

12064749



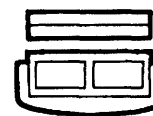
**BLACK**  
Metri-Pack 480  
**C387**  
Power Seat to Convenience  
Center In-Line

12047681



**BLACK**  
Metri-Pack 480  
**C378**  
Power Seat Switch

12052110



**NATURAL**  
Metri-Pack 480  
**C380**  
Front Tilt Motor

12052109



**BLUE**  
Metri-Pack 480  
**C381**  
Forward/Rearward Motor

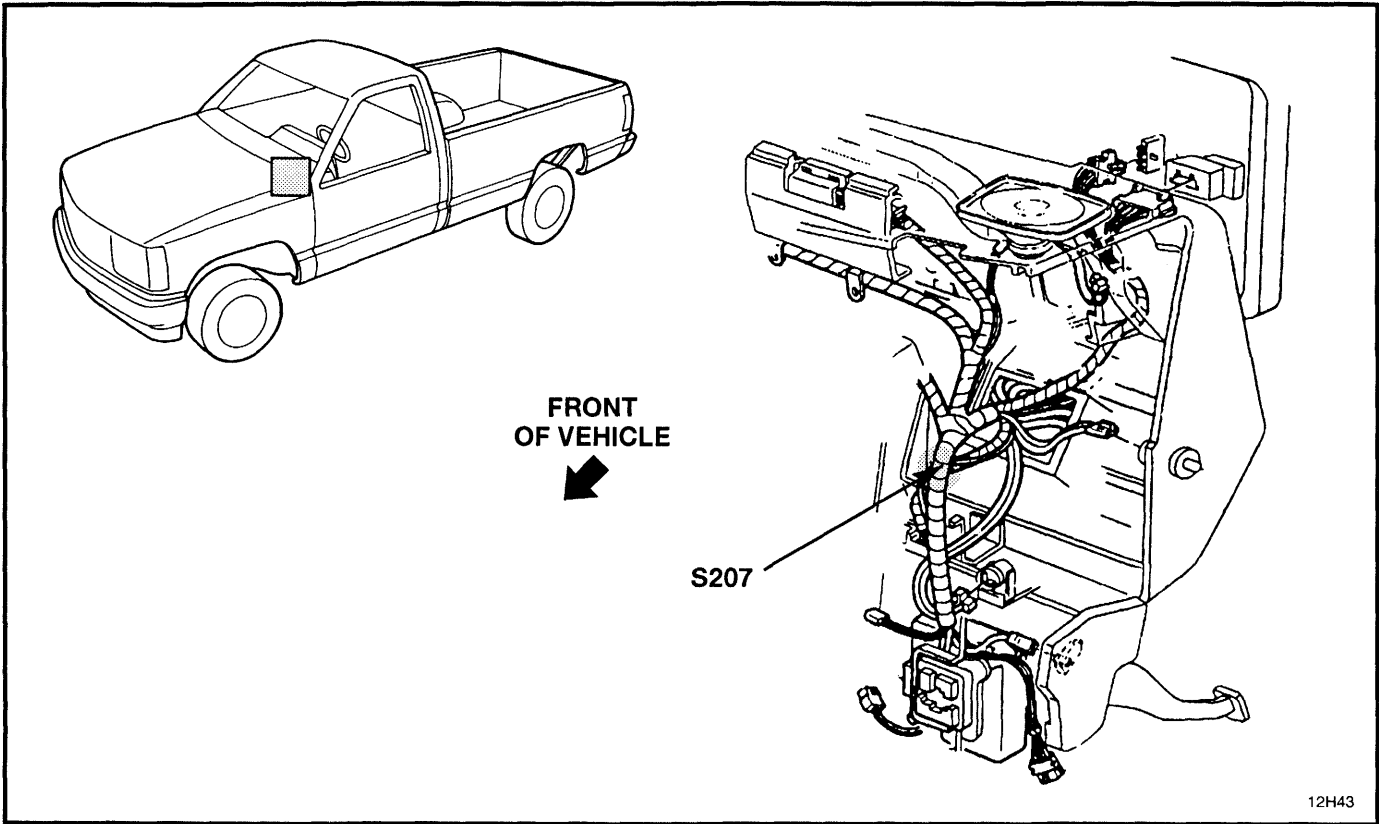


Figure 1 — LH Side of Instrument Panel

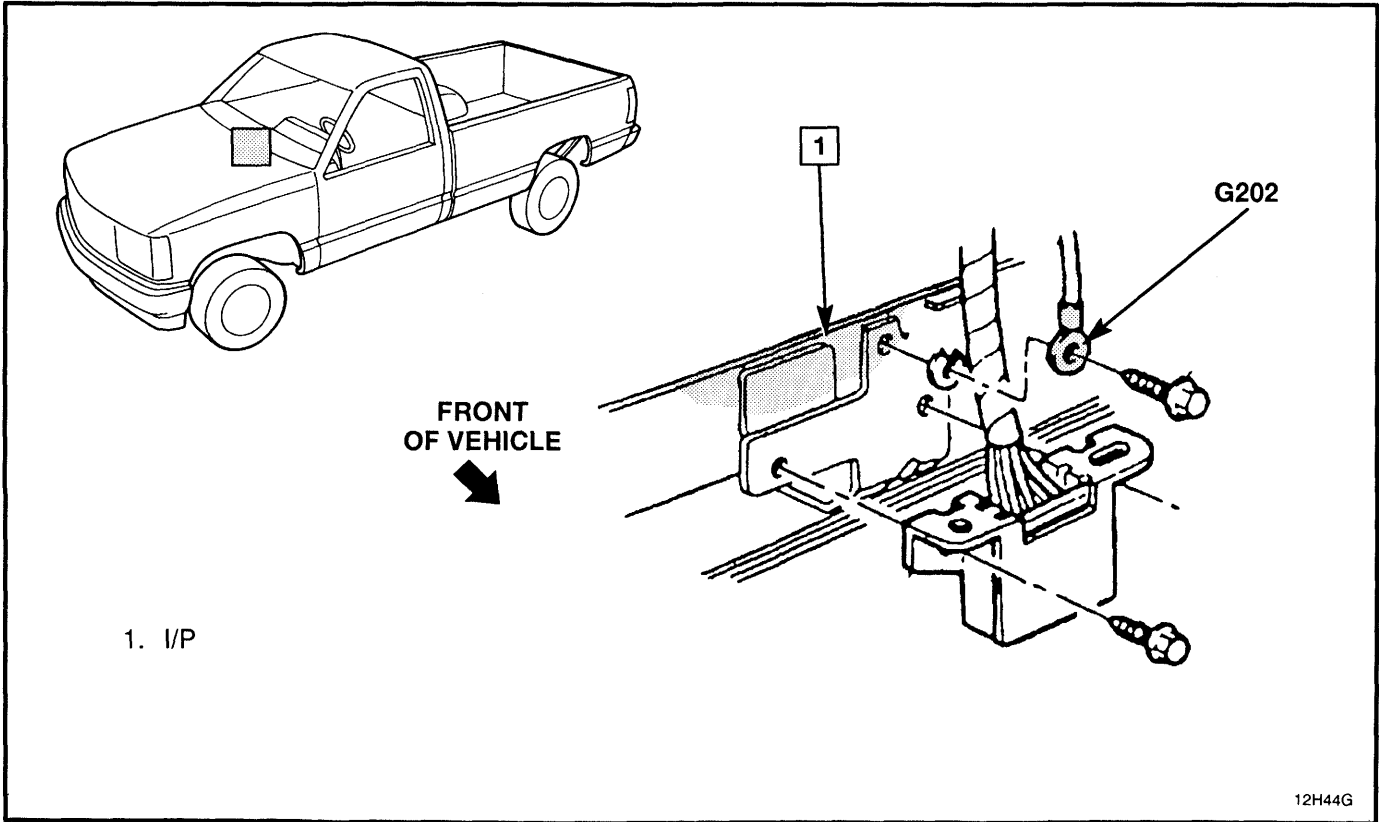


Figure 2 — I/P Ground

# 8A-140-8 POWER SEAT

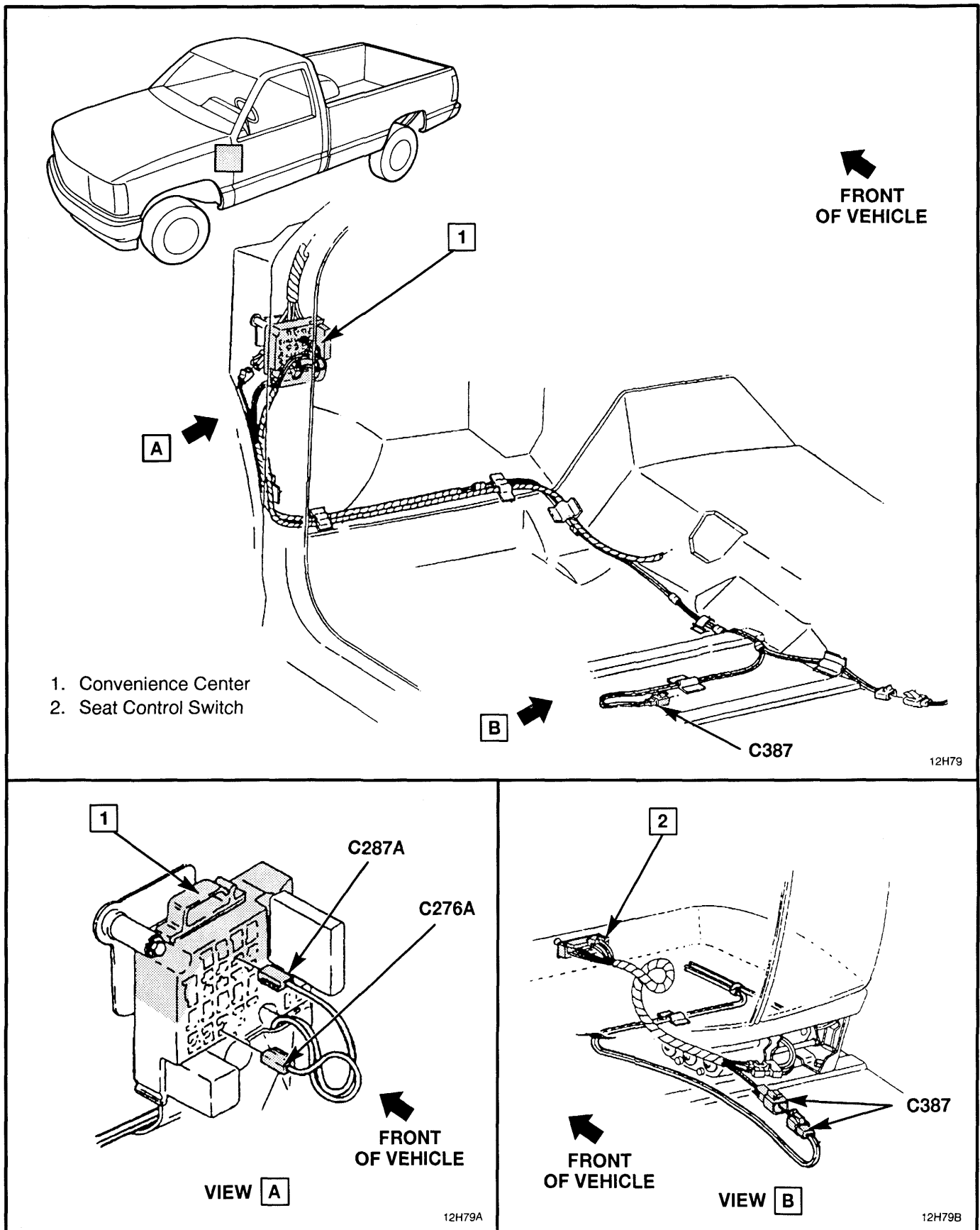


Figure 3 — Power Seat Wiring

## **CIRCUIT OPERATION**

### **POWER MIRRORS**

Voltage is supplied at all times to the Power Outside Rearview Mirror Switch through the ACC-BATT Circuit Breaker and an In-Line Auto Fuse.

The mirror assemblies contain two motors. One motor positions the mirror up and down, the other motor positions the mirror to the left or right. By reversing the polarity of the motors, the motors will move the mirrors either up/down or left/right.

### **COMPONENT LOCATION**

#### **Page — Figure**

|                                            |                                   |           |   |
|--------------------------------------------|-----------------------------------|-----------|---|
| Convenience Center .....                   | Under LH side of I/P .....        | 147-7     | 3 |
| Fuse Block .....                           | Under LH side of I/P .....        | 147-6     | 1 |
| Power Outside Rearview Mirror, LH .....    | On outside of LH front door ..... | Not Shown |   |
| Power Outside Rearview Mirror, RH .....    | On outside of RH front door ..... | Not Shown |   |
| Power Outside Rearview Mirror Switch ..... | On LH door trim panel .....       | 147-8     | 4 |

### **CONNECTORS:**

|            |                                                                    |       |   |
|------------|--------------------------------------------------------------------|-------|---|
| C241 ..... | At convenience center .....                                        | 147-7 | 3 |
| C246 ..... | Taped to cross body, near convenience center at in-line fuse ..... | 147-7 | 3 |
| C257 ..... | At convenience center .....                                        | 147-7 | 3 |
| C327 ..... | LH body hinge pillar .....                                         | 147-7 | 3 |
| C329 ..... | RH body hinge pillar .....                                         | 147-7 | 3 |

### **GROUND:**

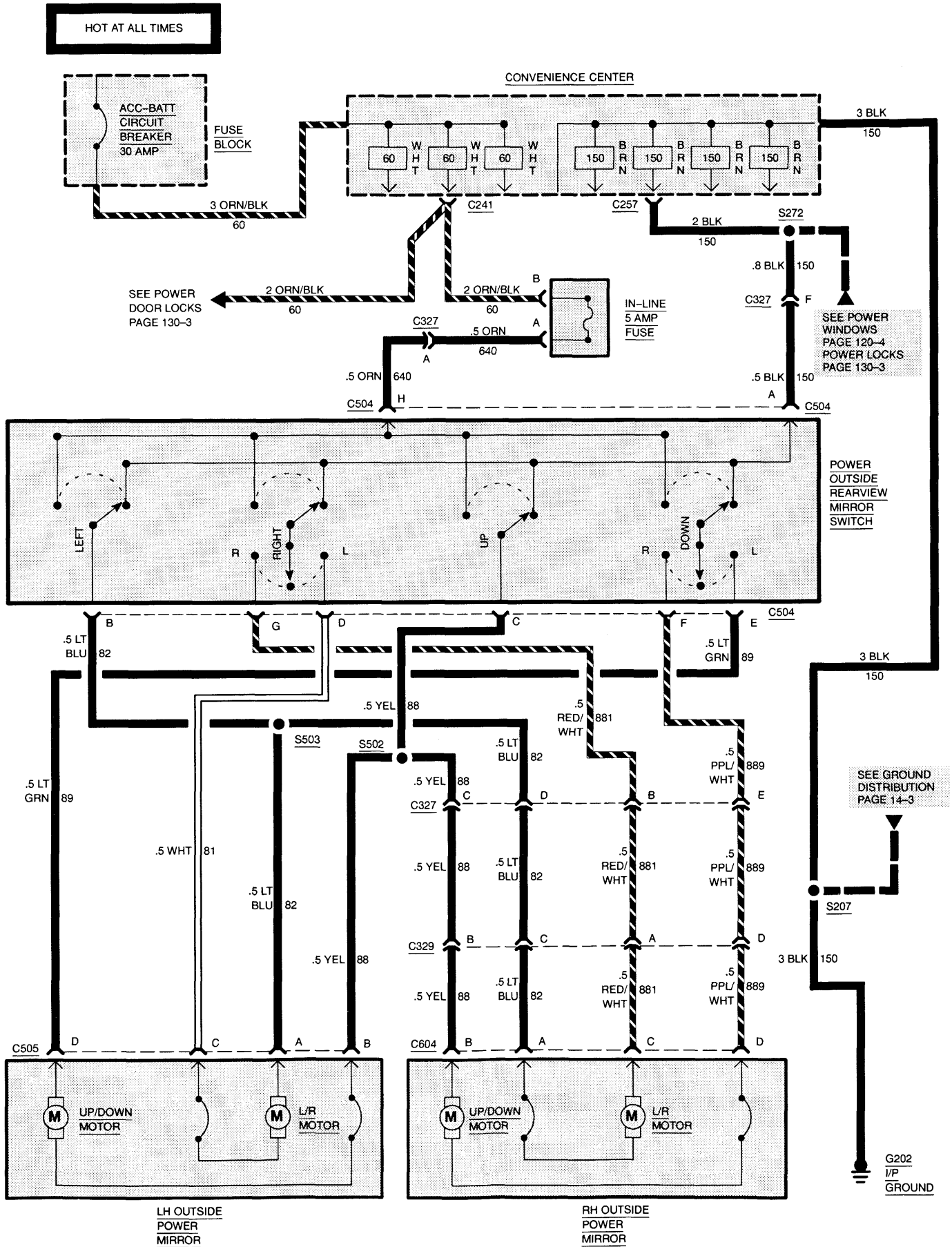
|            |                        |       |   |
|------------|------------------------|-------|---|
| G202 ..... | At DLC connector ..... | 147-6 | 2 |
|------------|------------------------|-------|---|

### **SPLICES:**

|            |                                                                             |       |   |
|------------|-----------------------------------------------------------------------------|-------|---|
| S207 ..... | Under LH side of I/P .....                                                  | 147-6 | 1 |
| S272 ..... | Power window and door locks harness, near convenience center leads .....    | 147-7 | 3 |
| S502 ..... | Power window/lock harness LH front door, near power window motor lead ..... | 147-8 | 4 |
| S503 ..... | Power window lock harness, LH front door .....                              | 147-8 | 4 |



# 8A-147-2 POWER OUTSIDE REARVIEW MIRRORS



## DIAGNOSIS — POWER MIRRORS

### PRELIMINARY CHECKS:

1. Check to see that the ACC-BATT Circuit Breaker and in-line (C296) fuse is not blown. If fuse is blown, locate and repair source of overload, then replace fuse. If Circuit Breaker is open, locate and repair source of overload, then check circuit breaker operation. If breaker does not reset, replace breaker.
2. Refer to Section 10A1 of the 1994 C/K Service Manual for diagnosis and repair of all non-electrical system components.

#### LH MIRROR WILL NOT ADJUST UP AND DOWN

| TEST                                                                                                                                                                                                                                                                                             | RESULT         | ACTION                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect in-line fuse connector C296 and connector C505 at LH mirror motor. Place ohmmeter on Rx1 scale and connect leads to YEL (88) and LT BLU (82) wires at LH mirror motor connector C505. While holding mirror adjustment switch in the UP and DOWN positions, measure for continuity. | Continuity.    | REPLACE LH mirror motor.                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                  | No continuity. | LOCATE and REPAIR open in YEL (88) or LT BLU (82) wires between mirror switch connector C504 and LH mirror motor connector C505. If none is found, REPLACE switch. |

#### LH MIRROR WILL NOT ADJUST LEFT AND RIGHT

| TEST                                                                                                                                                                                                                                                                                                | RESULT         | ACTION                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect in-line fuse connector C296 and connector C505 at LH mirror motor. Place ohmmeter on Rx1 scale and connect leads to WHT (81) and LT GRN (89) wires at LH mirror motor connector C505. While holding mirror adjustment switch in the LEFT and RIGHT positions, measure for continuity. | Continuity.    | REPLACE LH mirror motor.                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                     | No continuity. | LOCATE and REPAIR open in WHT (81) or LT GRN (89) wires between mirror switch connector C504 and LH mirror motor connector C505. If none is found, REPLACE switch. |

#### RH MIRROR WILL NOT ADJUST UP AND DOWN

| TEST                                                                                                                                                                                                                                                                                            | RESULT         | ACTION                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect in-line fuse connector C296 and connector C604 at RH mirror motor. Place ohmmeter on Rx1 scale and connect leads to YEL (88) and LT BLU (82) wire at RH mirror motor connector C604. While holding mirror adjustment switch in the UP and DOWN positions, measure for continuity. | Continuity.    | REPLACE RH mirror motor.                                                                                                                                            |
|                                                                                                                                                                                                                                                                                                 | No continuity. | LOCATE and REPAIR open in YEL (88) and LT BLU (82) wires between mirror switch connector C504 and RH mirror motor connector C604. If none is found, REPLACE switch. |

## 8A-147-4 POWER OUTSIDE REARVIEW MIRRORS

### RH MIRROR WILL NOT ADJUST LEFT AND RIGHT

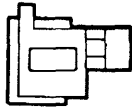
| TEST                                                                                                                                                                                                                                                                                                       | RESULT         | ACTION                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect in-line fuse connector C296 and connector C604 at RH mirror motor. Place ohmmeter on Rx1 scale and connect leads to RED/WHT (881) and PPL/WHT (889) wires at RH mirror motor connector C604. While holding mirror adjustment switch in the LEFT and RIGHT positions, measure for continuity. | Continuity.    | REPLACE RH mirror motor.                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                            | No continuity. | LOCATE and REPAIR open in RED/WHT (881) and PPL/WHT (889) wires between mirror switch connector C504 and RH mirror motor connector C604. If none is found, REPLACE switch. |

### NEITHER MIRROR IS OPERATIONAL

| TEST                                                                                        | RESULT                    | ACTION                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (640) wire at mirror switch connector C504 to ground.         | Test lamp does not light. | LOCATE and REPAIR open in ORN (640) wire between mirror switch connector C504 and connector C327 or between connector C327 and in-line auto fuse connector C296, or ORN (60) wire between in-line auto fuse connector C296 and convenience center connector C241. |
|                                                                                             | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                                     |
| 2. Connect test lamp from ORN (640) wire to BLK (150) wire at mirror switch connector C504. | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between mirror switch connector C504 and connector C327 or between connector C327 and splice S272 or between splice S272 and convenience center connector C257.                                                          |
|                                                                                             | Test lamp lights.         | REPLACE mirror switch.                                                                                                                                                                                                                                            |

# POWER OUTSIDE REARVIEW MIRRORS 8A-147-5

12059233



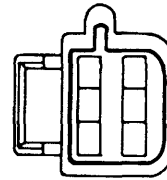
**C241**  
Power Tap to Convenience  
Center

12059236



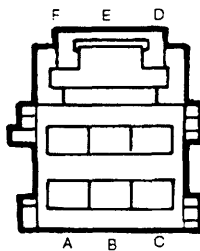
**C257**  
Ground Tap to Convenience  
Center

12064763



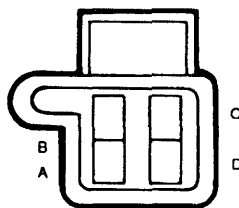
**GRAY**  
Metri-Pack 150  
**C327**  
Crossbody to LH Door

12064762



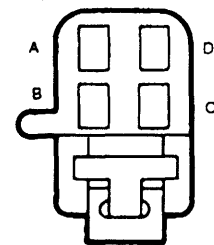
**GRAY**  
Metri-Pack 150  
**C327**  
LH Door to Crossbody

12064761



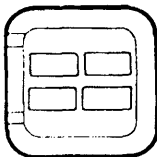
**BLACK**  
Metri-Pack 150  
**C329**  
Crossbody to RH Door

12064760



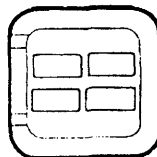
**BLACK**  
Metri-Pack 150  
**C329**  
RH Door to Crossbody

12047786



**BLACK**  
Metri-Pack 150  
**C505**  
LH Power Outside Mirror

12047786



**BLACK**  
Metri-Pack 150  
**C605**  
RH Power Outside Mirror

## 8A-147-6 POWER OUTSIDE REARVIEW MIRRORS

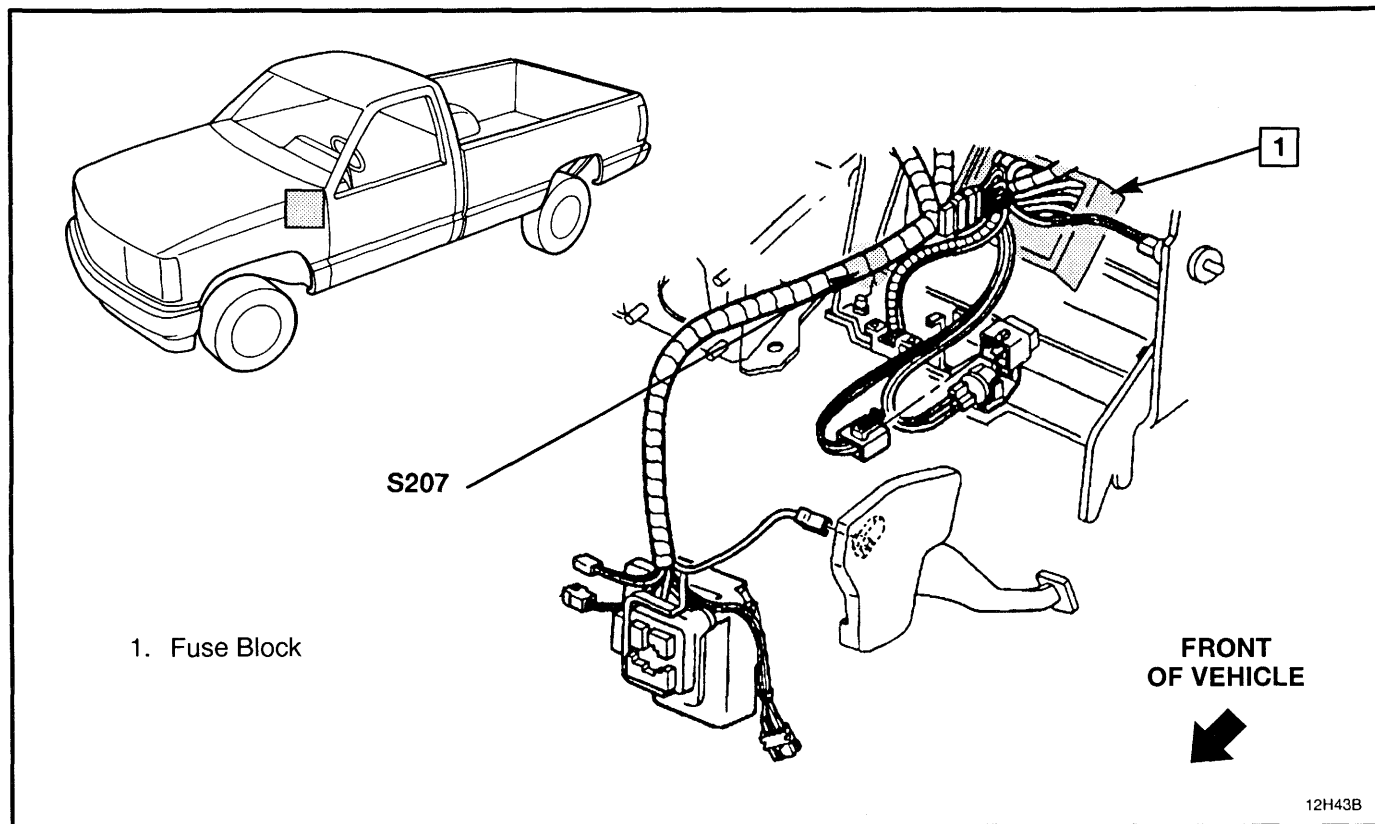


Figure 1 — LH Side of Instrument Panel

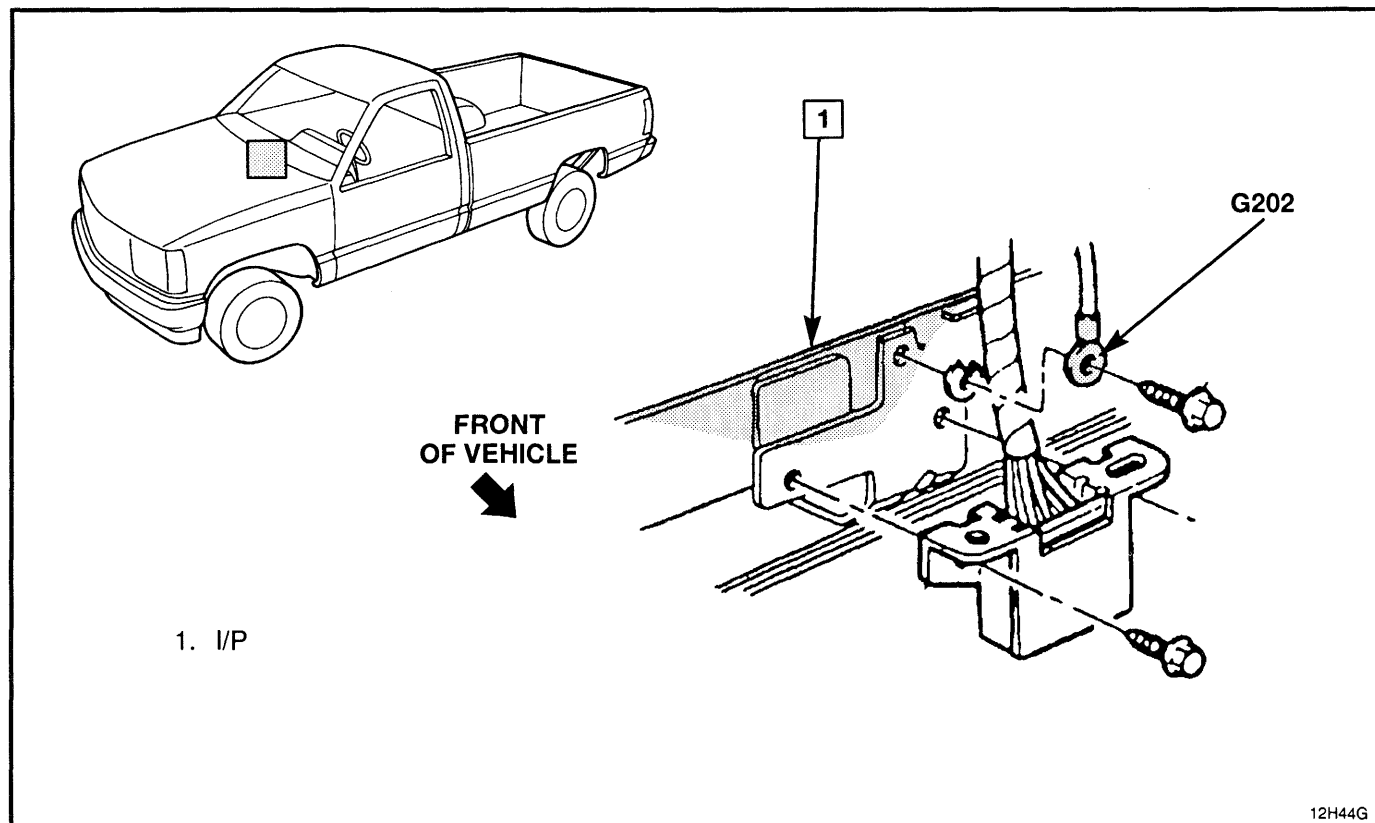


Figure 2 — I/P Ground Wiring

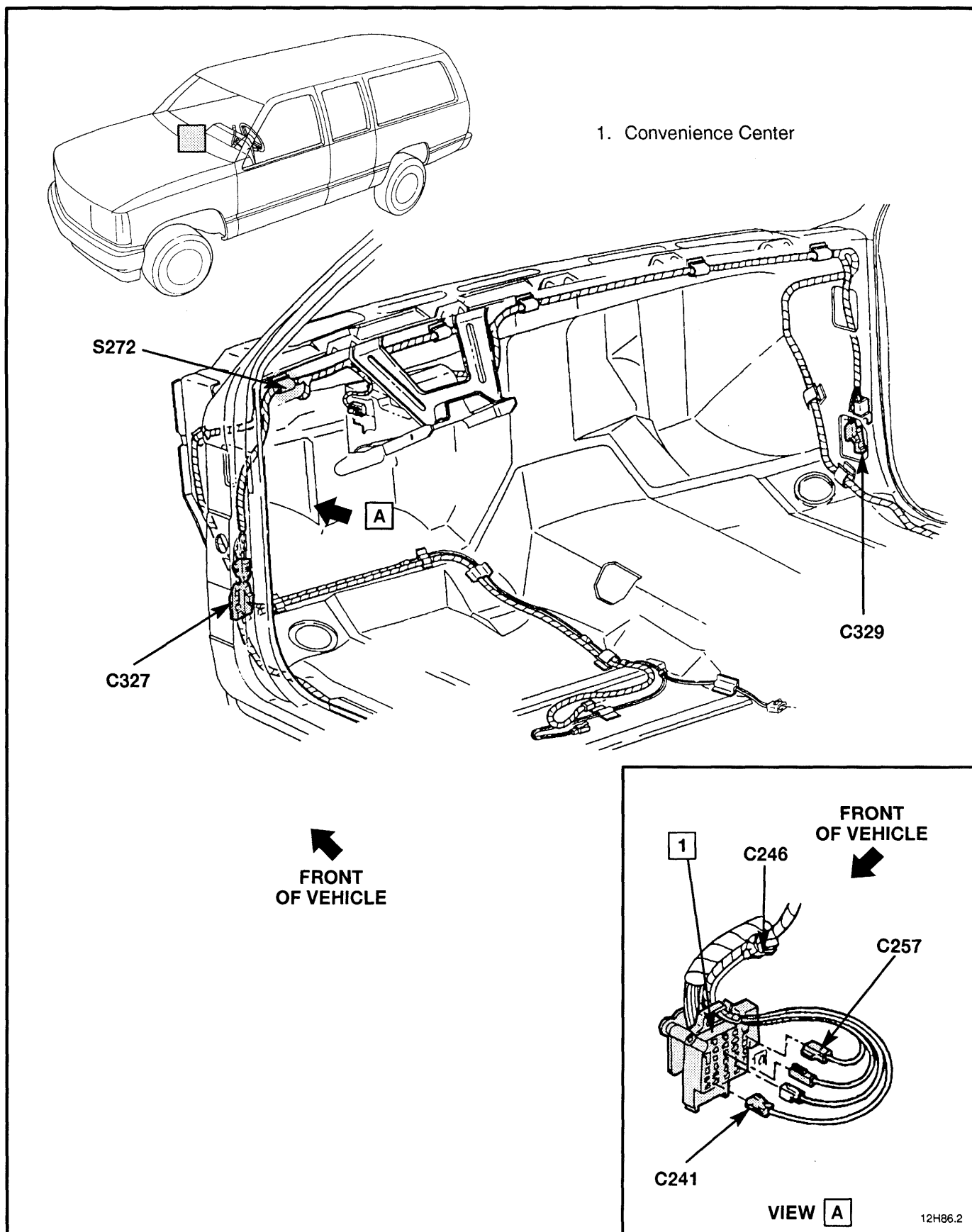
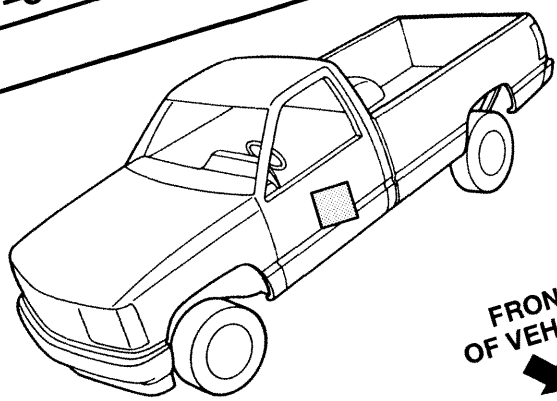
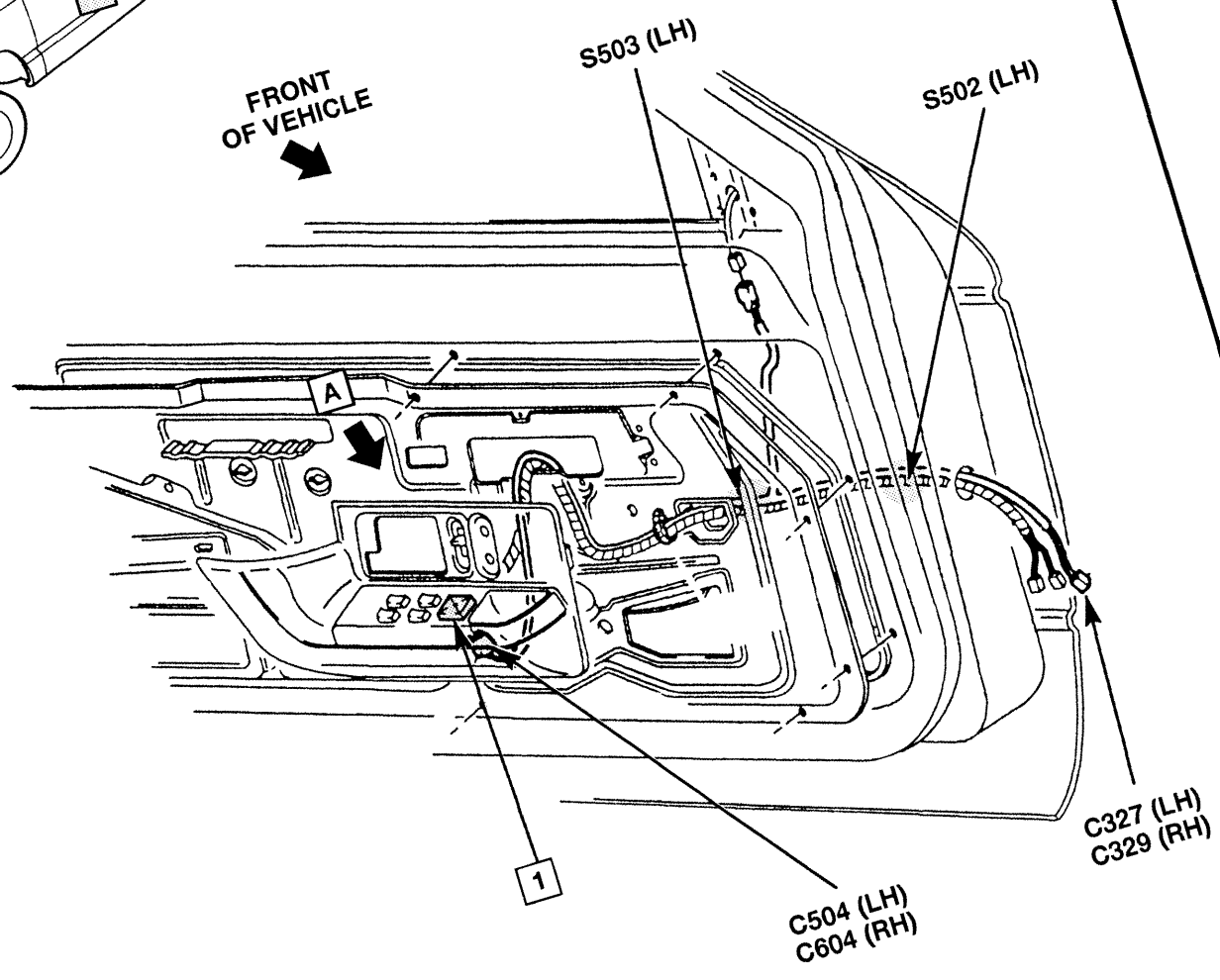


Figure 3 — Power Window and Door Lock Crossbody Wiring – Suburban

# 8A-147-8 POWER OUTSIDE REARVIEW MIRRORS



FRONT  
OF VEHICLE  
↓



1. Power Mirror Switch

Figure 4 — Door Wiring

## **CIRCUIT OPERATION**

### **LIGHTED VANITY MIRRORS**

The optional lighted vanity mirrors are incorporated in the LH and RH sunvisors. The mirror receives battery voltage at all times from the CTSY Fuse. The vanity mirror lamps switch on automatically when the mirror cover is opened and switch off when the mirror cover is closed.

### **COMPONENT LOCATION**

#### **Page — Figure**

|                                     |                                    |       |   |
|-------------------------------------|------------------------------------|-------|---|
| Convenience Center .....            | Under LH side of I/P .....         | 149-7 | 3 |
| Fuse Block .....                    | Below LH side of I/P .....         | 149-6 | 2 |
| Illuminated Vanity Mirror, LH ..... | Part of LH sunvisor assembly ..... | 149-5 | 1 |
| Illuminated Vanity Mirror, RH ..... | Part of RH sunvisor assembly ..... | 149-5 | 1 |

### **CONNECTORS:**

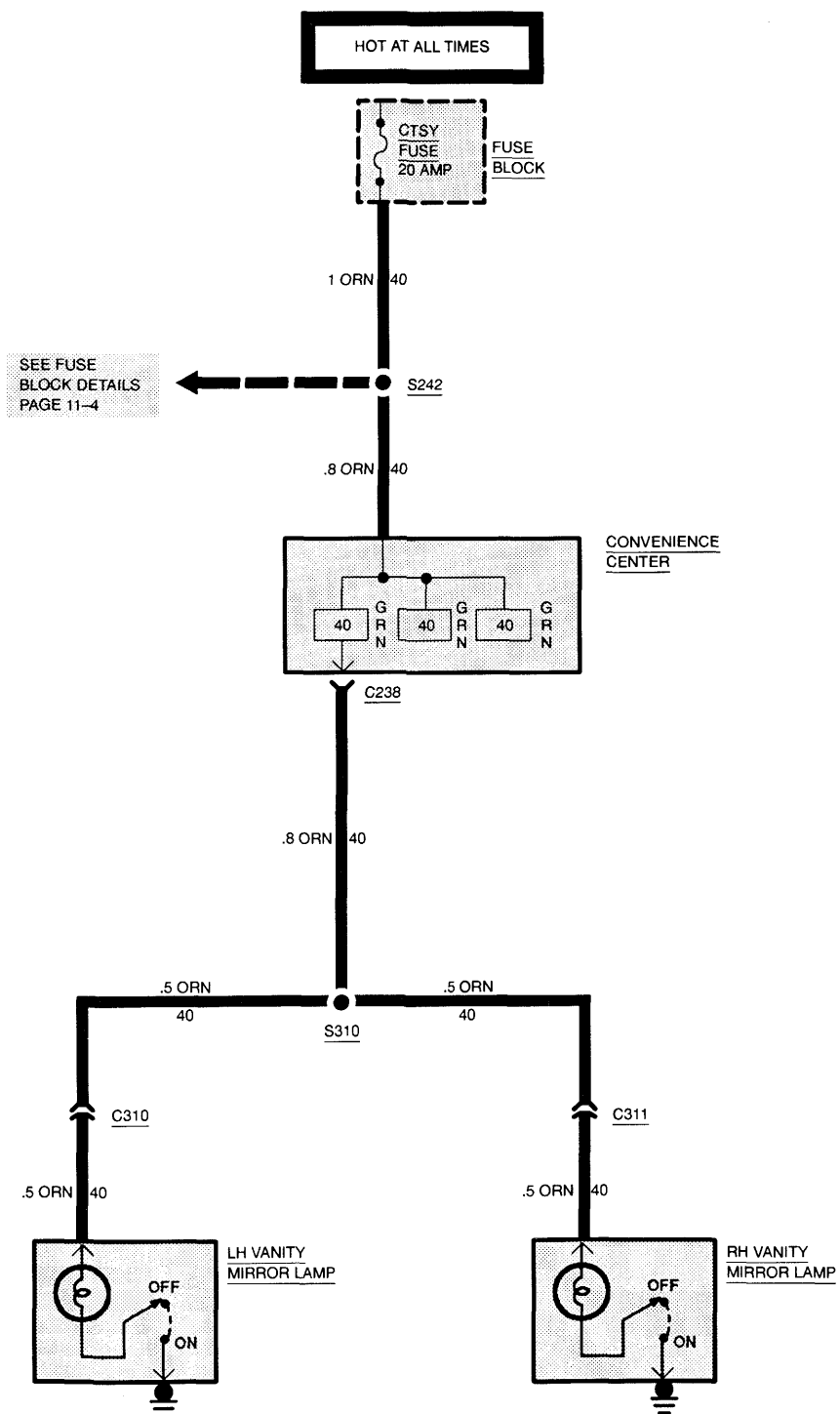
|             |                             |       |   |
|-------------|-----------------------------|-------|---|
| C238 .....  | At convenience center ..... | 149-5 | 1 |
| C239A ..... | At convenience center ..... | 149-7 | 3 |

### **SPLICES:**

|            |                          |       |   |
|------------|--------------------------|-------|---|
| S242 ..... | At LH side of cowl ..... | 149-6 | 2 |
| S310 ..... | At LH A-pillar .....     | 149-5 | 1 |



## 8A-149-2 LIGHTED VANITY MIRRORS



**DIAGNOSIS — LIGHTED VANITY MIRRORS**

**PRELIMINARY CHECKS:**

1. Check condition of CTSY Fuse. If fuse is blown, locate source of overload. Replace fuse.

**VANITY MIRROR DOES NOT OPERATE**

| TEST                                                                                        | RESULT                    | ACTION                                                                                                                                                      |
|---------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Connect test lamp from ORN (40) wire at vanity mirror connectors C310 or C311 to ground. | Test lamp lights.         | REPLACE vanity mirror assembly.                                                                                                                             |
|                                                                                             | Test lamp does not light. | LOCATE and REPAIR open in ORN (40) wire between mirror connector C310 or C311 and splice S310 or between splice S310 and convenience center connector C238. |

## 8A-149-4 LIGHTED VANITY MIRRORS

12059234



**C238**  
Power Tap at Convenience  
Center

12047683



**BLACK**  
Metri-Pack 150  
**C310**  
In-Line Convenience Center to  
LH Lighted Mirror

12047682



**BLACK**  
Metri-Pack 150  
**C310**  
In-Line LH Lighted Mirror to  
Convenience Center

12047683



**BLACK**  
Metri-Pack 150  
**C311**  
In-Line Convenience Center to  
RH Lighted Mirror

12047682



**BLACK**  
Metri-Pack 150  
**C311**  
In-Line RH Lighted Mirror to  
Convenience Center

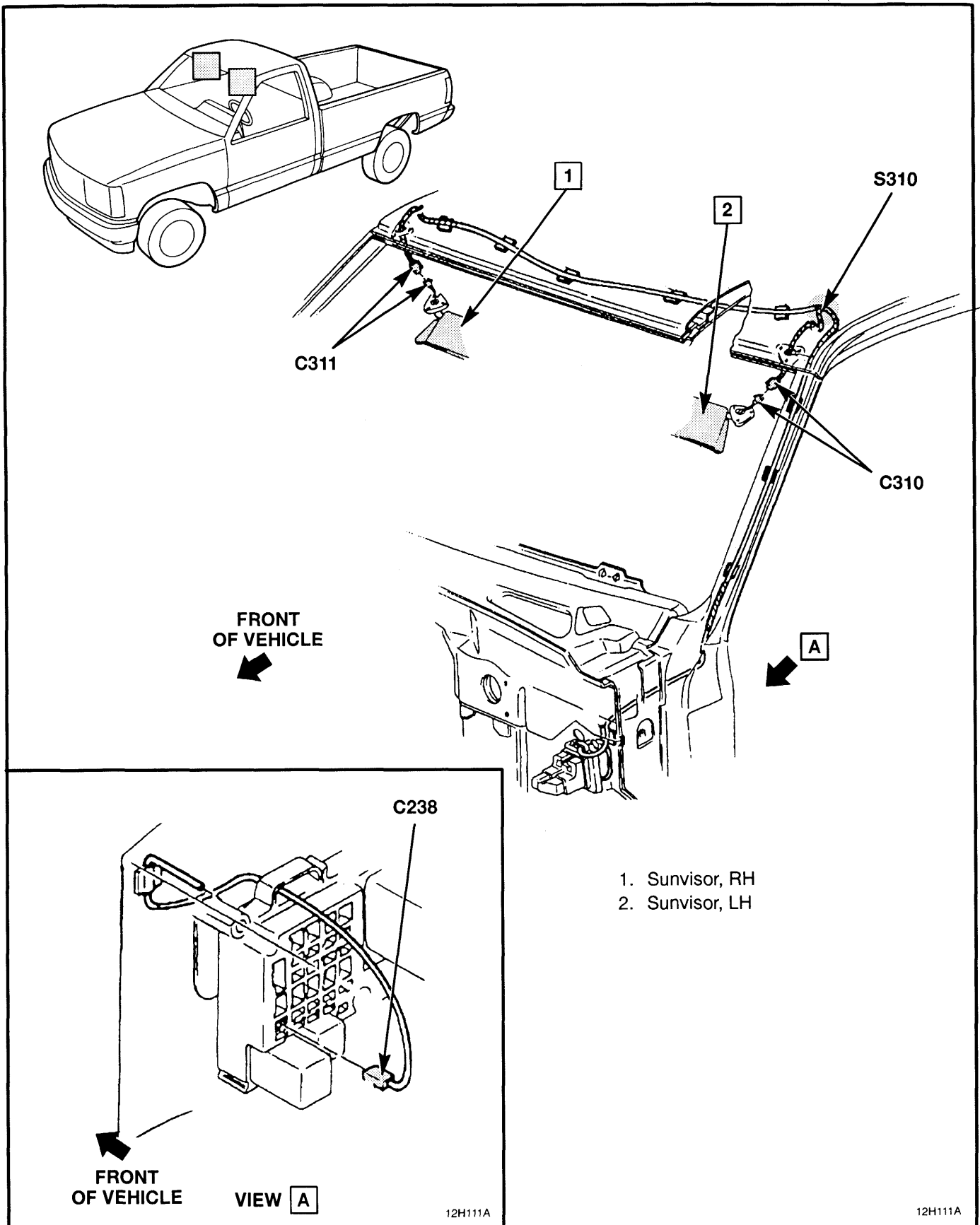


Figure 1 — Sunvisor Vanity Mirror Wiring

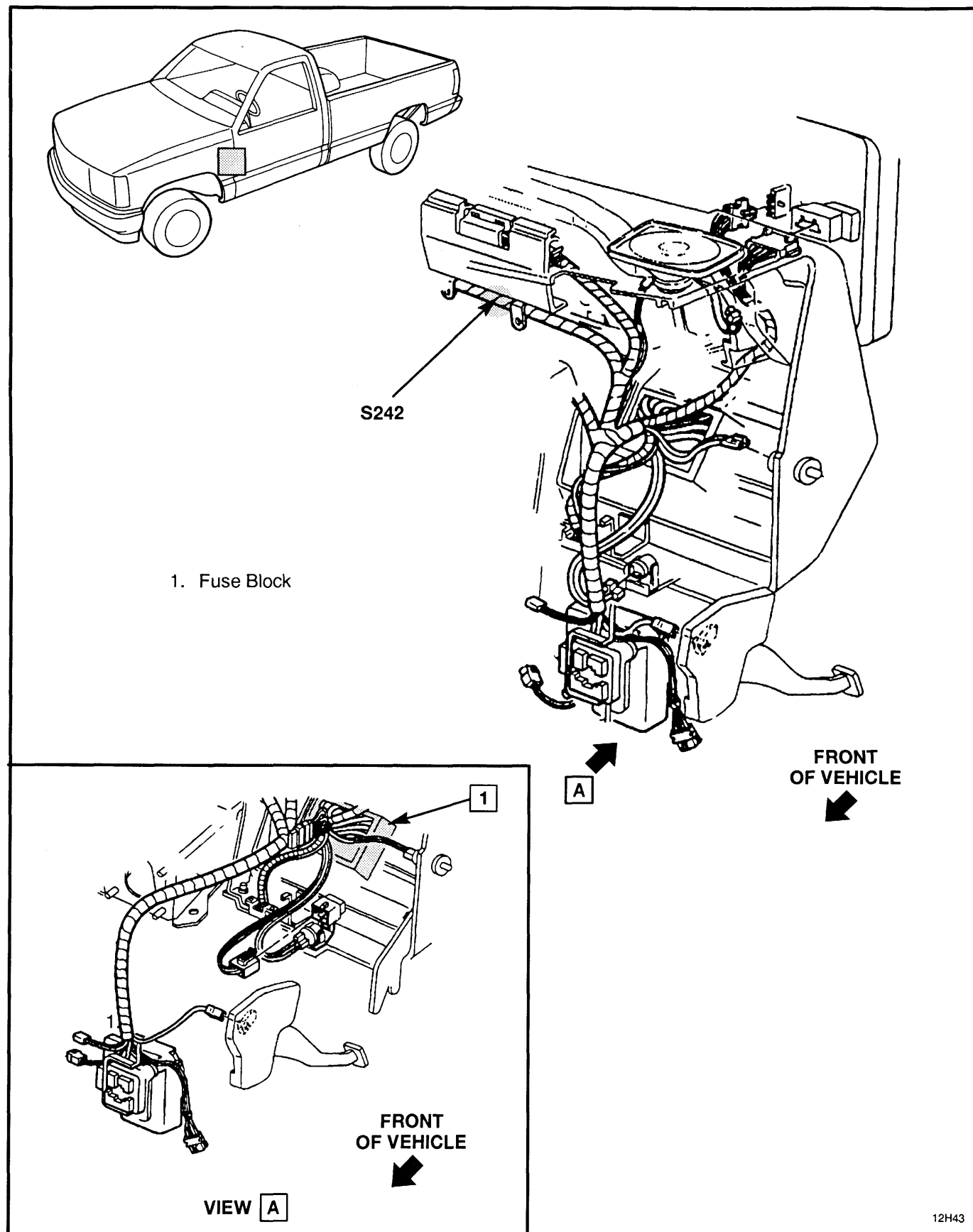
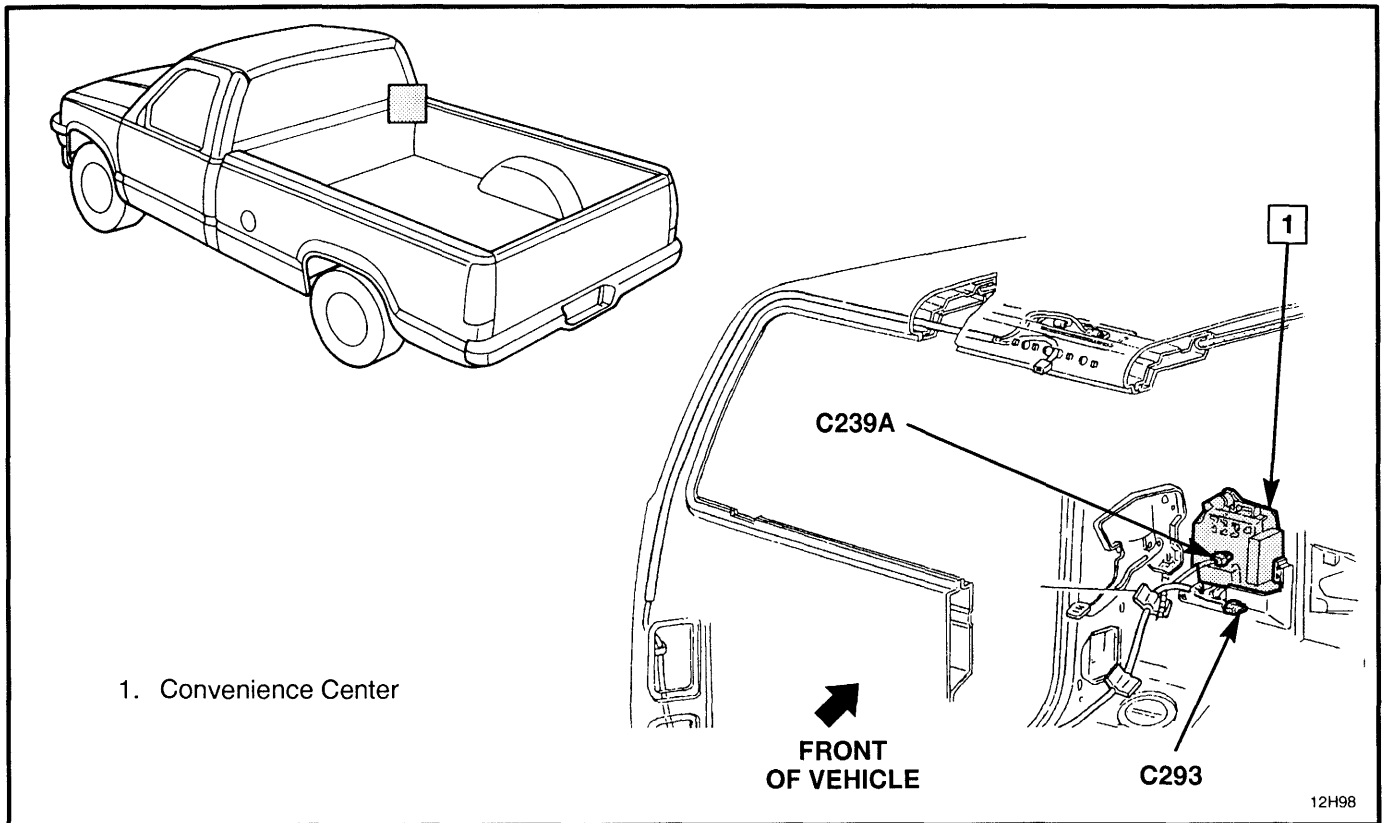


Figure 2 — LH Side of Instrument Panel



**Figure 3 — Cargo CHMSL and Dome Lamp Wiring**

**BLANK**

## **CIRCUIT OPERATION**

The RADIO Fuse provides main voltage to the Radio. With the Ignition Switch in ACC or RUN, voltage is supplied through the RADIO Fuse and YEL wire to the On/Off Switch in the Radio. The On/Off Switch is located in the Radio (without Cassette) or Radio Control Head (with Cassette). The circuit is grounded at G202. With the On/Off Switch closed, voltage is supplied to the Solid-State Radio circuits to ground. Two wires connect each speaker to the Radio. The ETR Radio has two inputs that other models do not have: Display Dim Signal and Clock Power.

The ETR model is an AM/FM Radio that changes stations electronically. The frequency of preselected stations can be stored in the electronic memory. The ETR model also provides a digital display of time or station frequency. As in other models, the Panel Lamp Switch controls panel lamp dimming. In the ETR model, dimming is also controlled by the Radio itself by means of the Dim Display Input Signal.

The ETR model's Clock memory and Radio memory functions are supplied voltage at all times through the CTSY Fuse. If power to the ETR model is cut off — by disconnecting the Battery, for example — the operator must reset the memory functions when power is restored.

A serial data output link is provided at Pin J of the data link connector on the 853 circuit.

If the Cassette or Cassette/Equalizer options are included, a separate Radio Control Head is installed. This sends information along the data line to the Radio to control the volume, frequency and other Radio functions.

### **REMOTE CASSETTE TAPE PLAYER (OPTIONAL)**

With the Ignition Switch in ACC or RUN and the Radio Control Head ON, voltage is supplied to the Cassette Tape Player through the Radio.

With the Remote Cassette Tape Player in PLAY, the Tape Player returns a Tape ON signal and the stereo audio signals to the Radio. The Tape ON signal causes the receiver circuitry to ignore the signals from the tuner and to send the audio signals from the tape player to the speakers. With a cassette tape in FWD, REV or SEEK, the tape player applies a mute signal to the Radio to prohibit the audio sound of these functions from being heard. When the EJECT Button is pushed on the tape player, the Tape ON signal is terminated and the Radio returns to normal operation.

### **REMOTE GRAPHIC EQUALIZER (OPTIONAL)**

With the Ignition Switch in ACC or RUN and the Radio Control Head ON, voltage is supplied to the Graphic Equalizer through the Radio Control Head. As the frequency bands are manually adjusted, this information is sent on the data line through the Radio Control Head to the Radio. The VF dim input allows dimming control of the Graphic Equalizer display when the Park or Headlamps are ON.

### **POWER AMPLIFIER (OPTIONAL) (SUBURBAN ONLY)**

The optional power amplifier boosts the sound of the four rear speakers in the SUBURBAN when equipped with the premium sound system.

With the ignition switch in ACC or RUN position and the Radio Control Head ON, battery voltage is supplied to the Power Amplifier Relay through the PNK/BLK (143) and ORN (40) wires. The relay is grounded through the BLK (150) wire at the I/P ground G202. When the relay contacts close, battery voltage is supplied to the Power Amplifier through the ORN (140) wire, the ground is completed through the BLK (150) wire at the I/P ground G202.



## 8A-150-2 RADIO

### COMPONENT LOCATION

### Page — Figure

|                            |                                           |           |   |
|----------------------------|-------------------------------------------|-----------|---|
| Cassette Deck              | Center of I/P                             | 150-23    | 6 |
| Convenience Center         | Under LH side of I/P                      | 150-22    | 4 |
| Graphic Equalizer          | Center of I/P                             | 150-23    | 6 |
| Power Amplifier            | Under driver's seat                       | Not Shown |   |
| Power Amplifier Relay      | Under I/P, LH side of brake pedal bracket | Not Shown |   |
| Radio Control Head         | Center of I/P                             | 150-23    | 6 |
| Radio Receiver             | Behind center of I/P                      | 150-23    | 6 |
| Speaker, LH Front          | Upper LH end of I/P                       | 150-20    | 1 |
| Speaker, RH Front          | Upper RH end of I/P                       | 150-21    | 3 |
| Speaker, LH Rear           | Upper rear sides of body                  | 150-22    | 5 |
| Speaker, RH Rear           | Upper rear sides of body                  | 150-22    | 5 |
| Speaker, LH Rear Side Door | On rear side door                         | 150-25    | 8 |
| Speaker, RH Rear Side Door | On rear side door                         | 150-25    | 8 |

### CONNECTORS:

|       |                                              |           |   |
|-------|----------------------------------------------|-----------|---|
| C237  | At LH body hinge pillar                      | 150-22    | 4 |
| C239  | At convenience center                        | Not Shown |   |
| C243  | At radio                                     | 150-23    | 6 |
| C244  | At radio                                     | 150-23    | 6 |
| C247  | At convenience center                        | 150-23    | 6 |
| C251  | At radio receiver                            | 150-23    | 6 |
| C253  | At amplifier relay                           | 150-24    | 7 |
| C257  | At convenience center                        | 150-24    | 7 |
| C299  | Under LH side of I/P near convenience center | 150-24    | 7 |
| C341  | At LH center pillar                          | 150-25    | 8 |
| C342  | At RH center pillar                          | 150-25    | 8 |
| C209  | Near radio receiver                          | Not Shown |   |
| C207A | Near radio receiver                          | Not Shown |   |

### GROUNDS:

|      |                  |        |   |
|------|------------------|--------|---|
| G202 | At DLC connector | 150-21 | 2 |
|------|------------------|--------|---|

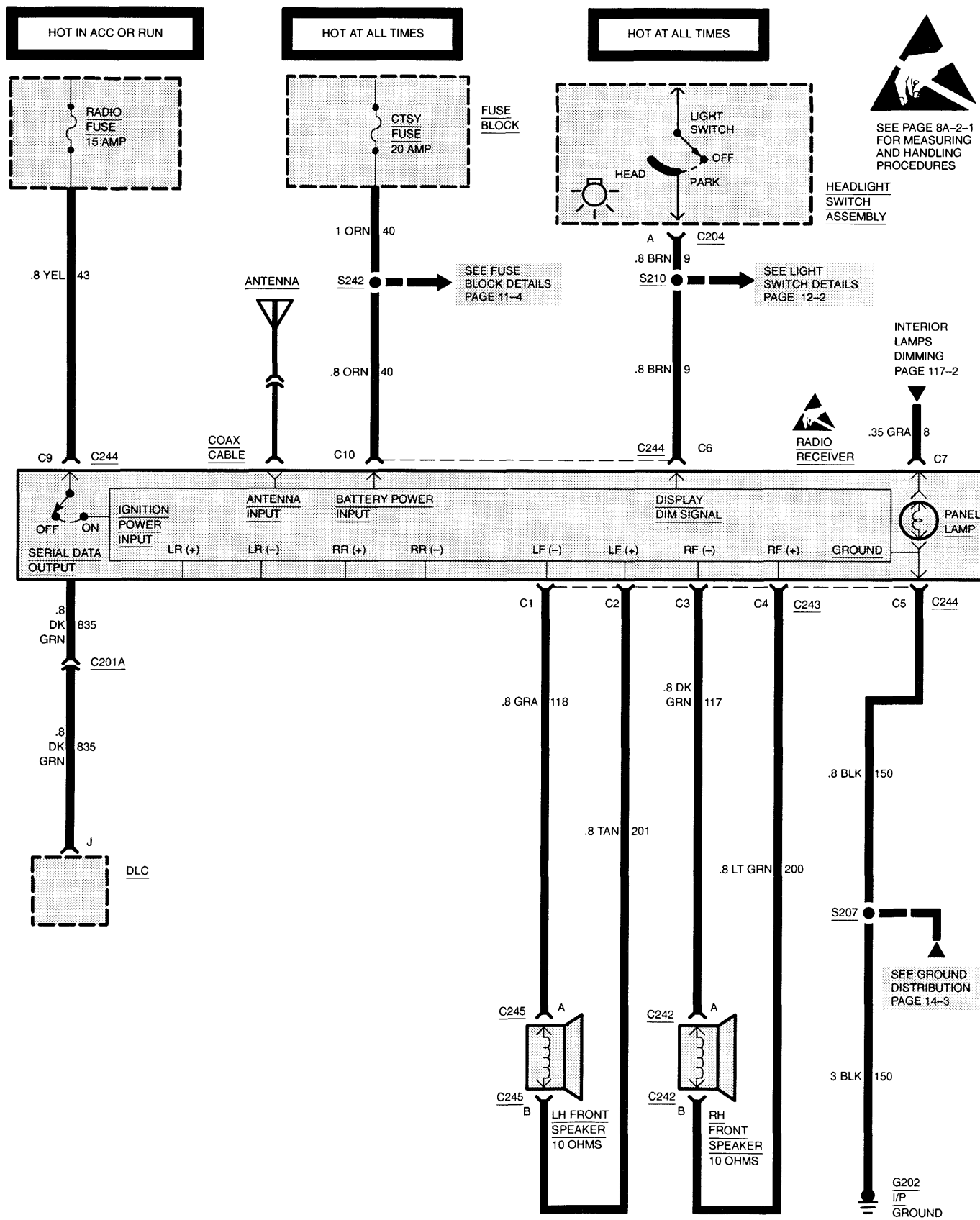
### SPLICES:

|      |                                                                   |        |   |
|------|-------------------------------------------------------------------|--------|---|
| S207 | Under LH side of I/P                                              | 150-20 | 1 |
| S210 | Under LH side of I/P                                              | 150-20 | 1 |
| S217 | Under LH side of I/P                                              | 150-20 | 1 |
| S242 | Under LH side of I/P                                              | 150-20 | 1 |
| S270 | Power window and door lock harness, near convenience center leads | 150-24 | 7 |
| S271 | Power window and door lock harness, near convenience center leads | 150-24 | 7 |
| S272 | Power window and door lock harness, near convenience center leads | 150-24 | 7 |
| S273 | Power window and door lock harness, near convenience center leads | 150-24 | 7 |
| S274 | Power window and door lock harness, near convenience center leads | 150-24 | 7 |

**BLANK**

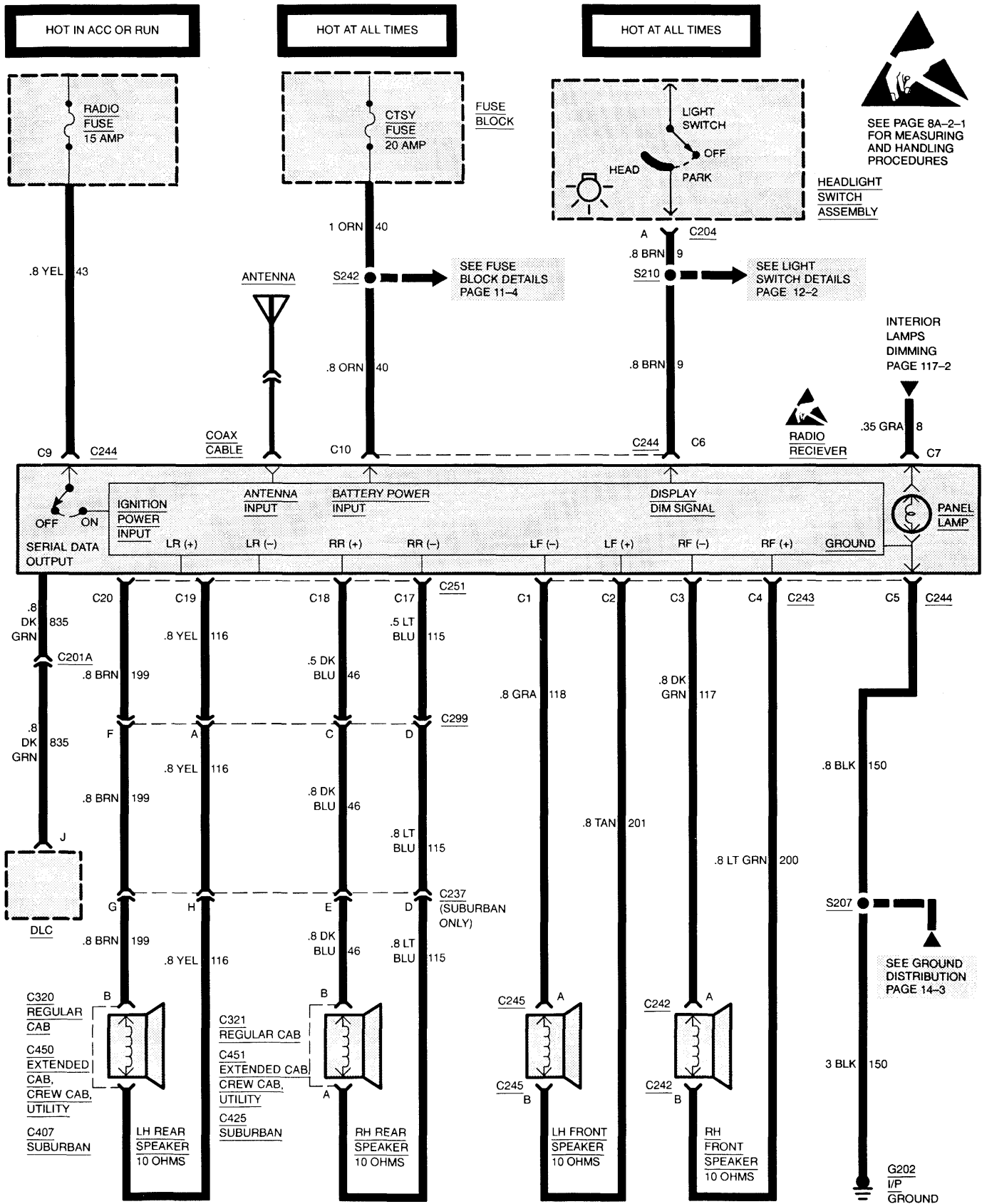
# 8A-150-4 RADIO

## BASE (ALL VEHICLES)

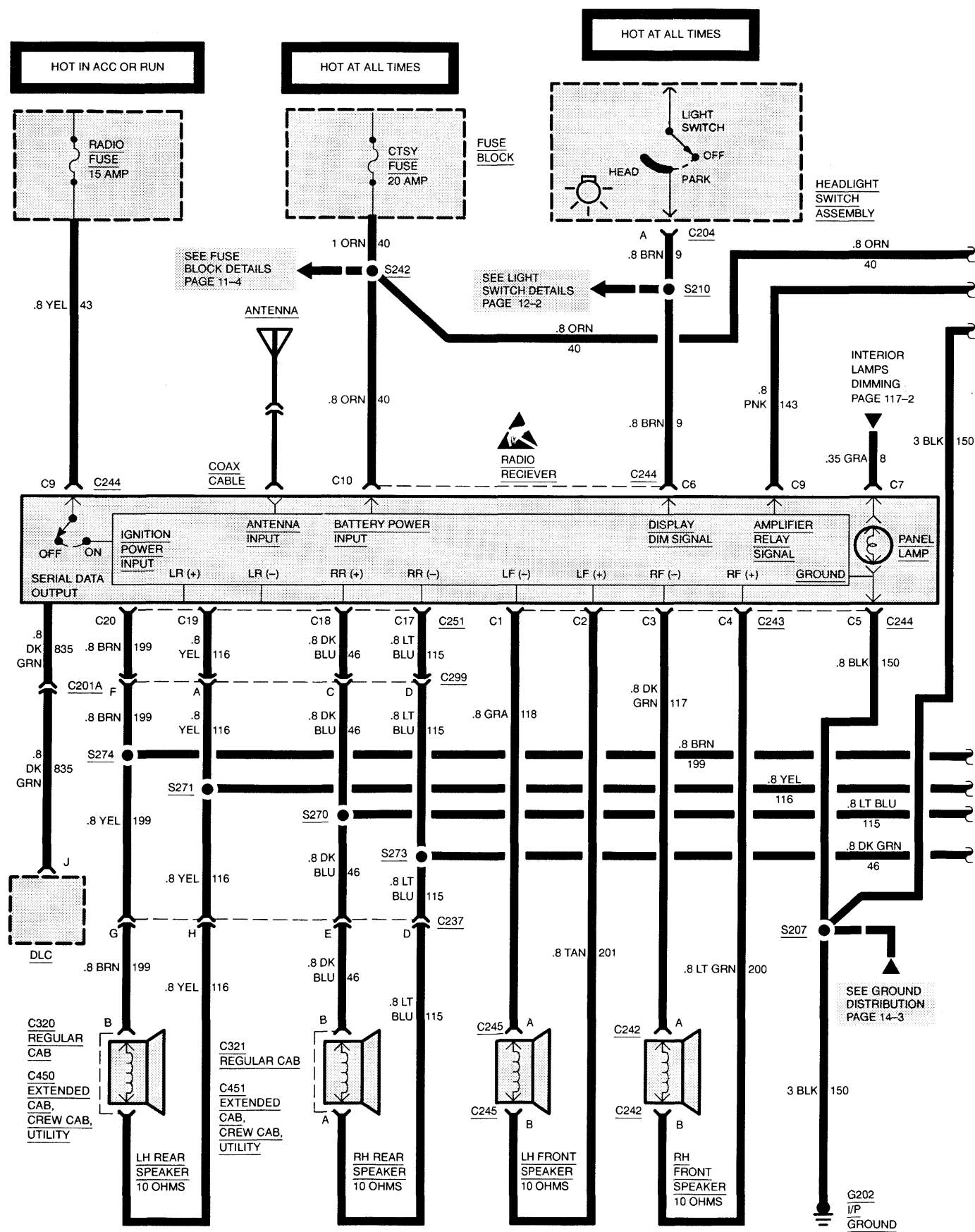


# RADIO 8A-150-5

## WITH STEREO



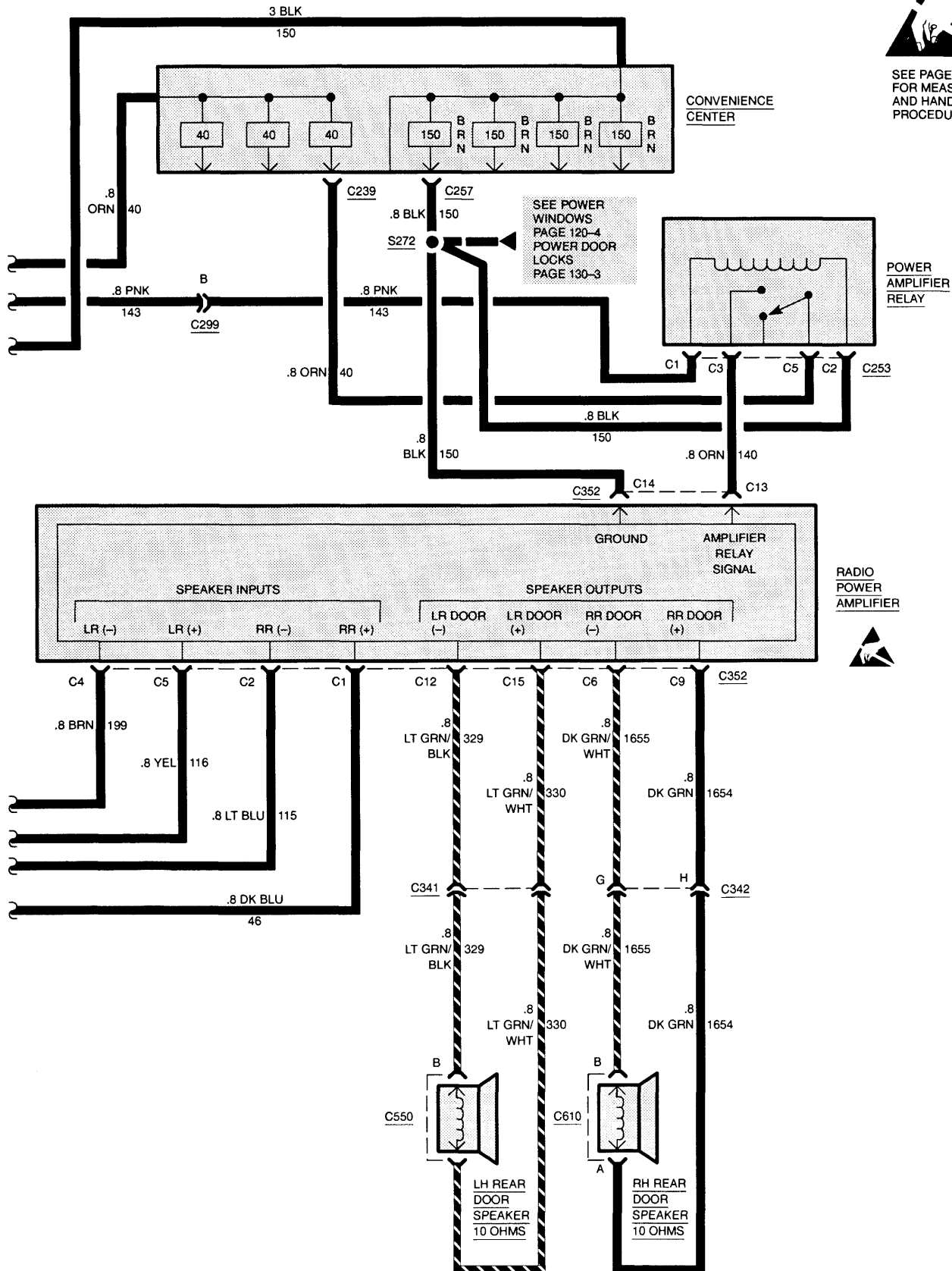
## STEREO W/POWER AMPLIFIER



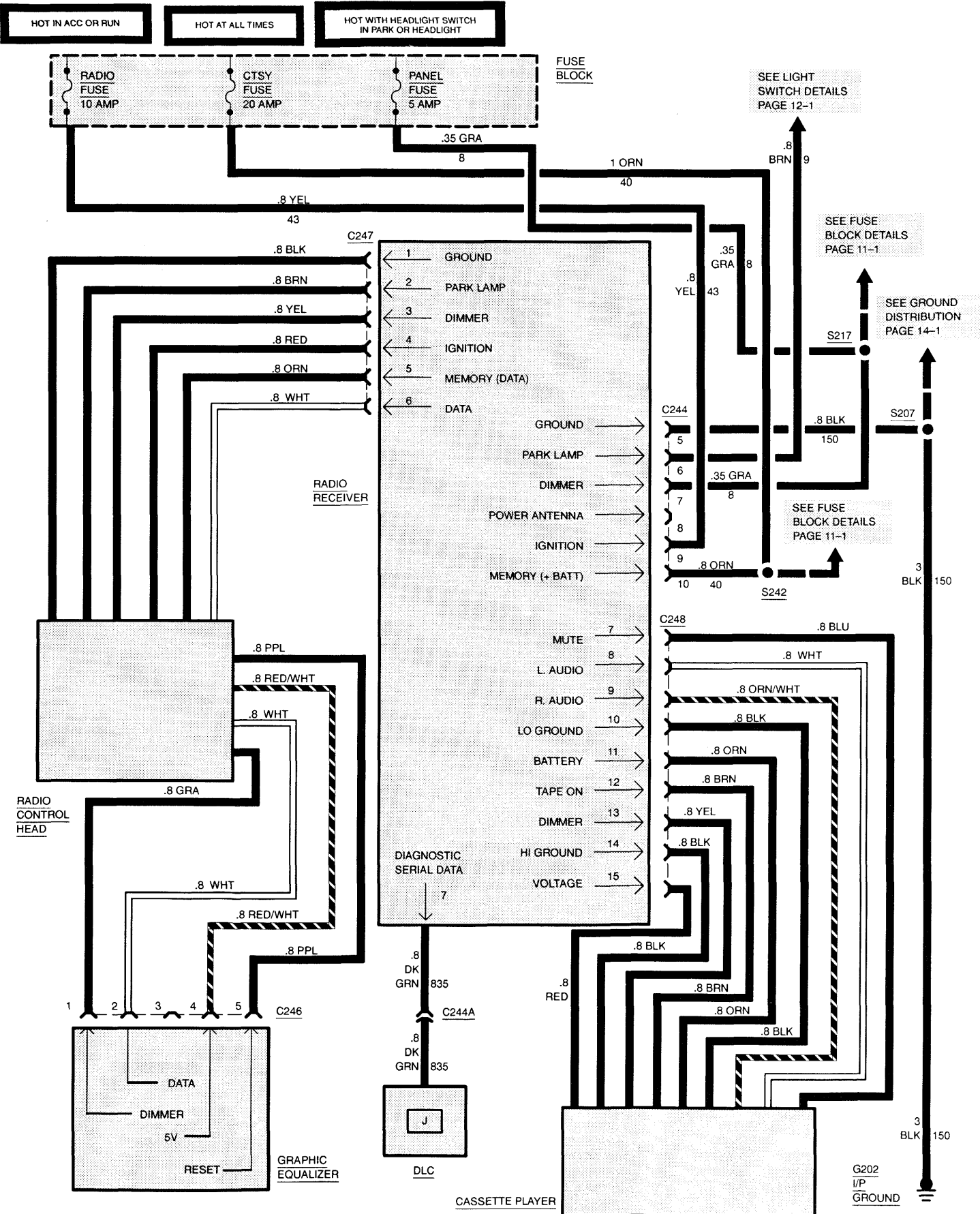
## STEREO W/POWER AMPLIFIER



SEE PAGE 8A-2-1  
FOR MEASURING  
AND HANDLING  
PROCEDURES



# 8A-150-8 RADIO



## DIAGNOSIS — RADIO (AM)

### PRELIMINARY CHECKS:

1. Check condition of RADIO, CTSY, PNL LPS Fuse(s).  
If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).

#### RADIO DOES NOT APPEAR TO WORK (NO DISPLAY LIGHTS, NO SOUND)

| TEST                                                                                                                                         | RESULT           | ACTION                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244 and place ignition switch in RUN. Connect voltmeter from YEL (43) wire at radio connector C244 to ground. | Battery voltage. | GO to step 2.                                                                                                             |
|                                                                                                                                              | No voltage.      | LOCATE and REPAIR open in YEL (43) wire between radio connector C244 and fuse block.                                      |
| 2. Connect voltmeter from YEL (43) wire to BLK (150) wire at radio connector C244.                                                           | Battery voltage. | REMOVE radio and send in for service.                                                                                     |
|                                                                                                                                              | No voltage.      | LOCATE and REPAIR open in BLK (150) wire from radio connector C244 to splice S207 or from splice S207 to I/P ground G202. |

#### CLOCK (IF EQUIPPED) DOES NOT OPERATE

| TEST                                                                                                        | RESULT           | ACTION                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244. Connect voltmeter from ORN (40) wire at radio connector C244 to ground. | Battery voltage. | REMOVE radio and send in for service.                                                                                       |
|                                                                                                             | No voltage.      | LOCATE and REPAIR open in ORN (40) wire between radio connector C244 and splice S242 or between splice S242 and fuse block. |

### PRELIMINARY CHECKS:

1. Observe instrument panel lamps. If inoperative, REPAIR before proceeding with radio lamp diagnosis.

#### RADIO PANEL LAMP DOES NOT COME ON

| TEST                                                                                                                                                                   | RESULT           | ACTION                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244. Place light switch in PARK and panel dimmer switch to HIGH. Connect voltmeter from GRA (8) wire at radio connector C244 to ground. | Battery voltage. | REMOVE radio and send in for service.                                            |
|                                                                                                                                                                        | No voltage.      | LOCATE and REPAIR open in GRA (8) wire from radio connector C244 to splice S217. |



## 8A-150-10 RADIO

### PRELIMINARY CHECKS:

1. Observe heater control lamp, if inoperative, REPAIR (9) circuit before proceeding with diagnosis.

#### DISPLAY DIMMING FUNCTION WILL NOT OPERATE

| TEST                                                                                                                                   | RESULT           | ACTION                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244. Place light switch in PARK. Connect voltmeter from BRN (9) wire at radio connector C244 to ground. | Battery voltage. | REMOVE radio and send in for service.                                            |
|                                                                                                                                        | No voltage.      | LOCATE and REPAIR open in BRN (9) wire from radio connector C244 to splice S210. |

### PRELIMINARY CHECKS:

1. Check condition of RADIO and CTSY Fuses. If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).

#### NO SOUND OR DISTORTED SOUND FROM A SPEAKER

| TEST                                                                                                                                                                                                                                    | RESULT                                | ACTION                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------------------|
| 1. Disconnect suspected speaker connector C242 or C245. Set analog ohmmeter on Rx1 scale. Connect ohmmeter across speaker terminals.                                                                                                    | Speaker pops.                         | GO to step 2.                                              |
|                                                                                                                                                                                                                                         | No noise.                             | REPLACE speaker.                                           |
| 2. Place ignition switch in RUN and turn radio ON. Tune radio to strong signal. Connect voltmeter across outputs for suspect speaker. LT GRN (200) and DK GRN (117) wires for RH speaker. GRA (118) and TAN (201) wires for LH speaker. | Varying around 1 volt AC.             | LOCATE and REPAIR speaker wires between radio and speaker. |
|                                                                                                                                                                                                                                         | No voltage or greater than 1 volt AC. | REMOVE radio and send in for service.                      |

**DIAGNOSIS — AM/FM STEREO RADIO WITH OPTIONS**

**RADIO DOES NOT APPEAR TO WORK (NO DISPLAY LIGHTS, NO SOUND)**

| TEST                                                                                                                                         | RESULT           | ACTION                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244 and place ignition switch in RUN. Connect voltmeter from YEL (43) wire at radio connector C244 to ground. | Battery voltage. | GO to step 2.                                                                |
|                                                                                                                                              | No voltage.      | LOCATE and REPAIR open in YEL (43) wire.                                     |
| 2. Connect voltmeter from YEL (43) wire to BLK (150) wire at radio connector C244.                                                           | Battery voltage. | GO to step 3.                                                                |
|                                                                                                                                              | No voltage.      | LOCATE and REPAIR open in BLK (150) wire from radio to ground terminal G202. |
| 3. Connect radio connector C244. Connect voltmeter from RED wire at radio connector C247 (going to radio control head) to ground.            | Battery voltage. | GO to step 4.                                                                |
|                                                                                                                                              | No voltage.      | REMOVE radio and send in for service.                                        |
| 4. Connect voltmeter from RED wire to BLK wire at radio connector C247 (both wires going to radio control head).                             | Battery voltage. | REMOVE control head and send in for service.                                 |
|                                                                                                                                              | No voltage.      | REMOVE radio and send in for service.                                        |

**NO SOUND OR DISTORTED SOUND FROM A FRONT SPEAKER**

| TEST                                                                                                                                                            | RESULT                                | ACTION                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect suspected speaker connector C242 or C245. Set analog ohmmeter on Rx1 scale. Connect ohmmeter across speaker terminals.                            | Speaker pops.                         | GO to step 2.                                                                                                                                                          |
|                                                                                                                                                                 | No noise.                             | REPLACE speaker.                                                                                                                                                       |
| 2. Place ignition switch in RUN and turn radio ON. Tune radio to strong signal. Connect voltmeter across outputs for suspect speaker at connector C242 or C245. | Varying around 1 volt AC.             | LOCATE and REPAIR short or open in LT GRN (200), DK GRN (117) or GRA (118), TAN (201) wires between speaker connectors C242 or C245 and radio receiver connector C243. |
|                                                                                                                                                                 | No voltage or greater than 1 volt AC. | REMOVE radio and send in for service.                                                                                                                                  |

## 8A-150-12 RADIO

### NO SOUND OR DISTORTED SOUND FROM A REAR SPEAKER

| TEST                                                                                                                                                               | RESULT                                        | ACTION                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect suspected speaker connector C407 or C405. Set analog ohmmeter on the Rx1 scale. Connect ohmmeter across the speaker terminals.                       | Speaker pops.                                 | GO to step 2.                                                                                                                                                                                                    |
|                                                                                                                                                                    | No noise.                                     | REPLACE speaker.                                                                                                                                                                                                 |
| 2. Place ignition switch in ACC or RUN position and turn radio ON. Tune radio to strong signal. Connect voltmeter across suspected speaker connector C407 or C405. | Varying around 1 volt AC.                     | LOCATE and REPAIR short or open in YEL (116), BRN (199) or the DK BLU (46), LT BLU (115) between speaker connector C407 or C405 and body connector C299 or from connector C299 to radio receiver connector C251. |
|                                                                                                                                                                    | No voltage or voltage greater than 1 volt AC. | REMOVE radio and send in for repair.                                                                                                                                                                             |

### PRELIMINARY CHECKS:

1. Check condition of RADIO Fuse. If fuse is blown, locate and repair source of overload. Replace fuse.

### CLOCK DOES NOT OPERATE

| TEST                                                                                                        | RESULT           | ACTION                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect radio connector C244. Connect voltmeter from ORN (40) wire at radio connector C244 to ground. | Battery voltage. | GO to step 2.                                                                                                               |
|                                                                                                             | No voltage.      | LOCATE and REPAIR open in ORN (40) wire between radio connector C244 and splice S242 or between splice S242 and fuse block. |
| 2. Connect voltmeter from ORN (40) wire at radio connector C247 (going to radio control head) to ground.    | Battery voltage. | REMOVE radio control head and send in for service.                                                                          |
|                                                                                                             | No voltage.      | REMOVE radio receiver and send in for service.                                                                              |

### PANEL LAMP DOES NOT COME ON

| TEST                                                                                                                                  | RESULT           | ACTION                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|
| 1. Place light switch in PARK and panel dimmer switch to HIGH. Connect voltmeter from GRA (8) wire at radio connector C244 to ground. | Battery voltage. | GO to step 2.                                                                    |
|                                                                                                                                       | No voltage.      | LOCATE and REPAIR open in GRA (8) wire from radio connector C244 to splice S217. |
| 2. Connect voltmeter from BRN (9) wire at radio connector C247 (going to radio control head) to ground.                               | Battery voltage. | REMOVE radio control head and send in for service.                               |
|                                                                                                                                       | No voltage.      | REMOVE radio receiver and send in for service.                                   |

**DISPLAY DIMMING FUNCTION WILL NOT OPERATE**

| TEST                                                                                                  | RESULT           | ACTION                                                                           |
|-------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|
| 1. Place light switch in PARK. Connect voltmeter from BRN (9) wire at radio connector C244 to ground. | Battery voltage. | GO to step 2.                                                                    |
|                                                                                                       | No voltage.      | LOCATE and REPAIR open in BRN (9) wire from radio connector C244 to splice S210. |
| 2. Connect voltmeter from YEL wire at radio connector C247 (going to radio control head) to ground.   | Battery voltage. | REMOVE radio control head and send in for service.                               |
|                                                                                                       | No voltage.      | REMOVE radio receiver and send in for service.                                   |

**CASSETTE DECK DOES NOT OPERATE**

| TEST                                                                                                                                                                              | RESULT                                    | ACTION                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------|
| 1. Place ignition switch in RUN, turn radio ON and cassette inserted into tape deck. Connect voltmeter from ORN wire at radio connector C248A (going to cassette deck) to ground. | Battery voltage.                          | GO to step 2.                                 |
|                                                                                                                                                                                   | No voltage.                               | REMOVE radio and send in for service.         |
| 2. Connect voltmeter from RED wire at radio connector C248A (going to cassette deck) to ground.                                                                                   | Battery voltage.                          | GO to step 3.                                 |
|                                                                                                                                                                                   | No voltage.                               | REMOVE radio and send in for service.         |
| 3. Connect voltmeter from ORN wire to BLK wire (LO ground) at radio connector C248A.                                                                                              | Battery voltage.                          | GO to step 4.                                 |
|                                                                                                                                                                                   | No voltage.                               | REMOVE radio and send in for service.         |
| 4. Connect voltmeter from ORN wire to BLK wire (HI ground) at radio connector C248A.                                                                                              | Battery voltage.                          | GO to step 5.                                 |
|                                                                                                                                                                                   | No voltage.                               | REMOVE radio and send in for service.         |
| 5. Connect voltmeter from WHT wire at radio connector C248A to ground.                                                                                                            | A reading of approximately 4.5 volts.     | GO to step 6.                                 |
|                                                                                                                                                                                   | A reading less or greater than 4.5 volts. | REMOVE cassette deck and send in for service. |
| 6. Connect voltmeter from ORN/WHT wire at radio connector C248A to ground.                                                                                                        | A reading of approximately 4.5 volts.     | GO to step 7.                                 |
|                                                                                                                                                                                   | A reading less or greater than 4.5 volts. | REMOVE cassette deck and send in for service. |
| 7. Connect voltmeter from BRN wire at radio connector C248A to ground.                                                                                                            | A reading of approximately 4.5 volts.     | GO to step 8.                                 |
|                                                                                                                                                                                   | A reading less or greater than 4.5 volts. | REMOVE cassette deck and send in for service. |
| 8. Connect voltmeter from BLU wire at radio connector C248A to ground.                                                                                                            | Battery voltage.                          | REMOVE cassette deck and send in for service. |
|                                                                                                                                                                                   | No voltage.                               | GO to step 9.                                 |

## 8A-150-14 RADIO

### CASSETTE DECK DOES NOT OPERATE (CONTINUED)

| TEST                                                                                                                                                | RESULT                                  | ACTION                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------|
| 9. Move tape deck switch to FWD and then REV. Connect voltmeter from BLU wire at radio connector C248A to ground, taking readings at each position. | A reading of approximately 8 volts.     | GO to step 10.                                |
|                                                                                                                                                     | A reading less or greater than 8 volts. | REMOVE cassette deck and send in for service. |
| 10. Remove cassette from tape deck. Connect voltmeter from BRN wire at radio connector C248A to ground.                                             | Battery voltage.                        | REMOVE cassette deck and send in for service. |

### GRAPHIC EQUALIZER DOES NOT OPERATE

| TEST                                                                                                                                                                             | RESULT                                   | ACTION                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------|
| 1. Disconnect graphic equalizer connector C246A. Place ignition switch in RUN and turn radio ON. Connect voltmeter from WHT wire at graphic equalizer connector C246A to ground. | A reading of approximately 10 volts.     | GO to step 2.                                      |
|                                                                                                                                                                                  | A reading less or greater than 10 volts. | REMOVE radio control head and send in for service. |
| 2. Place light switch to PARK and panel dimmer switch to HIGH. Connect voltmeter from GRA wire at graphic equalizer connector C246A to ground.                                   | Battery voltage.                         | REMOVE graphic equalizer and send in for service.  |
|                                                                                                                                                                                  | No voltage.                              | REMOVE radio control head and send in for service. |

## DIAGNOSIS — POWER AMPLIFIER

### PRELIMINARY CHECKS:

1. Check condition of RADIO and CTSY Fuses. If fuse(s) is blown, locate and repair source of overload. Replace fuse(s).
2. If fuse(s) is not blown, proceed with the following diagnostic charts.

### POWER AMPLIFIER DOES NOT OPERATE

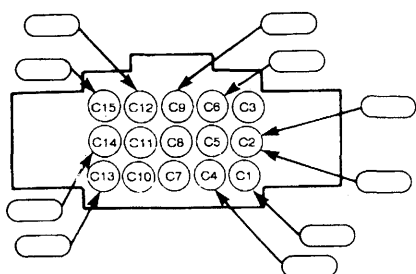
| TEST                                                                                                                                                                              | RESULT                    | ACTION                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Place Ignition switch in ACC or RUN position. Connect test lamp from PNK (143) wire at power amplifier relay connector C253 to ground. Turn radio control head to ON position. | Test lamp lights.         | GO to step 2.                                                                                                                                                                                                                                |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in PNK (143) wire between power amplifier relay connector C253 and radio receiver connector C244. If wire is good, REMOVE receiver and send in for repair.                                                            |
| 2. Connect test lamp from PNK (143) wire to BLK (150) wire at power amplifier relay connector C253.                                                                               | Test lamp lights.         | GO to step 3.                                                                                                                                                                                                                                |
|                                                                                                                                                                                   | Test lamp does not light. | LOCATE and REPAIR open in BLK (150) wire between power amplifier relay connector C253 and splice S272, from splice S272 to convenience center connector C257, from convenience center to splice S207 or from splice S207 to I/P ground G202. |
| 3. Connect test lamp from ORN (40) wire at power amplifier relay connector C253 to ground.                                                                                        | Test lamp does not light. | GO to step 4.                                                                                                                                                                                                                                |
|                                                                                                                                                                                   | Test lamp lights.         | LOCATE and REPAIR open in ORN (40) wire between power amplifier relay connector C253 and convenience center connector C239, from convenience center to splice S242 or from splice S242 to fuse block.                                        |
| 4. Connect test lamp from ORN (140) wire at power amplifier relay connector C253 to ground.                                                                                       | Test lamp does not light. | GO to step 5.                                                                                                                                                                                                                                |
|                                                                                                                                                                                   | Test lamp lights.         | REPLACE power amplifier relay.                                                                                                                                                                                                               |
| 5. Connect test lamp from ORN (140) wire to BLK (150) wire at power amplifier connector C352.                                                                                     | Test lamp does not light. | REMOVE power amplifier and send in for repair.                                                                                                                                                                                               |
|                                                                                                                                                                                   | Test lamp lights.         | LOCATE and REPAIR open in BLK (150) wire between power amplifier connector C352 and splice S272, from splice S272 to convenience center connector C257, from convenience center to splice S207 or from splice S207 to I/P ground G202.       |

## 8A-150-16 RADIO

### NO SOUND OR DISTORTED SOUND FROM REAR SPEAKERS

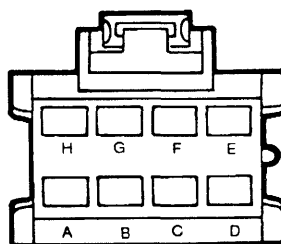
| TEST                                                                                                                                                                           | RESULT                                        | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Disconnect suspect speaker connector C407, C550, C405 or C610. Set ohmmeter on Rx1 scale. Connect ohmmeter across terminals of suspect speaker.                             | Speaker pops.                                 | GO to step 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                | No noise.                                     | REPLACE speaker.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2. Place ignition switch in ACC or RUN position and turn radio ON. Tune radio to a strong signal. Connect voltmeter across suspect speaker connector C407, C550, C405 or C610. | Varying around 1 volt AC.                     | LOCATE and REPAIR open or short in YEL (116), BRN (199), DK BLU (46), LT BLU (115) between speaker connector C407 or C405 and splice S271, S274 or splice S270, S273 and power amplifier connector C352; or check LT GRN/BLK (329), LT GRN/WHT (330), DK GRN (1654), DK GRN/WHT (1655) between speaker connector C550 or C610 and power amplifier connector C352. Also check wires from splice S270, S271, S273 or S274 to body connector C299 or from connector C299 to radio receiver connector C251. |
|                                                                                                                                                                                | No voltage or voltage greater than 1 volt AC. | REMOVE power amp and send in for repair.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

**12034325**



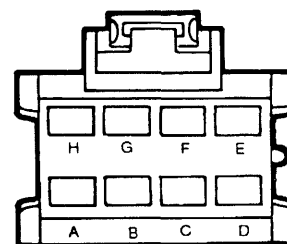
**C352**  
**Power Amplifier**

**12064998**



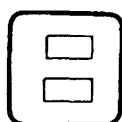
**BLACK**  
Metri-Pack 280  
**C341**  
**LH Rear Door to Crossbody**

**12064998**



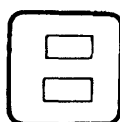
**BLACK**  
Metri-Pack 280  
**C342**  
**RH Rear Door to Crossbody**

**12092428**



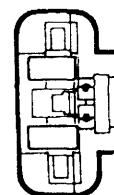
**C320**  
**LH Rear Speaker**  
**(Regular Cab)**

**12092428**



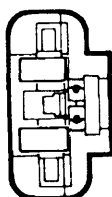
**C321**  
**RH Rear Speaker**  
**(Regular Cab)**

**08900444**



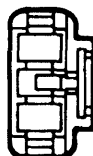
**BLACK**  
Pac/on  
**C407**  
**LH Rear Speaker**  
**(Suburban)**

**08900444**



**BLACK**  
Pac/on  
**C425**  
**RH Rear Speaker**  
**(Suburban)**

**12077887**



**BLACK**  
Pac/on  
**C450**  
**Rear Speaker (Crew Cab,**  
**Extended Cab & Utility)**

**12077887**

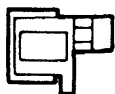


**BLACK**  
Pac/on  
**C451**  
**Rear Speaker (Crew Cab,**  
**Extended Cab & Utility)**



# 8A-150-18 RADIO

12059234



**C239**  
Power Amplifier Relay  
Convenience Center Tap

12059236



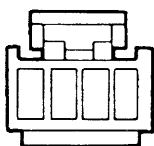
**C257**  
Power Amplifier & Amplifier  
Relay Convenience Center Tap

12047531



**BLACK**  
Micro-Pack 100  
**C244**  
Radio Receiver

12040904



**C243**  
Front Speakers at Receiver

12092428



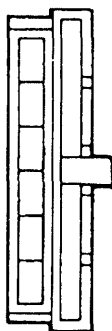
**C242**  
RH Front Speaker

12092428



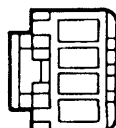
**C245**  
LH Front Speaker

12034061



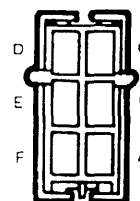
**NATURAL**  
Metri-Pack 480  
**C204**  
Light Switch

12047528



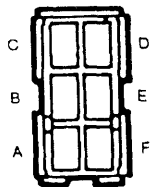
**BLUE**  
Micro-Pack 100  
**C251**  
Rear Speaker Extension

12034482



**GRAY**  
Metri-Pack 280  
**C299**  
In-Line Radio to Rear Speakers

12034481



GRAY  
Metri-Pack 280

C299  
In-Line Rear Speakers to Radio

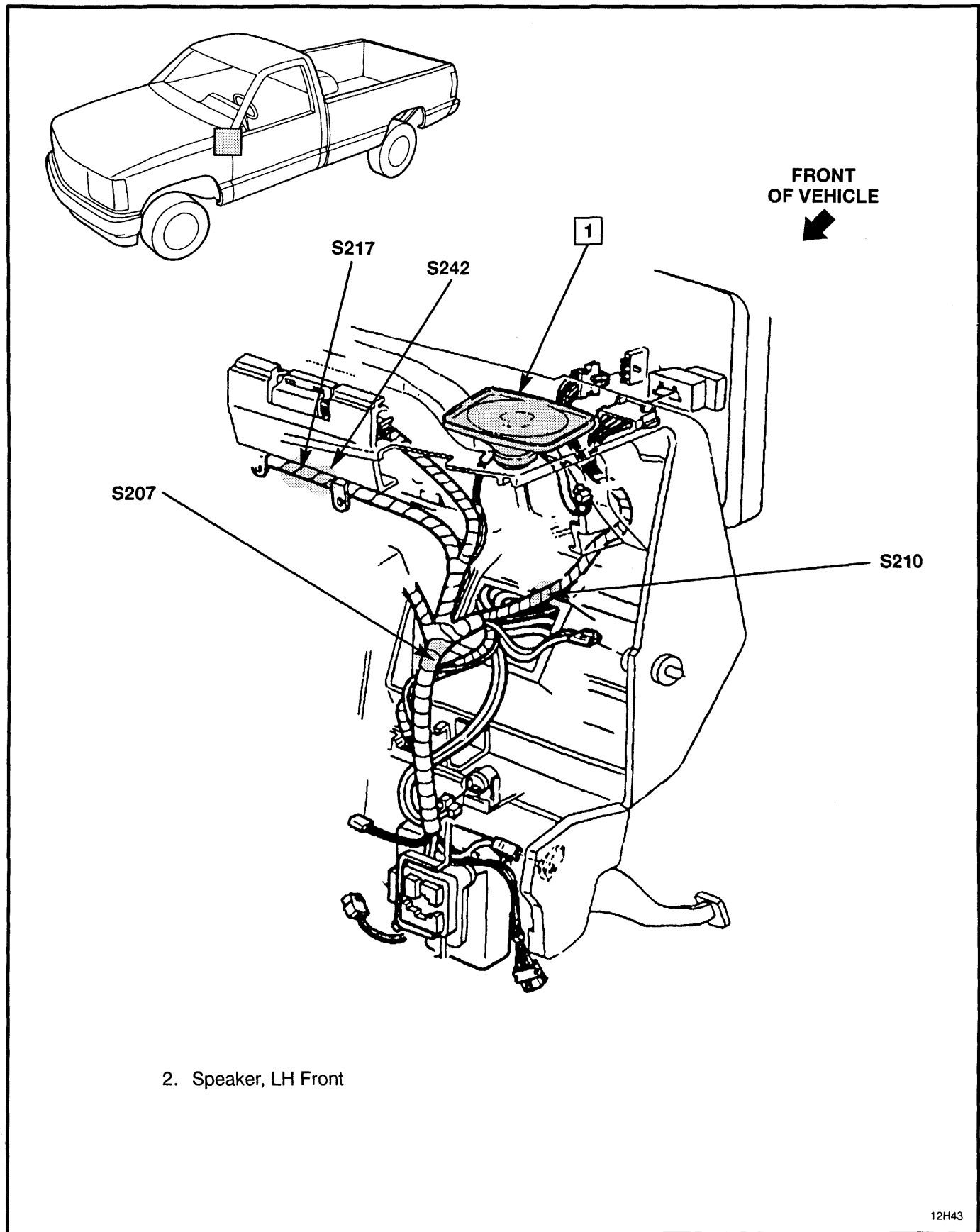


Figure 1 — LH Side of Instrument Panel

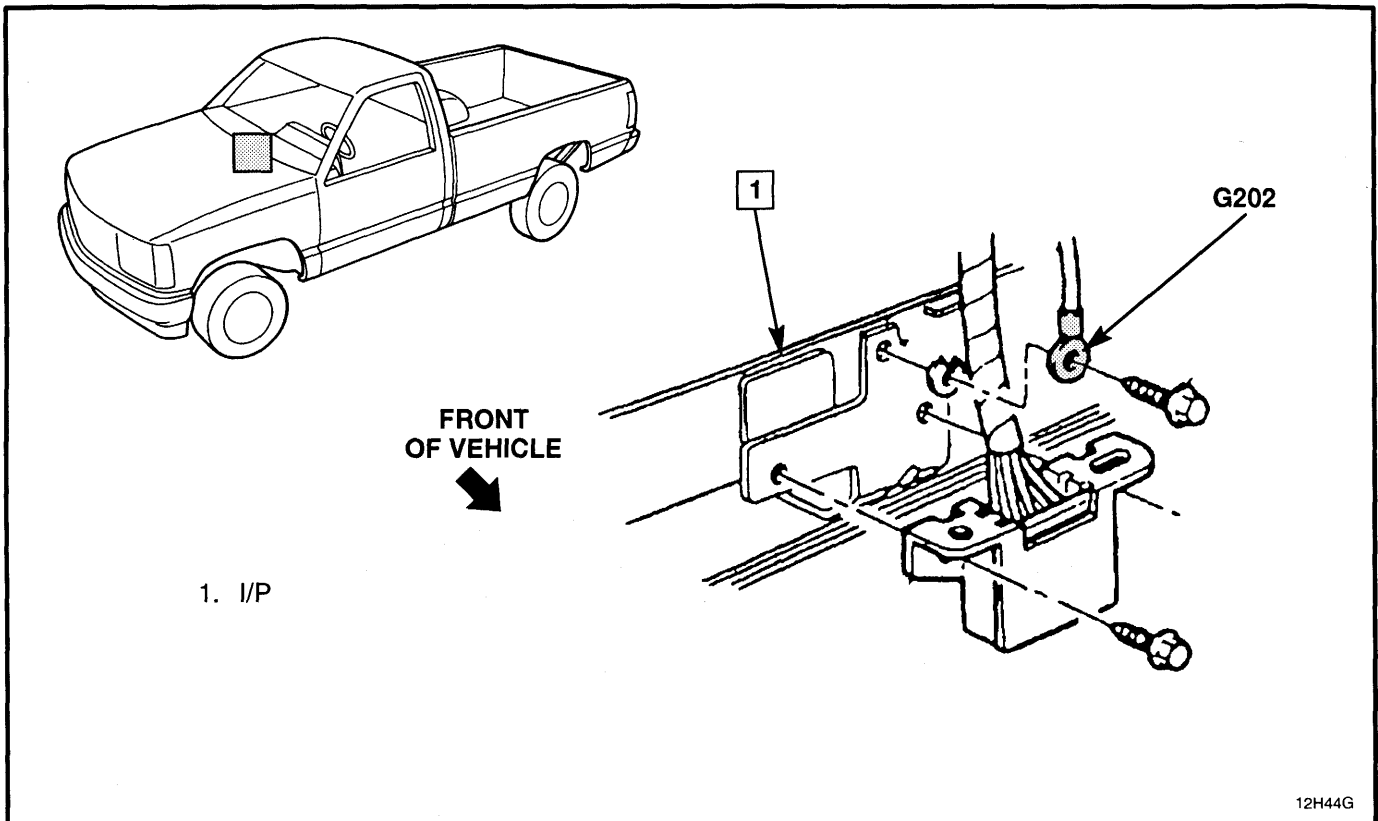


Figure 2 — I/P Ground

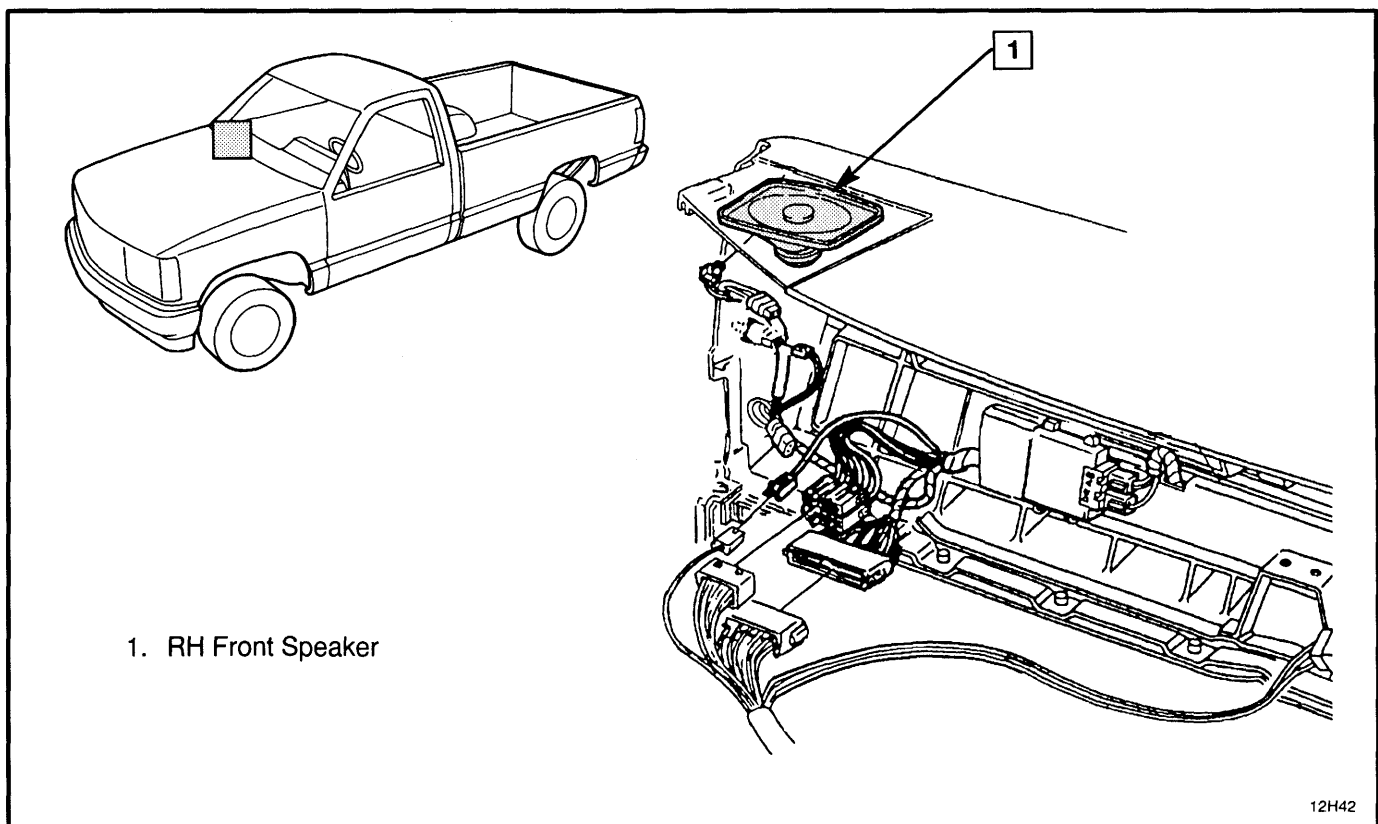


Figure 3 — Instrument Panel Wiring, RH Side

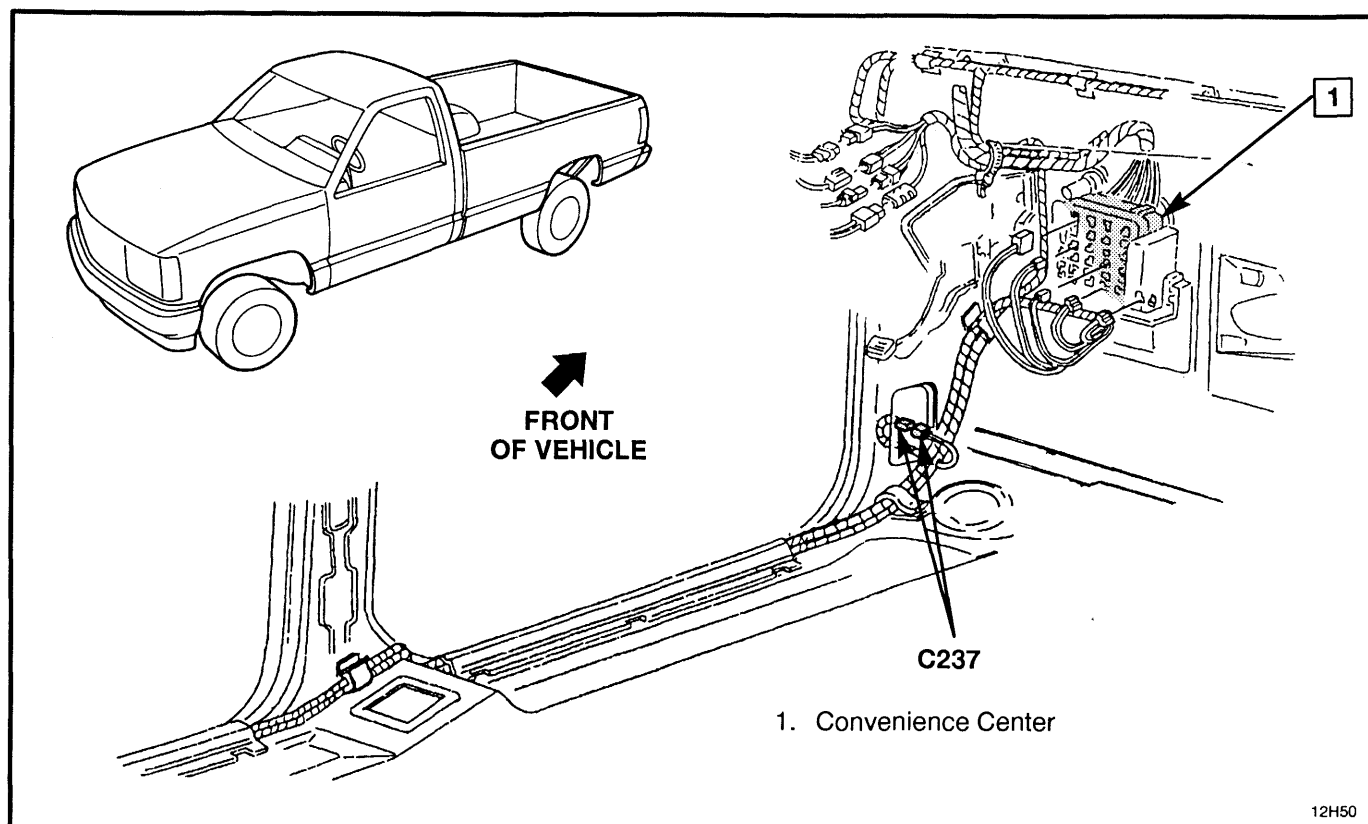


Figure 4 — Convenience Center

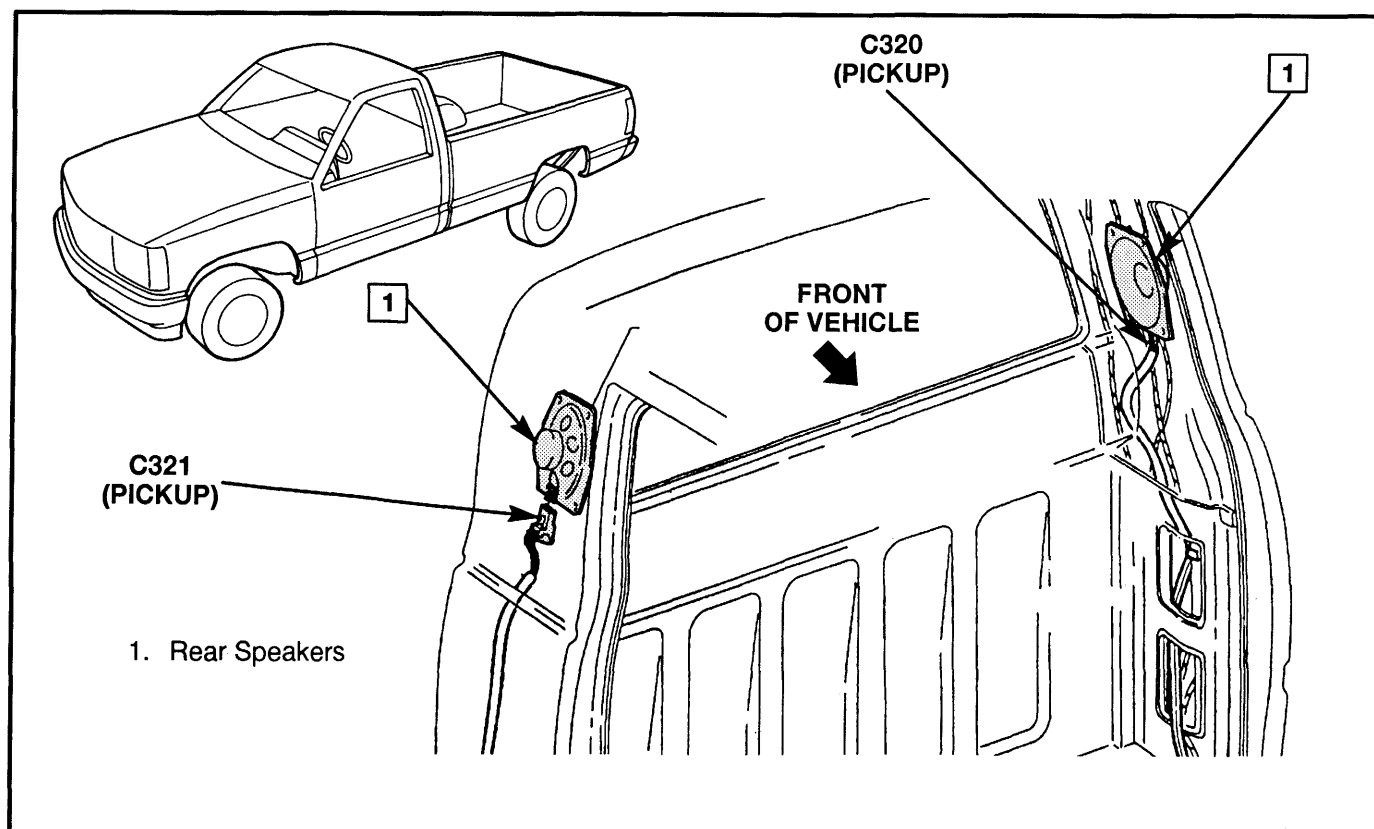


Figure 5 — Speaker Wiring

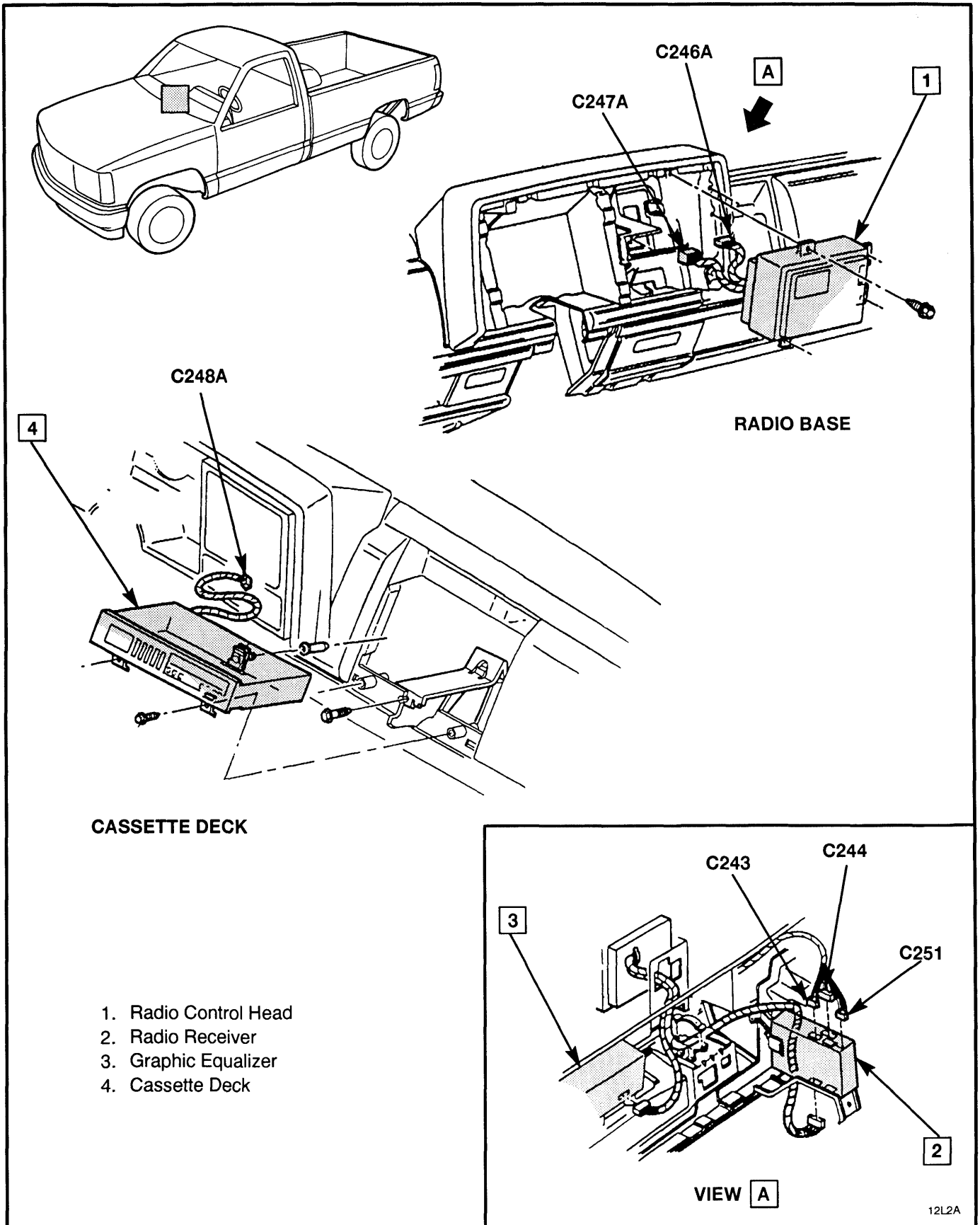


Figure 6 — Radio System

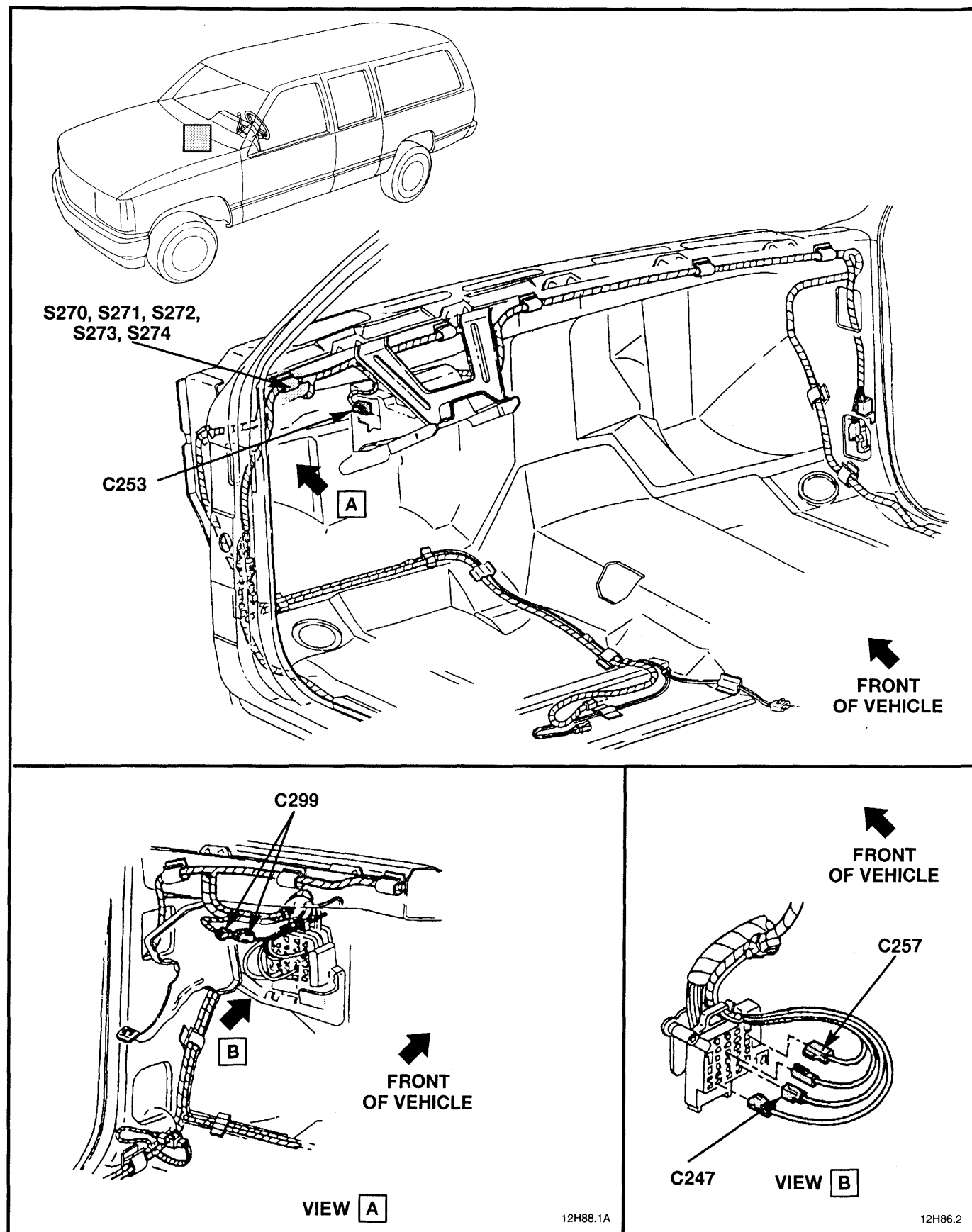
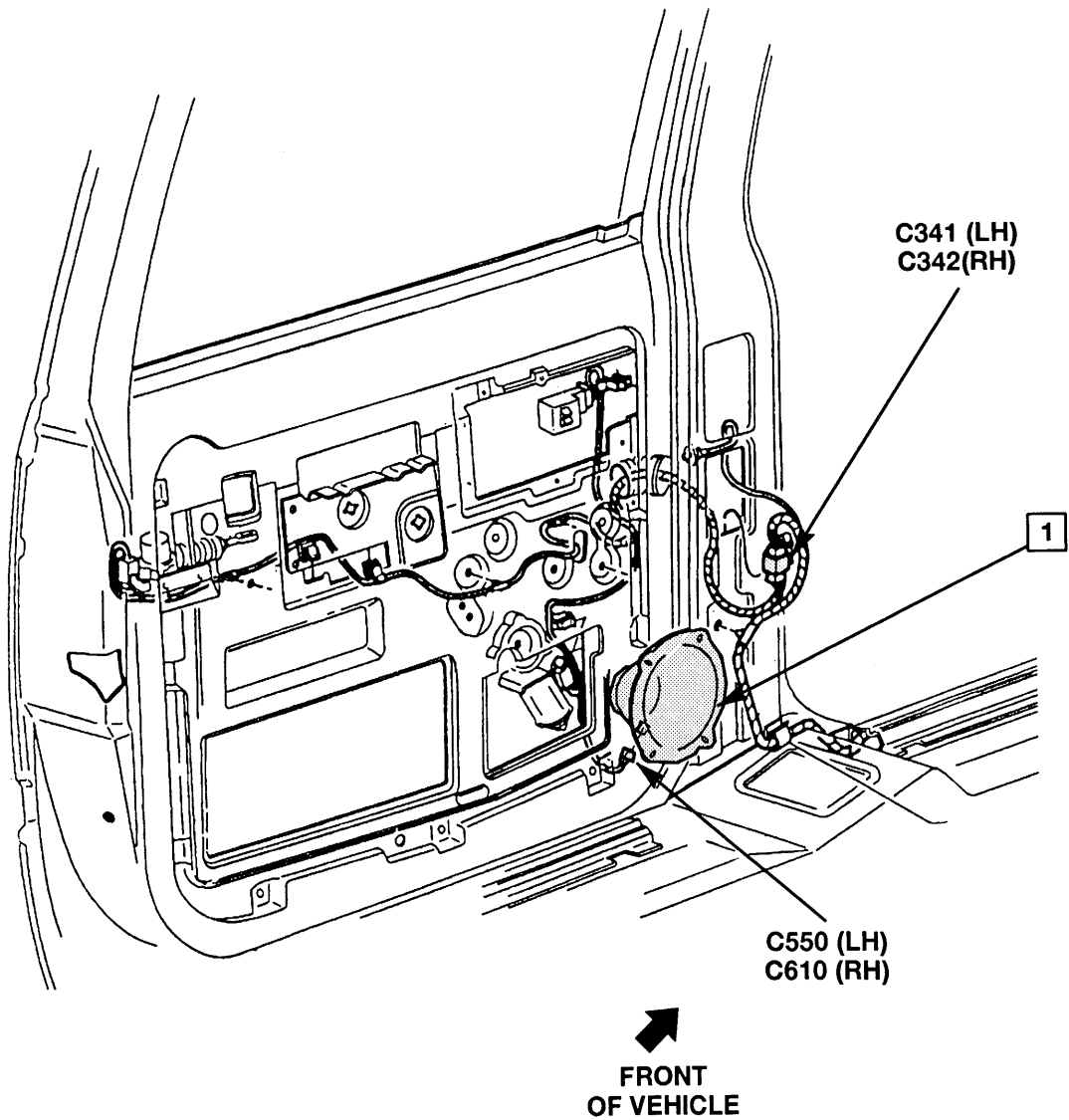
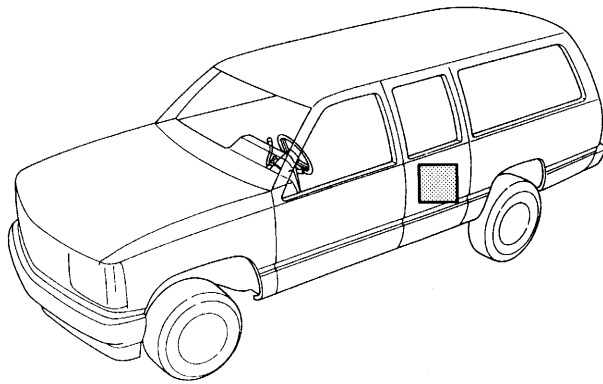


Figure 7 — Crossbody Wiring – Suburban



1. Rear Side Door Speaker

12H89

Figure 8 — Rear Side Door Wiring – Suburban and 4-Door



**BLANK**

## **CIRCUIT OPERATION**

### **VACUUM SYSTEMS**

A vacuum-operated component uses the force of normal air pressure working against the lower air pressure of a partial vacuum to provide voltage that operates the component. With a gasoline engine, the vacuum created in the inlet manifold when the engine is running is stored in a ball-shaped vacuum tank suspended from the center of the hood inner panel. A check valve in the line feeding vacuum to the tank keeps the stored vacuum from weakening when inlet manifold vacuum drops during high speed or high voltage operation.

An engine-driven mechanical vacuum pump serves as the source of vacuum with a diesel engine. A vacuum tank is not required with a vacuum pump.

Vacuum is routed through hoses to a mechanical or electric valve that provides a means of controlling the vacuum-operated component. When the valve is open, it allows vacuum to go to an actuator that actually operates the component. When the component is to be returned to its original position, the valve cuts off the vacuum to the actuator hose and vents the hose to normal air pressure.

A typical actuator is a metal shell with a movable shaft that retracts and extends to mechanically operate the component. A flexible diaphragm separates the interior of the shell into two chambers – a sealed chamber to which vacuum can be admitted, and an open chamber exposed to normal air pressure. The movable shaft is attached to the center of the diaphragm and extends from the open chamber.

When vacuum is directed to the sealed chamber, normal air pressure presses on the other side of the diaphragm and causes it to retract the shaft. When the vacuum is cut off, the sealed chamber is vented to outside air to balance the air pressure on both sides of the diaphragm and eliminate the force that retracted the shaft. A coiled spring within the sealed chamber expands to push the diaphragm back to its original position. This extends the shaft.

In addition to the two-position actuator described above, a three-position actuator may be used for certain applications. The three-position actuator has a vacuum hose at each end of the shell. When vacuum is applied to either end of the actuator and the opposite end is vented, the shaft will move in the direction of the end having the vacuum. When both ends of the actuator are vented to normal air pressure, internal springs center the shaft. This provides a center position as well as both extremes for an actuator application that requires three operating positions.

### **POWER BRAKE BOOSTER VACUUM SYSTEM (GASOLINE ENGINES ONLY)**

The power brake booster is a tandem diaphragm vacuum-suspended unit. When the engine is running, inlet manifold vacuum is transmitted to the booster unit through a vacuum hose. A check valve at the power brake booster end of the hose keeps air from flowing from the hose into the booster unit and weakening the power brake operating force when inlet manifold vacuum is low.

With the service brakes released, vacuum is supplied equally to both sides of the two diaphragms in the booster unit. Because pressure on both sides of the diaphragms are balanced, no boost is provided to the braking system and the brakes are not applied.

When the driver presses down on the brake pedal, the pedal pushrod depresses a spring-loaded air valve within the power brake booster. The air valve opens to admit air at atmospheric pressure to the back side of both diaphragms. This forces the diaphragms forward and causes a piston rod in the booster unit to push the brake master cylinder pistons and apply the service brakes.

The amount of atmospheric air admitted to the back side of both diaphragms depends upon the force the driver applies to the brake pedal. The greater the pedal pressure, the more the valve opens. This provides a power boost that multiplies the force applied to the master cylinder pistons in proportion to the pressure on the brake pedal.

When the brake pedal is released, the flow of atmospheric air is cut off and inlet manifold vacuum draws off the air behind the diaphragms. As a result, air pressures within the diaphragm chambers are once again balanced so no power boost is developed.

### **EGR VALVE VACUUM SYSTEM**

The exhaust gas recirculation (EGR) system allows a small amount of exhaust gas to flow from the exhaust manifold into the inlet manifold when the throttle is opened beyond idle and inlet manifold vacuum is normal. This reduces combustion temperatures in the engine to control oxides of nitrogen emissions.

The EGR valve is operated by an integral vacuum actuator that controls a pintle within the valve. The pintle remains closed to prevent exhaust gas recirculation until vacuum is applied to the actuator. The vacuum causes the pintle to open, allowing the measured flow of exhaust gas to enter the inlet manifold.

## 8A-199-2 VACUUM SYSTEMS

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The EGR system used with gasoline engines remains closed during periods of engine idle and deceleration to prevent rough idle from excessive dilution of the air/fuel mixture. It also remains closed at wide-open throttle to prevent power loss. At other times, it rapidly cycles open and closed to modulate the flow of exhaust gas as required. Under certain circumstances, it may remain fully open to provide the maximum EGR.

In gasoline engines, the manifold absolute pressure (MAP) sensor measures the strength of inlet manifold vacuum in the EGR vacuum circuit and sends a signal back to the engine control module (ECM/PCM). The ECM/PCM uses the signal from the MAP sensor to control fuel delivery and ignition timing. In addition, the ECM/PCM will adjust the on-off intervals of the EGR valve to correct the flow of exhaust gas into the cylinders if actual vacuum differs from the preferred vacuum as calculated by the ECM/PCM. This provides the required control of oxides of nitrogen emissions while retaining engine performance under all operating conditions.

Vacuum for the EGR system of gasoline engines is taken from the throttle body and routed through a hose to the EGR electronic vacuum regulator solenoid valve. This valve is controlled by the 435 circuit from the ECM/PCM. When the EGR electronic vacuum regulator solenoid valve is energized, the valve routes vacuum to the EGR actuator. The actuator opens the EGR pintle valve to allow exhaust gas to flow into the inlet manifold. When the EGR electronic vacuum regulator solenoid valve is released, the valve vents the EGR actuator to outside air to close the EGR pintle valve.

In the diesel engine, the operation of the EGR valve is assisted by the exhaust pressure regulator (EPR) valve. At idle, the EPR valve increases exhaust back pressure to force more exhaust through the EGR valve and reduce combustion temperatures. The vacuum which operates the EGR valve and the EPR valve is supplied by an engine-driven vacuum pump.

The powertrain control module (PCM) controls the EGR valve solenoid to regulate the vacuum to the EGR valve in the same way as with a gasoline engine. The PCM calculates the amount of exhaust gas recirculation based on inputs from the engine speed sensor and the throttle position (TP) sensor, and pulses the EGR valve solenoid to control EGR. The MAP sensor monitors the control of exhaust gas recirculation as indicated by the air pressure in the EPR vacuum line. If actual vacuum differs from the preferred vacuum as calculated by the PCM, the PCM will adjust the on-off intervals of the EGR valve to correct the flow of exhaust gas into the cylinders.

When the ECM/PCM recognizes the operating range in which no exhaust gas recirculation is needed, the EGR vent solenoid opens to vent the vacuum at the EGR valve.

At idle, the ECM/PCM energizes the EPR valve solenoid to send vacuum to close the EPR valve. This increases exhaust back pressure to force more exhaust gas through the EGR system and lower combustion temperatures to reduce oxides of nitrogen emissions.

## **DIAGNOSIS — VACUUM SYSTEMS**

### **PRELIMINARY CHECKS:**

Conditions most likely to cause vacuum system problems include hoses that leak or become disconnected. With the engine running, either condition is easily detected from the hiss of air at the opening. Other common vacuum problems are kinked or obstructed hoses, hoses connected incorrectly or binding components.

A vacuum pump can be used as a vacuum source to operate components and test the system. The built-in vacuum gage of the pump provides a means of checking for a vacuum leak as well. Once vacuum is applied to operate the component, the gage should hold steady until the vacuum is purposely released.

On vacuum systems that are controlled by electrical or electronic switches, check for a blown fuse, wiring that is cracked, frayed or burned, and high resistance in connectors of the control circuit(s) before checking for a suspected vacuum system problem.

### **EGR VALVE VACUUM SYSTEM**

A leak in the EGR vacuum system can upset the ECM's/PCM programmed control of exhaust gas recirculation and adversely affect engine operation. Too much exhaust gas recirculation at idle or cruise with a gasoline engine can result in the engine stalling after closed throttle deceleration, surging during steady throttle cruising or a rough idle. Too little exhaust gas flow allows combustion temperatures to become too high and bring about detonation ("spark knock") or an overheated engine. In addition, nitrous oxide emissions may be high enough to cause the vehicle to fail an emissions test.

Because the source of an EGR system symptom might be traced to a mechanical or electrical condition as well as a faulty vacuum system, an effective systematic diagnosis

procedure should examine all three categories of components – not just the vacuum system alone. Therefore, no exclusive vacuum system diagnosis procedures are provided here. For more information on the EGR system, refer to the 1994 Light Duty Fuel and Emissions manual.

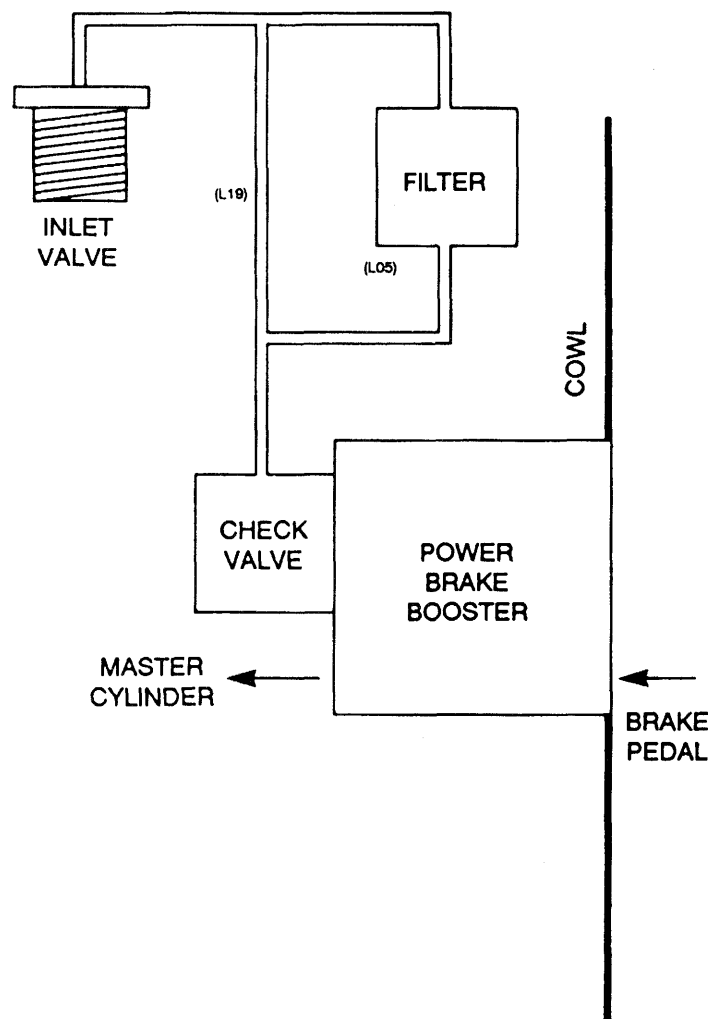
### **POWER BRAKE BOOSTER VACUUM SYSTEM (GASOLINE ENGINES ONLY)**

Little or no power assist upon brake application can be caused by a faulty power brake booster vacuum system. A simple two-step procedure can be used to check out the vacuum system if a visual inspection fails to uncover the cause.

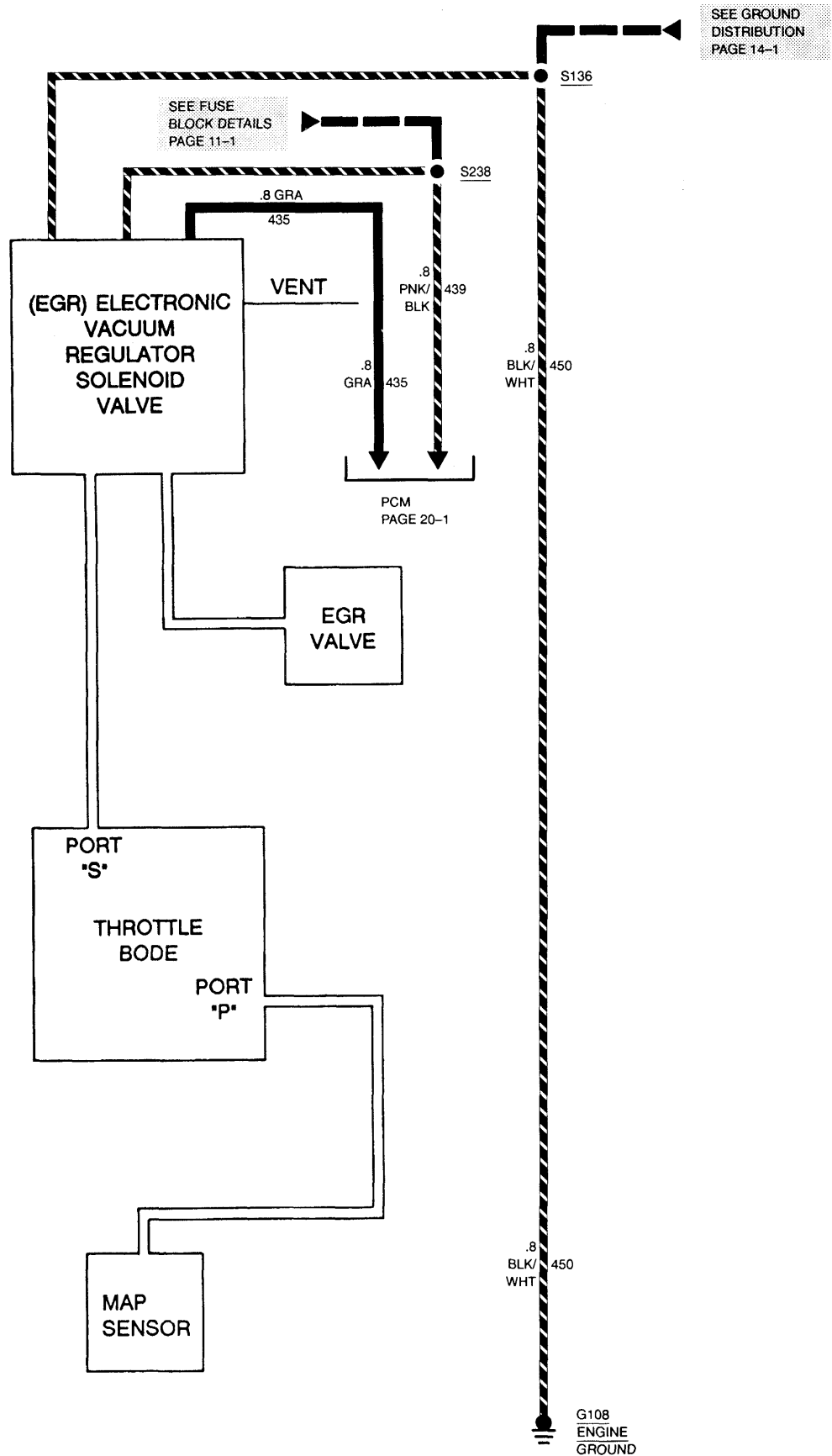
- With the engine off, apply and release the brake a number of times to exhaust all vacuum from the power brake booster. As many as 8 to 10 strokes may be required. Then hold your foot on the brake pedal with a firm pressure (comparable to the pressure required to bring the vehicle to a normal gradual stop). While maintaining a steady pressure, start the engine. If the vacuum system is working properly, you should feel the brake pedal "fall away" slightly under your foot as the engine starts. If there is no power assist, refer to the 1994 Service Manual, Section 5A-1.
- With no pressure applied to the brake pedal, shut off the engine and allow the vehicle to stand undisturbed for 3-5 minutes. Then depress and release the brake pedal a number of times until firm resistance is met with very little brake pedal travel. A vacuum leak or a faulty check valve at the booster unit end of the vacuum hose is indicated if firm resistance is encountered with very little brake pedal travel on the first few strokes.

## 8A-199-4 VACUUM SYSTEMS

## POWER BRAKE BOOSTER VACUUM SYSTEM (GASOLINE ONLY)

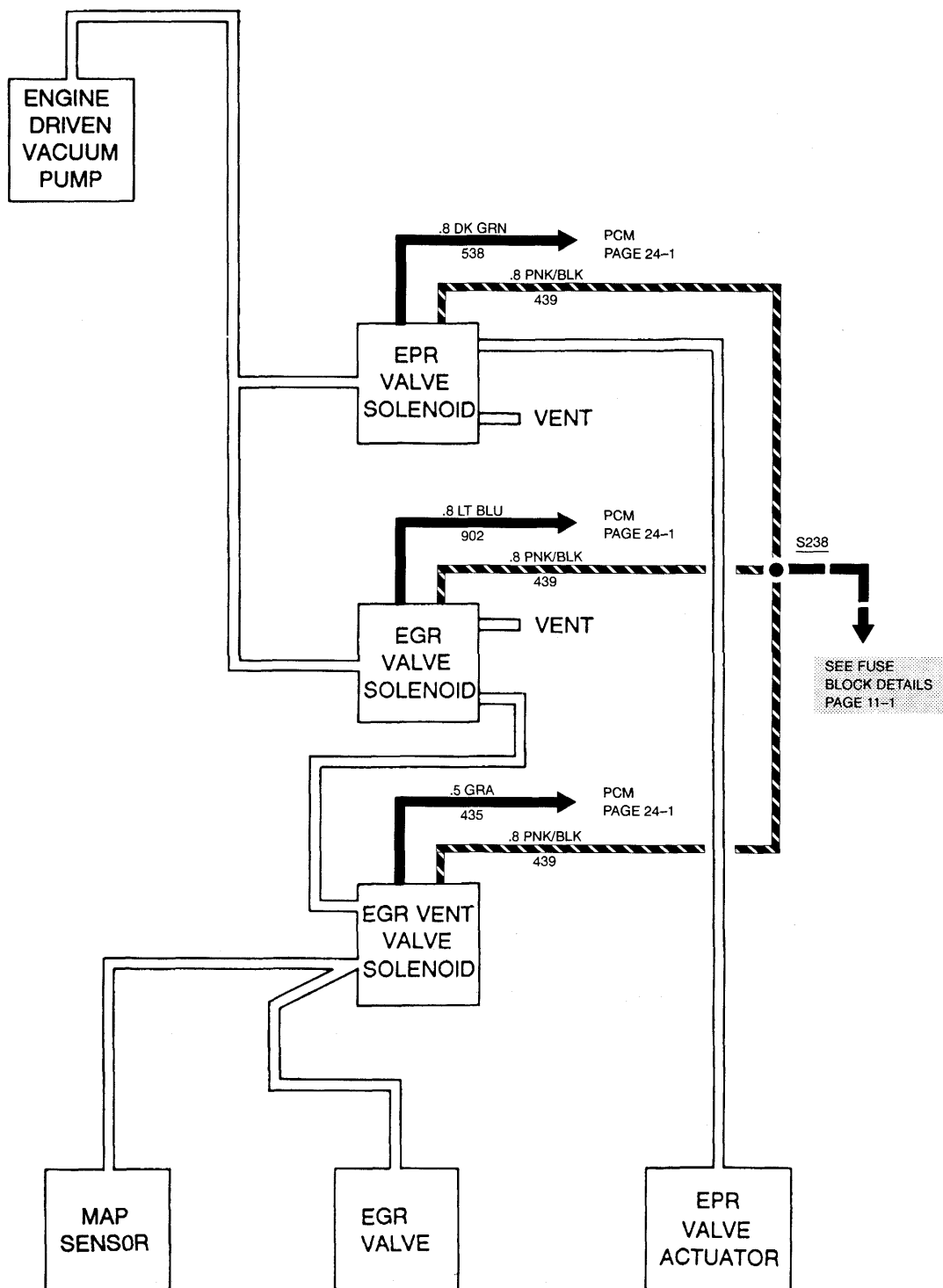


EGR VALVE VACUUM SYSTEM (GASOLINE ONLY)



# 8A-199-6 VACUUM SYSTEMS

## EGR/EPR VACUUM SYSTEM (DIESEL ONLY)



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